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Comparing international curriculum systems: the international instructional systems study

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ABSTRACT

This paper sets out the main findings of the International Instructional Systems Study (IISS), conducted by the UCL Institute of Education and funded by the Center on International Education Benchmarking (CIEB). The study examined the instructional systems and intended curricula of six 'high performing' countries and two US states. The study ultimately focused on nine specific aspects of those systems: the aims of the education system; how centralised or decentralised management of the instructional system is; principles and methods of accountability; what compulsory and optional subjects are included in the programmes of study; the degree to which curriculum is organised by discipline or integrated across disciplines; whether curriculum is common or differentiated; how twenty-first century skills are embedded in the curriculum; the clarity and content of curriculum for secondary vocational pathways; and how assessments are created and what stakes they have and for whom.

KEYWORDS

Curriculum; standards; twenty-first century skills; assessment; integrated curricula; vocational pathways; ability grouping; International Instructional Systems Study

Introduction

Through a grant from the Center on International Education Benchmarking (CIEB), the UCL Institute of Education (IOE) undertook a comparative study of instructional systems – hereafter the Study – across nine jurisdictions in six high-performing countries, as defined by rankings on the OECD's 2009 PISA assessments. Based on desk research conducted at the IOE during 2013 and 2014, and informed by in-country experts, that study produced six country profiles, a cross case analysis and a policy report. This paper summarises the Study's findings and sets the context for the other articles in this special issue.

The jurisdictions included in the Study were as follows:

- (1) Australia (New South Wales and Queensland)
- (2) Canada (Alberta and Ontario)
- (3) China (Hong Kong and Shanghai)
- (4) Finland
- (5) Japan
- (6) Singapore.

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In addition, the Study looked at two jurisdictions (Massachusetts and Florida) within the United States for comparative purposes. Massachusetts was chosen as a high-performing jurisdiction and Florida was chosen as a moderate performer based on results from the U.S. National Assessment of Education Progress (NAEP). Five subject areas were explored in depth:

- (1) Language of instruction
- (2) Mathematics
- (3) Sciences (earth science, biology, chemistry and physics)
- (4) Social studies (history and geography)
- (5) Vocational/applied subjects.

An instructional system was defined as the standards, curriculum and associated assessments of a jurisdiction. The aim was to understand what, if anything, there is in common among the high performers to see if there are aspects of instructional system design that might account, in part, for high performance.

The study began with intensive, country-based evidence gathering across the seven countries primarily through desk research. Data were organised to allow senior researchers to delve into each jurisdiction's instructional system, concentrating on evidence that provided: a description of the context for each instructional system, including an overview of the elementary and secondary education system; a description of how the instructional system developed and how it is governed, including who has the authority to set the standards, curriculum and assessments; a description of the current structure of the system and how students move through it; a description of the accountability system for teachers and students specifying what they are held accountable for; and the national approach to curriculum and its purpose.

We also produced a description and analysis of each nation's instructional system, including: a description of what elements of the curriculum are required and which are elective, and how much time is allotted to each; a detailed description and analysis of the components of the instructional system for the required programmes of study for elementary, lower secondary and upper secondary schooling for language of instruction (language arts), mathematics, social studies/history/geography, science and applied or vocational learning.

Once the descriptive work was accomplished, analyses took place on a subject basis, both at a single jurisdictional level and across the jurisdictions. These were then sent to in-country experts for checking and comments, culminating in nine reports, seven at country level, one cross jurisdictional report and one issues paper all of which can be found on the National Center on Education and the Economy's website, www.ncee.org.

Because of the nature of the remit, analysis was restricted to the *intended* curriculum, relying on government policies and processes – tempered where possible by the academic literature – since we did not have the resource to conduct fieldwork that might provide insight into whether students' actual experience in schools matched policy intentions.

The Study's policy analysis (CIEB, 2015) focused on nine specific aspects of instructional systems:

- (1) The goals or aims of the education system and how these are embodied in the curriculum
- (2) How centralised or decentralised management of the instructional system is
- (3) Principles and methods of accountability and their link to instructional systems

- (4) What compulsory and optional subjects are included in the programme of study in primary and secondary school levels
- (5) To what degree curriculum is organised by discipline or integrated across disciplines
- (6) How twenty-first century skills are embedded in the curriculum
- (7) The clarity and content of curriculum for secondary vocational pathways
- (8) Whether curriculum is common or differentiated
- (9) How assessments are created and what stakes they have and for whom.

Overall, the Study found that all the high-performing jurisdictions promote twenty-first century skills, have national curriculum guidelines that allow for local interpretation but hold the standards constant, and all but one offer a comprehensive core curriculum for all students through lower secondary school. But overall instructional system patterns varied across the jurisdictions. The countries differed in their approach to the organisation of instructional time and allocation of time to subject areas. Accountability systems are also structured differently, with some relying on internal mechanisms and others building in results of national assessments. Differential grouping varies from early segmentation in Singapore's upper primary years to the more typical approach of differentiation in some subject areas in upper secondary grades. Some jurisdictions use high stakes testing throughout the system and most others only at the end. The amount of assessment data that is shared publicly varies.

