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From drills to skills?

Cultivating critical thinking, creativity, communication, and collaboration through Malaysian schools

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making ideas work

Abstract

What policy approaches can help Malaysian primary and secondary schools to cultivate the cognitive and interpersonal skills that students need today? Since the 1980s, Malaysian policymakers have been attempting to shift the education system away from exam drills towards holistic skills development, but success has been elusive. In this paper, I focus on a set of skills called the Four Cs: critical thinking, creativity, communication, and collaboration. I examine why these skills are vital for the future well-being of the country and of individual students; and how such skills are cultivated in school systems elsewhere. Next, I evaluate the current state of skills cultivation in Malaysian schools, using (a) TIMSS and PISA microdata; and (b) policy documents, news reports, and social media posts on recent skills-related policies (PBS, PT3, HOTS questions in exams, and i-THINK mind maps). I identify three systemic patterns that hinder skills cultivation in Malaysian schools: a preoccupation with public exam results, an excess of paperwork-heavy directives that consume teachers' working hours, and an atmosphere of cynicism and blame among education stakeholders, compounded by frequent policy change. Finally, I propose a set of policy approaches—covering student assessment, instructional tools, school organisation, and the teaching profession—that could work within these systemic constraints to cultivate the Four Cs among Malaysian students.

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Executive summary

Since the 1980s, the Malaysian government has invested in numerous education policies aiming to shift the school system away from exam drills and rote memorisation towards skills development and holistic education. However, evidence indicates that school leavers lack flexible cognitive and interpersonal skills. Also, between 1999 and 2011, the Malaysian education budget more than tripled, but student performance in TIMSS, a cognitively challenging science and mathematics assessment, declined more than that of any other country participating in the 8th grade (Form 2) assessments.

Hence, the question I answer is: *given the decades of failed attempts to develop students' skills, what policy approaches can really cultivate flexible cognitive and interpersonal skills through Malaysian primary and secondary schools?* I focus on a set of skills known as the Four Cs: critical thinking, creativity, communication, and collaboration.

Cultivating the Four Cs is crucial for both our individual and collective futures. Malaysia's economy faces twin challenges: domestically, a growth plateau because of a failure to move to higher-value-added industries; and, globally, a technology revolution that threatens to render all routine jobs obsolete. A workforce equipped with the Four Cs would overcome these challenges by performing non-routine tasks that cannot be mechanised, and that reap greater returns. Additionally, the Four Cs can reinforce national stability by facilitating inter-ethnic relationships and civic consciousness. These skills would also enable young Malaysians to access greater opportunities and a fuller quality of life.

Around the world, school systems are striving to develop such complex skills in their students through initiatives spanning skills development modules, technology-based personalised learning, arts immersion programmes, and radical assessment methods. Detailed case studies of (a) project-based learning at the High Tech High schools in the United States, (b) blended learning at the Innova Schools in Peru, and (c) work-based learning at the Studio Schools in England suggest that successful skills development engages students in a mix of collaborative and independent learning, with connections to the real world, in a school environment unified by a common vision. These insights align with cognitive science research, which suggests that students best learn complex skills when they actively practise these skills in the context of meaningful knowledge, while receiving feedback on how to improve. I investigate the applicability of these insights to Malaysian schools using a statistical analysis of student survey data from TIMSS and PISA, the two largest international student assessment programmes. From the TIMSS and PISA microdata, I find that collaborative classroom activities engaging students in the Four Cs do cultivate the corresponding skills, but only to a limited extent—probably because the exam-oriented system hampers skills development and also skews students' interpretation of the survey questions.

Over the last several years, the Ministry of Education has introduced a number of policies that aim to cultivate skills such as the Four Cs. Drawing on policy documents, news reports, and social media posts, I evaluate four such policies—Pentaksiran Berasaskan Sekolah (School-Based Assessment, PBS), Pentaksiran Tingkatan 3 (Form 3 Assessment, PT3), higher-order thinking skills (HOTS) questions in

public exams, and i-THINK mind maps—and find that none of these policies have effected the intended changes to teaching and learning in schools. These failures can be traced to three counterproductive, ingrained patterns in the school system: an overemphasis on exam results; an excess of paperwork-heavy directives that consume teachers' time; and pervasive blame and cynicism among education stakeholders, heightened by frequent policy flip-flops.

These systemic constraints need not stymie skills cultivation permanently. I propose a set of fourteen policies to cultivate the Four Cs in Malaysian primary and secondary school students. For each policy, I consider aspects such as time frame, incentives, monitoring and accountability, and how to mitigate possible risks. The policies are as follows:

Student assessment

1. **SPM group project component**: a compulsory SPM component requiring each Form 4 student to complete a yearlong group project addressing a problem relevant to their community
2. **SPM portfolio option**: giving SPM candidates the option of being assessed not through exams, but through a portfolio of subject-specific projects
3. **Public collection of HOTS test questions**: a freely accessible bank of cognitively complex test questions and answers, across all subjects and school levels

Instructional tools

4. **Visible Thinking routines** (primary school): a set of protocols for helping students to articulate, extend, and share their thought processes with peers and teachers
5. **Peer Instruction** (secondary school science and mathematics): a protocol for deepening students' understanding through individual and paired work on puzzles testing key concepts in the syllabus
6. **Argumentation frameworks** (secondary school languages and humanities): frameworks for teaching different components of effective argumentation

School organisation

7. **Cocurricular public projects**: requiring each student to contribute significantly to one public project (e..g. a performance, competition, school event, or community service initiative) each year
8. **Self-contained classrooms in primary school**: a gradual move to self-contained classrooms, in which each class has the same teacher for most subjects, for each 3-year phase of primary school
9. **Policy experiment in eliminating streaming**: an opt-in experiment to determine if eliminating streaming improves student learning and/or weakens the focus on exam results
10. **Revamped school evaluations**: a phased transition to a school evaluation system incorporating data-driven improvement plans, student and teacher surveys, and town hall meetings with parents

The teaching profession

11. **Revamped teacher appraisals**: a phased transition to a teacher appraisal system focussed on improving teaching and learning, using videotaped classroom observations and student feedback
12. **Collaboration module**: a year-long series of structured, reflective professional learning activities for improving teaching among groups of teachers in the same subject

13. **Online platform for sharing classroom stories**: a nationwide, teacher-only platform for informally sharing stories of effective lesson techniques, activities, and student interactions
14. **Public discussions on questions in education**: periodic public discussions about ideas in education theory or policy, with accessible reference materials and dedicated discussion channels

These proposed policies fit together as a coherent package, with several compulsory policies supported by a range of opt-in policies. While the government should use its centralised authority to implement certain policies across the board, some other policy approaches should be optional, as they would only cultivate students' skills if executed by highly motivated school leaders, teachers, and students who have adequate resources and time, and who believe that the work entailed in implementing the change is worth the potential gains. If all fourteen proposed policies were compulsory throughout the school system, they would simply fuel the cynicism, blame games, and fabricated paperwork that constrain skills cultivation in Malaysian schools. Instead, each policy is designed to achieve results despite the skewed incentives and behavioural patterns described above. Collectively, the policies work to rectify these systemic constraints.

Chapter 1: The Four Cs and the future

Skills such as critical thinking, creativity, communication, and collaboration frequently feature in Malaysian media, for two reasons: we need these skills for the future; and many of our graduates don't seem to have them. While the real picture is more complicated, it is true that such skills are crucial to the continued well-being of Malaysia and her citizens. It is also true that skills development in our schools is far from where it should be, despite many policies and programmes to that end since at least the 1980s.