The Study crucially noted that many of the characteristics that these systems have in common were beyond its scope including: support for teachers and other education professionals throughout their careers and policies aimed at attracting the best and the brightest to the profession; a climate of high expectations in the home environment; and continuous professional development focused on persistently improving and upgrading instructional systems based on gathering evidence.

The rest of this paper analyses each of the findings in turn, before summing them up in a short 'concluding thoughts' section.

Findings

There were a number of systemic factors that we identified as useful to compare across the jurisdictions. While we believe these are all important and help to build a comprehensive picture of the curriculum for the jurisdictions, there are certainly other factors that we were not able to examine because of the nature of this study, such as the role of culture.

1. The goals of the education system and how these are embodied in the curriculum

Across the nine jurisdictions, the goals of the education systems varied in detail but were all clear and explicitly stated, which may support the idea that the more explicit a system is about its underlying principles and objectives, the more coherent a curriculum that reflects those aims can be (see Reiss & White, 2013; White, 2004). Many of the jurisdictions share similar statements of aims for their education systems. Nonetheless, it is interesting to look deeper into how systems' aims balance what we might describe as 'education for education's sake' with a more instrumental view based on succeeding in

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a globally competitive world (Pring, 2013). Most of the jurisdictions under study strive to combine both the development of personal qualities in students with overarching economic goals for the jurisdiction. An emphasis on literacy and numeracy, problem-solving, critical and creative thinking and citizenship as well as economic impacts pervades the aims.

New South Wales and Queensland set their educational goals in the context of a twenty-first century Australia being able to compete in the global economy on knowledge and innovation. Literacy and numeracy are emphasised, as is cross-disciplinary thinking. Like Australia, Canada also focuses on building twenty-first century skills for its students as a way to compete in a global economy. Hong Kong and Shanghai both suggest a break with the traditional rigid education of the past, describing a new vision of student-centred and competency-based systems. Finland's goal is to create a democratic society, empowering individual students to create an egalitarian society. Japan places a great value on education and skills, but also on group and social relations. There is a focus on developing a capable citizenry and a sense of nationalism. Like Japan, Singapore emphasises citizenship and responsibility to family, society and country (Isaacs, Creese, & Gonzalez, 2015, pp. 33–36). The two US states were notable for setting high aspirational goals without a clear connection to the curriculum standards.

Both Japan and Singapore clearly see their education systems primarily as economic drivers, while Finland's explicit aims of social aspirations based on equity and equality make it the most student-centred (and indeed teacher-centred) system. In contrast, the Australian states and Canadian provinces, respectively, look forward and are the most dominated by the OECD's conception of twenty-first century skills (Adamson & Darling-Hammond, 2012; Ananiadou & Claro, 2009).

Although the aims and objectives of the high-performing jurisdictions differ in both detail and overall approach, they are all clear, strong and well thought through, which may suggest that the more assertive the underlying principles, the easier it is to create a coherent curriculum that reflects those aims.

2. Centralised or decentralised aspects of instructional system management

The Study analysed the management of the instructional system (setting curriculum standards, content and assessment) concentrating on what was determined centrally and what was determined locally (see Table 1). This also includes how systems ensure that teaching materials align with standards and curriculum.

Levels of government prescription and control in managing school systems varied considerably. Some of the jurisdictions studied have a prescribed national curriculum while others have a core curriculum that allows for considerable local interpretation. Centralised control of curricula is often put in place to raise or maintain standards and provide curricular coherence and rigour; decentralised management, however, can reflect trust in locallybased decisions (Kuiper & Berkvens, 2013).

Australia recently introduced a national curriculum and also cross state-assessments aligned to that curriculum. Previously, Australia's six states and two territories each had its own curricula and assessment. In 2008, Australia adopted the National Assessment Program – Literacy and Numeracy (NAPLAN) requiring all states and territories to use the same literacy and numeracy tests. Over the next few years, the Australia Curriculum,

	Curriculum	Textbook regulation
Australia-New South Wales	National	Open choice
Australia-Queensland	National	Open choice
Canada	Local	Choose from approved list
China-Hong Kong	Local	Choose from approved list
China-Shanghai	National	Official textbooks plus other teaching materials selected by schools
Finland	National/local	Open choice
Japan	National	Official textbooks
Singapore	National	Choose from approved list
Florida	Local	At least half need to be state approved
Massachusetts	Local	Open choice

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Assessment and Reporting Authority (ACARA) developed national curricula in English, mathematics, science, and history.

Each of the Canadian provinces, including Ontario and Alberta, has its own provincial curricula and assessments linked to the provincial curricula. Shanghai is a leader in curriculum reform efforts that complement the Chinese national curriculum, often piloting new curriculum before it is rolled out to the rest of the country. While exams are still the primary driver and focus of student learning, there is a shift towards conceptual and more integrated learning in China, especially in Shanghai. Finland has a core curriculum with room for local interpretation and school-based assessments until the end of high school when there is a national entrance exam that is required for college entry. Japan has a history of centrally determined education policy but is liberalising this approach. Local schools can shape a local curriculum and teaching methods within the national curriculum frameworks. In Singapore there is a national curriculum with course syllabi and assessments but teachers are given 'white space' to adapt the syllabi to local needs. The United States has no national curricula although many states have adopted the Common Core State Standards in English Language Arts and Mathematics developed by a consortia of states and the Next Generation Science Standards developed by the National Science Foundation.¹ Massachusetts has state curriculum frameworks, but Florida does not.

2.1. Use of textbooks

Other ways some systems manage instruction is by centrally controlled provision of textbooks and other support materials. A majority of the countries studied had formal processes for approving textbooks. Canada, Hong Kong and Singapore allow schools to choose texts from an approved list, whereas Japan develops national texts for each subject. Finland and Australia are the two jurisdictions with a free market in textbooks and teacher materials, allowing schools to choose their own materials. Schools in Massachusetts choose their own texts, whereas in Florida texts must be state approved.

3. Principles and methods of accountability and their link to instructional systems

Governments want both to influence and reliably gauge how well individual students, teachers, localities, regions and the nation itself are performing against education policy objectives. Many of the jurisdictions studied have developed assessment-based

Table 2. Account	ability systems.					
	External evaluation/ inspection	Includes test-based measures	Other forms of assessment	Consequences for schools	Consequences for teachers	Consequences for students
Australia-New South Wales	Yes, administered by state, with alignment to national	Yes	N	No, except to identify those in need of support	N	No for NAPLAN tests in grades 3, 5, 7 and 9. Yes, for university admission
Australia- Queensland	Yes, administered by state, with alignment to national	Yes	State Schools Division conducts Teaching and Learning Audits in all state schools	No, except to identify those in need of support	QN	No for NAPLAN tests in grades 3, 5, 7 and 9. Yes, for university admission
Canada	Yes, administered by province	Yes	Ontario's Education Quality Indicators incorporate student, teacher, and principal sturvev data	No, except to identify those in need of support	<u>0</u>	oN
China-Hong Kong	Yes, national inspection	Yes	Self-evaluation by schools and inspection by the Education Bureau	Yes	No	Yes, for university admission
China-Shanghai	Yes, national inspection	Yes	School inspection by the Education Bureau	Yes	No	Yes, entrance tests for upper secondary school and university
Finland	No	No	Self-evaluation and sample- based student assessment by teachers	No	No	Yes, entrance test for university
Japan	No	No	Group accountability: teacher success tied to student success	N	No	Yes, entrance tests for upper secondary school and university
Singapore	Yes, national inspection	Yes	School Excellence Model incorporates self- evaluation on nine quality criteria as well as an external inspection by the appraisal branch of the Ministry of Education	Yes	Yes, teacher evaluation results are based in part on student achievement as well as other measures. Performance ratings are used to determine bonuses and promotion decisions	Yes
Florida	No	Yes	No	Yes	Yes, teacher evaluation is based in part on student achievement	N
Massachusetts	No	Yes	No	Yes	Yes, teacher evaluation is based in part on student achievement	No

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accountability policies in the belief that assessment outcomes are the fairest and most objective measure of national achievement. However, unlike Massachusetts and Florida those data-driven accountability measures are used as support mechanisms rather than as punishment (see Table 2).

Some countries use national inspection systems to monitor school performance. Finland and Japan have no national inspection and instead rely on sample-based student assessment. Finland uses self-assessment and municipal level inspection of schools as well. Hong Kong, Singapore and Shanghai have rigorous internal planning and monitoring and regular outside inspection. Australia and Canada have rigorous external testing (at the national level in Australia and at province level in Canada) with the intent of identifying schools in need of support. Singapore, Florida and Massachusetts categorise schools based on student test results. In Australia, NAPLAN was ostensibly low stakes for children but intended to be higher stakes for schools and teachers. Nonetheless, in international terms, it is not clear that NAPLAN is as high stakes for schools as in some other jurisdictions; the *MySchool* website is the only accountability instrument introduced for schools and there are no repercussions for teachers on their careers or promotion or any link to pay.

Florida has the highest stakes in that a low rating can result in the closure of a school. The danger here is that if assessment systems become high stake, even those that might be useful monitors of educational success can lose some of their dependability and credibility (Brewer, Knoeppel, & Lindle, 2015; Sahlberg, 2010). In this way, accountability policies can encourage schools to shift away from a curriculum to a test focus; what is not tested is either not taught or is given minimal time.

4. What compulsory and optional subjects are included in the programme of study

All jurisdictions must decide how much time to devote to in-school instruction and which subjects are mandatory in which grades and for how long. Generally there are regulatory requirements regarding hours of instruction overall as well as hours spent on particular subjects. However, in some of the jurisdictions there is a certain amount of leeway for local autonomy in the organisation of curriculum time or subject choice.

The OECD (2014) has gathered data on compulsory instruction time and the number of days in the school year for some of the jurisdictions studied (see Table 3). The figures differ dramatically, both for the number of days children spend in school and the number of hours they are in formal learning. A quality education does not necessarily seem to be anchored to longer instructional time.

	Average hours per year primary	Average hours per year lower secondary	Total hours lower secondary	Total hours lower secondary plus primary	Days in the school year
Australia	1010	1015	4060	10120	197
Canada	919	921	2764	8279	183
China	612	816	2448	6117	160
Finland	632	844	2533	6327	187
Japan	762	895	2686	7259	200
United States	967	1011	3033	8835	180

Table 3. Compulsory instruction time in general education.