Hence, the question I address in this project is: *given the decades of failed attempts to develop students' skills, what policy approaches can really cultivate critical thinking, creativity, communication, and collaboration through Malaysian primary and secondary schools?* I answer this question using evidence ranging from cognitive science and pedagogy, to Education Ministry circulars and analyses of the Malaysian economy. In order to keep the project tractable, I focus on the 10,000 or so government-managed primary and secondary schools across the country.[1]

In the research question, I speak of "cultivating" skills, rather than "generating" or "building" them, because every person has innate capacities for these skills, and uses them naturally in situations that are comfortable and interesting. The challenge, however, is that students need to practice using these skills systematically, with increasing complexity, and in a wide range of settings. Moreover, the global economy now demands that a wide swathe of people learn how to deploy these skills whenever demanded by the workplace. While children from privileged socioeconomic backgrounds often hone these skills in well-resourced schools locally and abroad, the same cannot be said of the populace at large. Thus, the pressing economic imperative—ensuring the future survival of the Malaysian workforce—dovetails with the duty to make quality education accessible to all children.

Outline of this paper

In the remainder of this chapter, I define a set of skills called the Four Cs, and explain why I chose to focus on this skill set. In Chapter 2, I discuss why it is important to help students develop the Four Cs while in primary and secondary school. Chapter 3 looks at empirical insights on skills development; first surveying the dizzying range of approaches taken by schools in other countries, then discussing three case studies in detail, before summarising some observations from cognitive science about how the human brain learns skills.

Chapter 4 shifts back to Four Cs cultivation in Malaysia, using microdata from the TIMSS 2007 and PISA 2012 student assessments and surveys to investigate how the Four Cs are practised among Malaysian students today. In Chapter 5, I deepen this investigation by looking at historic and current policies related to skills development in Malaysian schools; focussing on Pentaksiran Berasaskan Sekolah (PBS), Pentaksiran Tingkatan 3 (PT3), higher-order thinking skills (HOTS) questions in public exams, and the i-THINK mind maps. As with earlier policies, these have had limited success in developing

1 In Chapter 2, I discuss in more detail this choice to focus on primary and secondary schools, rather than early childhood or tertiary education. (Notably, I do not discuss pre-service teacher training, which falls under tertiary education and has a huge impact on primary and secondary school. However, in this project I have neither the time nor the expertise to design a teacher training curriculum targeting student skills development.)

students' skills. Chapter 6 considers three systemic factors that have constrained skills development policies: the national preoccupation with exam results; the endless barrage of paperwork-heavy directives that consume teachers' time; and an atmosphere of cynicism and blame among education stakeholders, compounded by frequent policy change. Finally, in Chapter 7, I propose fourteen policies for boosting the cultivation of the Four Cs in Malaysian primary and secondary schools, taking into account the incentives and constraints discussed in earlier sections.

The Four Cs: critical thinking, creativity, communication, and collaboration

Potential employees with skills for the modern workforce may be in short supply, but typologies for these "work-ready" skills abound. For example, "21st-century skills" is a popular catchphrase for the competencies needed for thriving in a fast-changing, technology-oriented world. In Malaysia, higher-order thinking skills (HOTS; or kemahiran berfikir aras tinggi, KBAT) have been the subject of many recent policy statements and frustrated public discussions. Meanwhile, Malaysian employers and news articles regularly bemoan the lack of soft skills.

In this study, I use another popular framework: the Four Cs, or critical thinking, creativity, communication, and collaboration. Often seen as an extension of the traditional Three Rs—reading, 'riting, and 'rithmetic—the Four Cs strike a balance between (a) wide coverage of skills important in employment and further academic study, and (b) simplicity. Education initiatives that use the Four Cs include the Partnership for 21st Century Learning, which identifies the Four Cs as its crucial "learning and innovation skills" (P21, 2015); and the World Economic Forum's New Vision for Education project, in which the Four Cs constitute the four "competencies" for approaching complex challenges under its set of 21st century skills (World Economic Forum, 2015).