There is a striking similarity in core subjects covered in 4th grade with children in all jurisdictions studying language arts, mathematics, science, social studies, physical education/health and the arts. The table below shows time spent on core subjects for some of the jurisdictions studied (see Table 4):

	New South Wales	Queensland	Alberta	Hong Kong	Finland	Japan	Singapore
Language of instruction	50% to English and mathematics	240	240 (25%)	220	133	185	260
Mathematics science		200 70	140 (15%) 140 (15%)	160	114 64	130 80	220 80

Table 4.	Hours sper	it per yeai	on key	subjects	 Grade 4 	(P4). ²
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Ontario, Florida and Massachusetts do not provide guidance on time spent for each subject.

In 8th grade, the core subjects remain and most jurisdictions add a language and about half add religious studies or ethics. In 10th grade, the core subjects remain in common (language arts, mathematics, sciences and social studies) but there is more variation among the jurisdictions with a few requiring career education and most requiring technology.

A number of the jurisdictions organise curriculum across disciplines: Shanghai is organised into eight interdisciplinary learning areas; Hong Kong has also reorganised its curriculum around eight Key Learning Areas. Hong Kong, Singapore and Shanghai offer an integrated science curriculum and exams.

It is interesting to note that New South Wales, Shanghai, Hong Kong and Japan all specify large periods of elective or flexible time in upper secondary school. In addition, students in Asian countries spend a great deal of extra time in the classroom outside of normal hours, both doing extra studies at school or with private tutors (Isaacs, Creese, & Gonzalez, 2015, pp. 69–88). Also, jurisdictions such as New South Wales and Finland have a great deal of flexibility regarding how the time is spent in each grade; they have allocations of time across age bands, giving schools autonomy in how they actually use that time.

One surprising outcome of the separate subject studies (see articles by Scott; Morgan & Smith; Reiss & Hollins; and Brant, Chapman & Isaacs in this issue) was that level of demand in the *intended* curriculum did not uniformly seem higher in, for example, Asian countries than in the US states. What was different was that for some subjects, especially mathematics, particular topics are introduced earlier in some of the jurisdictions than others, and certainly in the Asian jurisdictions there is an assumption that most, if not all, students will master the taught content. But because the Study was based on desk research, it was nearly impossible to ascertain how similar the intended and taught curricula were and whether or not there is a correlation between the level of demand in the various subjects and the outcomes of international tests — on which the original jurisdiction choice was based.

5. To what degree curriculum is organised by discipline or integrated across disciplines

Curriculum integration may range from those that have very clear boundaries between subjects in their curricula and those that do not. Those with clear boundaries, which cannot reasonably be thought of as integrated, have subject delineations that are clearcut, taught in separate blocks on the timetable, have their own formal knowledge structure, and content is treated as distinctive and belonging to the specific area.

Across the systems studies, the strongest impetus toward integration arises from jurisdictions' decision to embed twenty-first century skills in the curriculum. In almost all cases this development is recent and has been introduced from ministerial level. We found, however, that in some jurisdictions the aspirations from the top have not necessarily been met with enthusiastic compliance from below.

One way Australia takes a cross-disciplinary approach is by specifying that 'general capabilities' such as ICT capability, critical and creative thinking, personal and social capability, and other twenty-first century skills are important skills to be developed across subjects. Queensland was an early leader in developing integrated approaches through project work but has recently been moving away from that position, in part because of political pressures (Isaacs, Creese, & Gonzalez, 2015, pp. 37-39). It does retain an interdisciplinary social studies curriculum called Studies of Society and the Environment (SOSE) that bridges history and science. In New South Wales, there are fewer cross-curricular themes and less embedding of twenty-first century critical skills than in Queensland. In Canada, both Alberta and Ontario emphasise a foundation of literacy and numeracy integrated across the curriculum. Alberta has had an integrated curriculum policy for grades K through 3 since 2007, with explicit guidelines for multi-disciplinary and interdisciplinary teaching and learning. It is moving away from a more prescriptive curriculum in grades K through 12 in order to encourage teachers to take a more cross-disciplinary approach. Ontario's curriculum identifies opportunities for teachers to link related content and/or skills in two or more subjects within a single unit, lesson or activity (Isaacs, Creese, & Gonzalez, 2015, pp. 39–40).

China has focused on integration of subjects, particularly across science disciplines. Hong Kong's Integrated Science integrates chemistry, physics and biology, providing students with a wider range of scientific ideas addressed in greater depth. Similarly, Hong Kong's Integrated Humanities combines history, Chinese history, economic and public affairs and geography. Since 1985, from grade 7 on, Shanghai has produced integrated examination papers that cross disciplinary boundaries in all subject areas that test students' capacity to apply their knowledge to real-life problems. Multiple-choice questions have disappeared from the city's public examinations.

Finland takes an integrated curriculum approach with the sciences. For example, environmental and natural sciences is an integrated subject group comprising the fields of biology, geography, physics, chemistry and health education. Japan created a set period in secondary schools for interdisciplinary studies with a focus on experiential learning, although the time allocated to this has been reduced recently.

The national curriculum in Singapore is organised by core subjects, but schools have the flexibility to use an integrated instructional approach. There are broad life skills such as citizenship, values education, and information technology integrated throughout the national curriculum.