Defining the Four Cs

Critical thinking, creativity, communication, and collaboration are hardly obscure notions. Nevertheless, in this section I define each of the Four Cs, to ensure conceptual clarity. I also list observable behaviours that demonstrate aspects of each skill. These behaviours are hallmarks of each skill, regardless of context. The definitions and behaviours are summarised in Table 1.1.

I define **critical thinking** as *using reasoning to analyse, evaluate, and synthesise diverse sources of information*. This definition draws on the higher levels of Benjamin Bloom's (1956) famous cognitive taxonomy, which identifies a hierarchy of six thinking skills: knowledge, comprehension, application, analysis, synthesis, and evaluation. Bloom's Taxonomy is particularly appropriate as a source here because the current School-Based Assessment (or Pentaksiran Berasaskan Sekolah, PBS) framework draws on the taxonomy for its six achievement bands. In my definition of critical thinking, "reasoning" emphasises that critical thinking is a logical process—arbitrarily deciding that Coke is superior to Pepsi is not critical thinking, while reaching the same evaluation through a systematic analysis of consumer surveys is. Table 1.1. lists a few behaviours that demonstrate critical thinking. This list draws on Tony Wagner's (2010) Seven Survival Skills for the twenty-first century, which are based on extensive interviews with industry leaders, and the Partnership for 21st Century Learning framework (2015).

Table 1.1: Definitions and observable student behaviours for the Four Cs

Skill	*Description*
Critical thinking	using reasoning to analyse, evaluate, and synthesise diverse sources of information
	• ask questions that deepen understanding of unfamiliar material, and look for answers in efficient ways • identify points of view, claims, and evidence • select the most important/relevant pieces of information, based on evidence • discuss the interaction between different pieces of information • describe, reflect on, and direct one's own thinking process
Creativity	the process of developing original ideas that have value
	• generate multiple and varied ideas to solve an unfamiliar problem • elaborate on, and revise, the ideas to suit the circumstances • weigh the strengths and weaknesses of each idea • integrate different perspectives while developing and evaluating ideas • reflect on the creative process continuously, and use these insights to strengthen the selected ideas
Communication	expressing views clearly and persuasively, and responding constructively to others' views
	• convey views confidently and respectfully in writing and speech, and in familiar and unfamiliar contexts • structure information systematically and effectively • acknowledge information conveyed by others using verbal and non-verbal cues • accurately summarise information conveyed by others • affirm, modify, or contradict others' views, with politeness and reasons
Collaboration	the process of engaging actively and reciprocally in a team to achieve shared goals
	• build consensus and motivation through discussion • distribute tasks according to each member's strengths and weaknesses • adapt to different working styles and to changing task requirements • resolve conflicts through fair negotiations and compromises • monitor and affirm individual and group achievements

For **creativity**, I follow Ken Robinson's definition: "*the process of developing original ideas that have value*" (2011, pp. 2–3, my italics). For Robinson, creativity comes after imagination, which is "the process of bringing to mind things that are not present to our senses"; but before innovation, "the process of putting new ideas into practice" (pp. 2-3). Imagination allows us to step out of our immediate realities to encounter a limitless range of concepts, ideas, and possibilities. While imagination can occur passively, creativity is a deliberate act, consciously producing an idea that has meaning in a particular context. Innovation, in turn, turns those meaningful ideas into practices that have tangible impact. Thus, "creativity is applied imagination ... [and innovation] is applied creativity" (p. 142). Robinson argues against popular perceptions that some people are more inherently creative than others, and instead approaches creativity as a set of skills that can be learned and refined. The behaviours in Table 1.1 that demonstrate creativity are drawn from Robinson's work.'

The aspects of **communication** I focus on are *expressing views clearly and persuasively, and responding constructively to other's views*. This definition emphasises sensitivity to your audience, whether in persuading them to support your point of view, or in responding suitably to their perspectives. Effective communication skills are prized in the workplace, but are often lacking in young graduates, as documented in both the United States and Malaysia (Wagner, 2010; Yusuf & Nabeshima, 2009b; myStarJob, 2014). As with critical thinking, the communication behaviours described in Table 1.1 build on Wagner's Seven Survival Skills and the P21 framework. I also incorporate some aspects of Deanna Kuhn's case for teaching argumentation skills in schools (2005, Chapters 6–8).