Neither of the two US states has a definitive policy on integrated studies, but both have adopted the Common Core State Standards that focus on literacy across the natural and social sciences.

While in many cases it is too early to judge the success of these efforts to move away from subject oriented content towards more integrated and competency based study, there is a clear 'direction of travel' in favour of further integration of the curriculum and away from the classical fixed boundaries of the traditional subjects.

6. How twenty-first century skills are embedded in the curriculum

The OECD defines twenty-first century skills as those necessary for citizens to thrive in a globally competitive marketplace and be responsible and contributing members of society (Ananiadou & Claro, 2009). These include: creativity and innovation; critical thinking; communication; collaboration; information literacy; personal and social responsibility; and cultural awareness and competence. All the jurisdictions highlight the skills students need to thrive in a globally competitive marketplace and be responsible and contributing members of society. The Study found, however, that they differ in the degree of prescription in how they are taught and if they are explicitly assessed.

In Australia, Queensland includes the twenty-first century skills of literacy, numeracy, ICT capability, critical and creative thinking, personal and social capability, intercultural understanding, and ethnical understanding into its curriculum. Known as general capabilities, these skills are addressed in the Australian Curriculum using icons within the content descriptions for English, mathematics, science, history and geography to indicate opportunities to develop these skills. New South Wales' curriculum is more traditional than the Queensland curriculum, with civics and citizenship absent from its key learning areas, fewer cross-curricular themes and less embedding of twenty-first century critical skills.

Alberta includes twenty-first century competencies under the rubric of 'competencies for engaged thinkers and ethical citizens with an entrepreneurial spirit' in its curriculum. Examples of ideal student performance and outcomes are provided. In Ontario, twentyfirst century skills have been an important focus of reforms and are combined with government strategy for literacy and numeracy.

Recent reforms in Hong Kong emphasise twenty-first century skills and teachers are encouraged to change their pedagogy and focus on making their classrooms more interactive. Assessment has also been changed to be more open-ended and inquiry-based. There is a large investment in technology to unleash the learning power and strengthen the development of students' self-directed learning, creativity, collaboration, problemsolving, and computational thinking skills. Shanghai does not have an overarching framework for measuring twenty-first century skills, but uses PISA-type tests of problem-solving to shift teaching and focus on modern skills. A professional development programme supports teacher learning of twenty-first century competencies.

Finland's definition of twenty-first century skills is unique in that it includes such themes as cultural identity and internationalism and responsibility for the environment. The Finnish National Board of Education expects teachers to incorporate broad cross-curricular themes such as active learning, technology and society, active citizenship and media skills into their instruction, without prescribing exactly how they are to be taught.

Japan's 2008 rewrite of the national curriculum emphasises the importance of students acquiring basic skills, nurturing thinking abilities, and self-expression. The country has implemented 'integrated learning' across courses, without allocating hours for this as a course, but allowing teachers to design courses that promote critical thinking and communication skills. However, while these skills and ICT education are prioritised in national policy documents, it is not clear that they are being fully implemented across schools.

Singapore's Ministry of Education introduced a greater focus on creative and critical thinking beginning with its 1997 reforms. The Singapore approach calls for the integration of thinking skills explicitly within core disciplines. Project-based and inquiry approaches were later added to help students make connections across disciplines. In mathematics, the emphasis is on problem-solving and adaptive reasoning; in science and humanities, the focus is on the inquiry process.

Both US states include twenty-first century skills in their goals statements and have adopted the Common Core State Standards which include a focus on twenty-first century skills, but neither has integrated these skills into their curriculum. In every grade level of the English language arts standards there is a common standard calling for 'collaborative discussions'. The ELA standards also call for students to communicate effectively and through a variety of media. Digital tools are mentioned as well as oral and written skills. In the mathematics standards, there is an emphasis on problem-solving and critical thinking.

The Australian states, Canadian provinces and Finland seem to have the most developed approaches, with curricula that include a large range of skills seen as twenty-first century skills, well developed cross-curricular approaches and a commitment to implementation. This contrasts with some US states. Florida, for example, does not appear to have a commitment to these skills or approaches. All the East Asian countries to some extent seem to be trying to impose a top-down reform, encouraging their schools to loosen their strict subject boundaries and try integrated projects, group and team working, problem-solving and critical thinking.

7. The clarity and content of curriculum for secondary vocational pathways

Vocational learning, with hands-on 'applied' elements, especially in upper secondary and post-compulsory education, is often seen as a way of augmenting the participation rates of young people in education with direct attempts to retain students who might otherwise have left school early. Real world experiences widen students' perspectives and provide a foundation for future career success, encouraging the development of practical skills, such as decision-making, problem-solving, teamwork, and written and oral communication. In most of the jurisdictions studied, vocational education and training leads to both the workplace and higher education (although it may be most likely that a student enters a polytechnic/technical institution rather than a university).

In each of the systems studied, some form of vocational/applied learning outside the usual skill-based traditional courses such as design and technology and ICT are offered to some, but not all, students (see Table 5). In all the jurisdictions studied there are vocational pathways for students from around grade10 onwards; these pathways also include a core element of academic subjects, most usually language of instruction and mathematics.

8. Whether curriculum is common or differentiated

Ability grouping is a controversial issue, yet all of the jurisdictions studied used it in one form or another. Those who argue for it believe that instruction should be individualised to students, who should be taught at the right level and have access to textbooks and resources that reflect their level. These students can work at their own pace and higher achievers can move onto more demanding work. In the negative column, proponents of

Table 5. Vocational pathways of study.

	Secondary vocational options	Vocational certification available
Australia-New South Wales	Vocational courses at colleges of technical and further education, senior colleges, or rural training schools	Record of student achievement plus vocational qualifications on the Australian Qualifications Framework
Australia- Queensland	Vocational courses at colleges of technical and further education, senior colleges, or rural training schools	Courses provide credit towards the Queensland certificate of education that details academic and vocational results of completed studies
Canada-Alberta	Vocational courses in comprehensive secondary schools	High-school diploma (or certificate of achievement) requires three vocational credits
Canada-Ontario	Applied course options in grades 9 and 10 with students selecting academic/ vocational pathway in grades 11 and 12	Vocational credits can be used to meet the Ontario Secondary School Diploma requirements (with special notation of vocational credentials earned)
China-Hong Kong	Vocational programmes during last three years (of six) of secondary school	Diploma in vocational education (instead of diploma of secondary education)
China-Shanghai	Vocational upper secondary school coursework (two to four years)	Gaokao (university entrance test) does not have specific vocational focus
Finland	Vocational upper secondary vocational schools (distinct from general upper secondary schools)	Vocational qualifications can be completed in addition to the Matriculation Examination (university entrance test)
Japan	Upper secondary schools with a focus on vocational and technical education (distinct from general upper secondary)	Certificate of upper secondary education does not have a specific vocational focus
Singapore	Normal Technical curriculum is the most vocationally oriented pathway available in lower/upper secondary. The curriculum prepares students for a technical-vocational education at the Institute of technical education	GCE N Levels; no special vocational certification
Florida Massachusetts	Vocational courses in secondary school Vocational courses in secondary school. Also vocational—technical schools.	High-school diploma; no special vocational certification High-school diploma

mixed ability classes/schools argue that all children working together allows for the highest performance for all, where students can help each other out and higher achievers get challenged through aiding students who might not have grasped a concept as quickly as they. There is a social based argument for mixed groups, since ethnic minority and impoverished students tend to be over-represented in lower ability groupings (Hanushek & Woessmann, 2005; Hattie, 2009; Higgins et al., 2014; Steenbergen-Hu & Moon, 2011).

Differentiating students is usually done by streaming, setting and/or grouping by ability. All of the jurisdictions differentiate among some students at some point. For instance, all jurisdictions have some groups of students studying calculus in upper secondary and other mathematics courses that do not offer calculus. Ability grouping allows students to remain in heterogeneous classrooms, for example, through reading groups in primary education; setting means that a combination of heterogeneous and homogenous classrooms can be found in the same school, for example, ability groups in science but mixed ability groups in social studies; streaming is the most differentiated, where groups of students study with peers of their own ability group.

The majority of jurisdictions studied have clear policies encouraging classes to remain together and to cover the same material. There may be explicit enhanced programmes for the gifted and talented, or extra support, possibly extra tuition or students withdrawn to small groups, for those who are struggling. However, this differentiation is almost always within the class and at the teacher's discretion. In general, streaming or ability grouping occurs largely in upper secondary. In Japan, for example, students take a number of entrance exams to apply and be admitted to a senior high school. They are then placed into general, specialised or integrated curricular programmes. General courses lead to university while specialised courses prepare students for vocational study. In Shanghai, students take the *zhongkao* to determine whether they attend an academic or a vocational school. Finland also streams students into general or vocational education but the student makes the choice. In Ontario, there are academic and vocational pathway choices offered within comprehensive high schools.

The Australian federal government and states have no explicit policies on setting or streaming (except for gifted and talented), delegating decisions to the school or class-room level. Similarly, Canada has no overall national policy on differentiation among students (and neither do the provinces of Ontario or Alberta). Administrators at the district or school level are allowed to determine if gifted and talented students get special provision. Alberta supports differentiated learning within classrooms, using a system of stratified courses at the senior high school for almost every academic subject. It also has different types of diplomas and certificates that reflect different levels of learning and courses taken. Ontario takes a similar approach offering coursework differentiated by level in high school. Students take different courses depending on their postsecondary pathway interest (university, technical college, workplace).

Hong Kong has moved away from the traditional practice of streaming students at the secondary level, promoting a standardised foundation of learning. Shanghai offers three types of secondary courses: a basic compulsory curriculum, an enriched curriculum of electives and an 'inquiry based' curriculum which takes place outside of school and includes community service.

Finland used to stream students into groups according to their ability in mathematics and in foreign languages, however, that is no longer the case. Finland has a core value of inclusiveness and all students receive a similar basic education through age 16, even those with severe learning difficulties. Students who need extra help are provided with part-time special education in small groups led by specialist teachers. Japan also has clear policies encouraging classes to remain together and cover the same material. There is no differentiation into ability groups.