Finally, I adapt Bedwell et al's (2012) multidisciplinary conceptualisation of **collaboration** to define it in this study as *the process of engaging actively and reciprocally in a team to achieve shared goals*. Not only is collaboration central to stable, democratic communities; it is also an increasingly important workplace skill set, driven in part by technological change (Karoly & Panis, 2004). Like creativity, collaboration is defined as a process because it implies an end product, whatever form that that product might take. The collaboration behaviours in Table 1.1 draw on Bedwell et al's collaborative performance framework.

A common thread across all the definitions here is the importance of being prepared to deal with unfamiliar settings and problems. Exponential technological change and global population movements have led to various oft-quoted estimates that only X percent of jobs that exist today will still exist in year Y. For example, the World Economic Forum estimates that the period between 2015 and 2020 could see the loss of 7.1 million jobs in some sectors, and a gain of 2 million jobs in others (2016, pp. 13–14). Whatever the actual numbers turn out to be, it is clear that primary and secondary schooling can only expose students to a fraction of the contexts that they will have to engage with throughout their careers. Moreover, the capacity for functioning well in diverse contexts is invaluable in our multicultural country. Hence, flexible skills such as the Four Cs are vital, as I will argue in Chapter 2.

Why the Four Cs?

As noted above, there is no shortage of frameworks for skills that students need for their future careers and for fulfilling lives. For example, the U.S. Department of Education (2012) reviewed 21 overlapping typologies to develop its own Employability Skills Framework. While the phrase "21st-century skills" is popular, it is also vague. Moreover, it implies that such skills did not matter in previous centuries. While workplace demand for non-routine cognitive and interpersonal skills is higher than before, these skills have always been important to human flourishing (National Research Council, 2012, p. 3; Rotherham & Willingham, 2009). "Soft skills" and "noncognitive skills" are similarly vague, and suggest a false separation between thinking and relating.

For simplicity, this project uses a parsimonious and common-sense framework, the Four Cs. Rather than ascribing a time frame or description to an indeterminate group of skills, "the Four Cs" just identifies the skills in focus: critical thinking, creativity, communication, and collaboration. As shown in the examples in Table 1.2, the Four Cs underlie many other competencies that are seen as crucial in children's futures. The Four Cs overlap with almost every capability listed in one industry-oriented skills framework (from the World Economic Forum (2016) *Future of jobs* survey) and one education-based skills

framework (Wagner's (2010) Seven Survival Skills). The exception to the overlap is the WEF's "service orientation", defined as "actively looking for ways to help people"; which is more a disposition than a skill. Dispositions, attitudes and values are invaluable in a thoughtful and fulfilling life and career, and are indirectly cultivated through many of the policies proposed here. However, widening the focus beyond skills would make this project unwieldy.

Table 1.2: Overlap of the Four Cs with the WEF skill sets survey and the Seven Survival Skills

Framework	Skill		Critical thinking	Creativity	Communication	Collaboration
The four sets of skills most demanded by employers (World Economic Forum, 2016)	*Complex problem solving*	Complex problem solving	✓	✓		
	Social	Coordinating with others			✓	✓
		Emotional intelligence				✓
		Negotiation		✓	✓	✓
		Persuasion			✓	
		Service orientation				
		Training and teaching others			✓	✓
	Process	Active listening			✓	✓
		Critical thinking	✓			
		Monitoring self and others	✓			✓
	Systems	Judgement and decision making	✓			
		Systems analysis	✓			
The Seven Survival Skills (Wagner, 2010)	Critical thinking and problem solving		✓	✓		
	Collaboration across networks and leading by influence				✓	✓
	Agility and adaptability			✓		✓
	Initiative and entrepreneurship			✓		✓
	Effective oral and written communication				✓	
	Accessing and analyzing information		✓			
	Curiosity and imagination			✓		