Singapore is the only jurisdiction that separates students by ability (or streams) in primary school on the basis of an examination in primary 4. There is some shifting toward differentiating students within subject areas rather than for a full programme of study because while students can and do change pathways, most students' future is mapped out at an early age. In lower secondary, students are streamed into Express, Normal (Academic) and Normal (Technical) courses, which lead to examinations that determine their entry into university or vocational/technical programmes of study.

While elementary students in the United States receive a common foundational curriculum, teachers regularly place students into ability groups in order to target lessons to children's individual needs more effectively. At the secondary level, there is a general goal of graduating all students ready for success in college and careers; however, schools tend to offer pathways of study that are oriented towards a student's postsecondary interest (vocational or university). Students with an interest in going directly to university are more likely to enrol in more rigorous coursework, such as Advanced Placement courses or

I able 6. Compulsory	testing.		
	Primary	Secondary	University entrance
Australia-New South Wales	Best start kindergarten one-on-one diagnostic assessment of literacy and numeracy skills Yearly literacy and numeracy assessments, Grades 3 and 5 (NAPLAN). Sample testing in science, civics and citizenship and information and communications technology (ICT), every three years in Grade 6 (NAP)	Yearly literacy and numeracy assessments, Grades 7 and 9 (NAPLAN) Sample testing in civics and citizenship and information and communications technology (ICT), every three years in Grade 10 (NAP) Essential Secondary Science Assessment, Year 8 Higher School Certificate examinations for each subject worth 50% of students' crade	Australian Tertiary Admission Rank (ATAR) rank orders students nationally (except Queensland) based on weighted results of high-school course outcomes
Australia-Queensland	Yearly literacy and numeracy assessments, Grades 3 and 5 (NAPLAN) Sample testing in science, civics and citizenship and information and communications technology (ICT), every three years in Grade 6 (NAP)	Yearly literacy and numeracy assessments, Grades 7 and 9 (NAPLAN) Sample testing in civics and citizenship and information and communications technology (ICT), every three years in Grade 10 (NAP) Externally moderated school-based assessment. Years 10-12	Queensland Core Skills test in year 12 containing multiple-choice questions, short answers and a writing task used for scaling purposes
Canada-Alberta	Provincial assessment tests (PAT) in English language arts and mathematics (Grade 3) and English, mathematics, science, social studies and French (Grade 6) are being replaced by Student Learning Assessments (SLAs) 'readiness' assessments. SLAs will be given at the beginning of the school year in Grades 3 and 6 to plan for learning. They are computer-based and interactive, concentrate on literacy and numeracy, and designed to assess problem-solving, critical thinking and creativity	Provincial Assessment Texts (PAT) in English, mathematics, science, social studies and French (Grade 9) are being replaced by Student Learning Assessments (SLAs) 'readiness' assessments. SLAs will be given at the beginning of the school year in Grade 9 to plan for learning. They are computer-based and interactive, concentrate on literacy and numeracy, and designed to assess problem-solving, critical thinking and creativity Students enrolled in Science 30, Biology 30, Chemistry 30, Physics 30, ELA 30-1 and 30-2, Français 30-1, French Language Arts 30-1 and 30-2, Français 30-1, French Studies 30-1 and 30-2, must take diploma examinations Pan-Canadian Assessment Program (PCAP), national standardised tests of reading, mathematics and science stills. cincar every three vears in Grade B	
Canada-Ontario	Assessments in reading, writing and mathematics, Grades 3 and 6	Assessment of mathematics in Grade 9 Literacy assessment in order to graduate from high school Pan-Canadian Assessment Program (PCAP), national standardised tests of reading, mathematics and science skills, given every three years in Grade 8	
China-Hong Kong	Territory-wide System Assessment (TSA), basic competency tests in Chinese language, English language and mathematics in Primary 3 and 6	Secondary schools can set entrance tests(not all do) The Territory-wide System Assessment (TSA), basic competency tests in Chinese language, English language and mathematics in Secondary 3 Hong Kong Diploma of Secondary Education (HKDSE) examinations in Chinese, English, mathematics and liberal studies plus, typically, two or three other subjects in Secondary 6	Students who want to attend mainland universities take the <i>gaokao</i> (see Shanghai, below)

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Table 6.(Continued)

	Primary	Secondary	University entrance
China-Shanghai Einland	Examination at last year of primary Entrance examination for lower secondary	Graduation examinations for lower and upper secondary (<i>huikao</i>) in ten subject based areas Entrance examination for senior high school (<i>zhongkao</i>) in Chinese, mathematics, English, sciences, social science	Entrance examination for university (gaokao). Chinese, mathematics and foreign language (usually English) are compulsory. Students also select from three sciences and three humanities depending on their desired programme of study and provincial requirements.
Japan	Diagnostic exams in Japanese and mathematics, Grade 6	Diagnostic exams in Japanese and mathematics Grade 9 Entrance examination for upper secondary	wattrondeton examination action of upper secondary National Achievement test in civics, geography and history, Japanese literature, foreign language, science and mathematics
Singapore	Primary-school leaving exams in English, mother tongue, mathematics and science	N or O level examinations at end of lower secondary in six to eight subjects H1, H2 and H3 (A level) examinations at end of upper secondary usually in four subjects for academic track	A level examinations used for university entrance
Florida	Reading and mathematics tests every year between Grades 3 and 8 Science test once between Grades 3 and 5 and once between Grades 6 and 8 FCAT charde test in Grade 5 and writing test in Grade 4	Reading and mathematics in Grade 11 Science once between Grades 10 and 12FCAT Science test in Grade 8 and Writing test in Grades 8 and 10 Florida End of Course Assessments (FLEOC) in Algebra I,	Required to pass FCAT Grade 10 reading in order to graduate high-school ACT, SAT in reading, writing and mathematics
Massachusetts	For the second second and writing second sec	Reading and mathematics in Grade 11 Reading and mathematics in Grade 11 Science once between Grades 10 and 12	Advanced placement accumulation Required to earn a scaled score of at least mathematics, scaled score of at least 220 on one of biology, chemistry, physics or technology/engineering in order to graduate high school ACT, SAT in reading, writing and mathematics Advanced placement examinations

dual enrolment college classes, to increase their chances of being admitted to a more selective university. In Florida, for example, more than 50,000 high-school students participate in dual enrolment, taking post-secondary coursework and earning credit towards an industry credential or associate's degree.

9. How assessments are created and what stakes they have and for whom

Our definition of assessment covers both the summative (assessment of learning) and formative (assessment for learning) aspects of assessment that the jurisdictions studied use in order to ascertain if students have been successful at obtaining the knowledge, skills and understandings that define the intended curriculum.³

All of the jurisdictions prescribe a combination of the two types of assessment, but the emphasis is different, from the school-based, largely formative assessment found in Finland and Japan to the high stakes testing in Singapore and the US (see Table 6). Assessment for learning – using an assessment to provide feedback to both the teacher and the students on the student's progress towards achieving the learning objective – is an explicit requirement in most of the jurisdictions covered, with the exception of Japan and the US states.

Hong Kong is moving away from frequent territory-led testing, which is also the intention of Shanghai. However, the continuing dominance of the traditional Chinese *zhongkao* and *gaokao* examinations can distort the teaching and learning process. Singapore conducts external tests in three stages — at the end of primary school, upper secondary and post-secondary. However, the nature of the system, with its large number of differentiated pathways and early streaming or setting regimes means that the system is characterised by intense, examination-driven assessment.

Finland is at one extreme with only one national examination at the end of high school, some sample testing before then and school-based testing (with clear stakes for students). Japan has mostly school-based tests until high school when it is high stakes for the students. Both Shanghai and Singapore are characterised by intense, examination-driven assessment systems. Hong Kong shifted away from gateway exams at the end of lower secondary. Now students only sit for an examination at the end of upper secondary that helps determine their entrance to university. Australia and Canada have tests which are high stake for schools but not students (although Canada requires students to pass a literacy exam to graduate). Both Florida and Massachusetts have tests that are high stakes for both schools and students, with students having to pass certain tests in order to graduate.

Some concluding thoughts

The instructional systems studied varied in many of the ways we might have conjectured they would have before the project started — in some cases their curricula do not seem to be more demanding than other curricula with which we are familiar; they do not all have longer school days or longer school years; some reinforce educational activities outside the school day, others do not; they begin formal teaching at different ages; some have high stakes testing throughout the school years, others have none at all except for school leaving and/or university entrance examinations; the amount of assessment data shared publicly varies.

Other factors that successful systems might have in common were only touched on tangentially during our research. For example, there seemed to be a pattern of support

for teachers throughout their careers with initial teacher training aiming to attract 'the best and the brightest'; this is often supported by serious mentoring programmes during the first years of teaching, ongoing professional development and an emphasis on teaching and learning communities where teachers work together on lesson plans, delivery and assessment techniques, and are formally engaged in observing and learning from each other. Another factor frequently noted is the climate of high expectations in home environments and how this might affect the outcomes of international tests.⁴

Finally, we note that almost every system studied is either refreshing and renewing their instructional system, or is working towards a planned refreshment. These changes are not all in the same direction, and with some systems recently modifying reforms that had been in place in the past. Such revisions need to be done, it seems to us, with a clear understanding of the achievements or otherwise of the current curricular system as well as insights into other, successful, jurisdictions. Defining exactly what 'success' means is elusive, however, as we have learned during this project. Regardless, the careful gathering of evidence on what does and does not work in an existing instructional system remains a critical factor.

Notes

- The Common Core State Standards Initiative has created a single set of standards in mathematics and English – and is working on science – for kindergarten through 12th grade. The aim is to ensure that students who graduate from high school are ready for university or the workplace. For more information, see the Common Core website: http://www.corestandards.org.
- A number of assumptions have been made to create a common format for all jurisdictions. We have assumed that Finland has on average 38 weeks of school per year and lessons of 45 minutes, that Singapore has on average 40 weeks of school per year and Alberta has 950 hours of instruction per year.
- Some scholars argue that the summative/formative distinction is not the same as the distinction between assessment of and assessment for learning, for example, see Bennett, R. E. (2011). Formative assessment: a critical review. Assessment in Education: Principles, Policy & Practice, 18 (1), p. 5–25.
- Jerrim's (2014) recent work with ethnic Chinese students in Australia is interesting in this regard. He found that even in Western environments East Asian children outperform their counterparts, presumably due to out of school factors

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