Similarly, because of this focus on skills, the framework does not include entrepreneurship. Some argue that entrepreneurship is increasingly important for students' future employability (e.g. Wagner & Dintersmith, 2015; Zhao, 2012), entrepreneurship is a set of knowledge, skills, and attitudes—such as

market familiarity, creativity, and risk-taking—rather than a single competency. The skills discussed here may strengthen students' capacities for entrepreneurship by developing component skills. However, the goal of this project is a set of national policies that can be feasibly implemented in primary and secondary schools. Hence, it is more useful to focus on the Four Cs than on entrepreneurship because the Four Cs (a) can be practised by students in a school setting; (b) have immediate and long-term benefits for their lives, regardless of what fields they pursue in post-schooling years; and (c) consist of easily recognised behaviours that can be used to track student progress. In the next chapter, I delve into why it is important to cultivate the Four Cs in Malaysian primary and secondary schools today.

Chapter 2: Why do we need to cultivate the Four Cs in Malaysian schools?

In this chapter, I make a case for cultivating the Four Cs in Malaysian primary and secondary schools. Using a series of theoretical arguments and empirical data from economics, development studies, educational studies, developmental psychology, and philosophy, I address the following questions:

- How can Four Cs cultivation help Malaysia?
- How can Four Cs cultivation help Penang?
- How can Four Cs cultivation help individual Malaysian children?
- Why focus on primary and secondary schools, rather than on other levels of education?

Few would argue against the value of the Four Cs for our individual and collective futures.[2] Still, it is important to consider the particular roles that these skills need to play in Malaysia—both to refine policy planning; and to provide motivation to see through the long-range policy solutions. "Because we're in the bottom third of PISA rankings", "because the SPM has many HOTS questions", and "because of the future" are adequate neither for policy design nor for political will.

How can Four Cs cultivation help Malaysia?

Boosting economic productivity and filling job market gaps

The Four Cs matter to Malaysia's economic future, because of both international pressures and local realities. A workforce equipped with a complex set of cognitive and interpersonal skills can master the technologies and processes that drive high-productivity economies. Global technological change is driving unprecedented opportunities for economic growth—both also widening the gulf between those who can leverage these technologies and those who cannot. The World Economic Forum's *Future of Jobs* project calls it the "Fourth Industrial Revolution" (World Economic Forum, 2016). As noted in the 2016 *World Development Report*, the current wave of automation is replacing not only blue-collar jobs, as in the case of mechanised factory assembly lines several decades ago, but also white-collar jobs in areas such as secretarial work, business services, and finance. In this climate, workers need not only basic literacy and numeracy, but also technical skills, "non-routine, higher-order cognitive skills", and "non-routine interpersonal, socioemotional skills" (World Bank, 2016c)—which include the Four Cs. Jobs requiring both non-routine cognitive skills and non-routine interpersonal skills are the hardest to automate, and hence the most likely to see growth in the coming years (Kraft & Grace, 2016). Industry leaders agree with these research-based predictions: according to World Economic Forum's *Future of Jobs* survey of chief human resource officers in the 100 largest global employers in each of nine target industry sectors,

2 Some do argue that the United States labour market is overqualified for currently available jobs, most of which do not require a university degree; and that there has been a reversal in the job market demand for cognitive skills since the year 2000 (Beaudry, Green, & Sand, 2013; Cockburn, 2012). However, as I argue below, Malaysia's job market does need more skilled workers; and there are other, non-economic reasons why skills such as the Four Cs matter for the future well-being of young Malaysians.

the five skills that will be demanded the most in 2020 are complex problem solving, critical thinking, creativity, people management, and coordinating with others (Gray, 2016).

Addressing these technology-driven changes is especially important for developing countries, which already face a technology gap. The most recent global economic forecasts by both the World Bank and the International Monetary Fund (IMF) noted that the average growth of emerging market economies had slowed, due in part to external factors, but also to a decline in productivity growth (IMF, 2015, p. 80; World Bank, 2016a, pp. 17–18). This echoes an earlier IMF study on the importance of improving productivity in developing economies. The study argued that a key pathway for economic growth is equipping the workforce with skills in innovation; which requires, among other things, greater educational quality and access (Dabla-Norris, Ho, Kochhar, Kyobe, & Tchaidze, 2013, p. 27).

The need to raise workforce skill levels has also been a frequent refrain in World Bank prescriptions for Malaysia's economy over the last several years (Jimenez, Nguyen, & Patrinos, 2012b, p. 4; World Bank, 2009, p. 40, 2010a, p. 12). Analysts have described Malaysia's economic situation as a middle-income trap: having achieved some industrialisation through historically strong growth, it has lost momentum and now cannot compete with either the lower manufacturing costs in lower-income countries, or with the superior knowledge and technology accumulation of higher-income countries (Flaaen, Mishra, & Ghani, 2013, pp. 5–6; Jimenez, Nguyen, & Patrinos, 2012a, p. 2). Shahid Yusuf and Kaoru Nabeshima attributed this growth plateau to a lack of long-range structural plans supporting higher value-added production; including the fact that Malaysia "has been slow to try to construct a culture of excellence and innovation through its schools and tertiary level institutions [unlike] Korea; Singapore; and Taiwan, China, [which] saw the need for such a culture and took steps to make it a reality, recognizing that doing so might take decades" (2009b, p. 11). Instead, Malaysia's long-standing dependence on MNCs for technological innovation, and on cheap low-skilled labour (whether native or foreign) for attractive production costs, is too narrow a base; especially as competition from China intensifies (Yusuf & Nabeshima, 2009b, pp. 47–49). Declining commodity prices pose a further threat (World Bank, 2016a, p. 71). Layered onto these challenges is the global wave of automation, as discussed above: the latest *World Development Report* estimates that 49 percent of jobs in Malaysia are susceptible to replacement by new technologies, even after accounting for low local wages that make automation less attractive, as well as time lags in adopting automation (World Bank, 2016c, p. 129). Other reports have noted that policy attempts to improve workforce quality since the early 1990s have shown little fruit (Yusuf & Nabeshima, 2009b, p. 25); and current policies under the Government Transformation Programme (GTP) are too small and specific to upgrade system-wide skills and productivity (World Bank, 2012, p. 27, 2013, p. 42)

Besides such long-range projections and strategies, the ground-level indicators show worrying data about the scale and level of skills in the Malaysian workforce. Companies surveyed in recent years have reported that it takes, on average, 5.4 weeks to fill a professional job vacancy; and that skills shortages were the dominant reason for job vacancies (Yusuf & Nabeshima, 2009b, p. 131; World Bank, 2009, p. 65). In the 2007 Productivity and Investment Climate Survey, 40 percent of firms reported that skills shortages were one of the three biggest constraints that they faced (World Bank, 2012, p. 56). Similarly, global accounting and advisory services firm Grant Thornton reported in its 2013 *International Business Report* that 43 percent of business leaders surveyed in Malaysia—the sixth highest in the world—expected a lack of skilled workers to constrain their growth in the next twelve months (2013, p. 20).

Despite these human capital shortages, graduate unemployment in Malaysia is high. In May 2015, 161,000 of the 400,000 unemployed persons nationwide were graduates (Bernama, 2015a). This implies a serious mismatch between the education being provided in Malaysia and current workplace demands. Industry leaders, ranging from Hong Leong Bank chief human resources officer Ramon Chelvarajasingam, to TalentCorp CEO Johan Merican, to the Bar Council's then-treasurer Steven Thiru, have commented that Malaysian graduates lack the critical thinking skills and creativity that are crucial for keeping up with professional demands (Bernama, 2012; Cheah, 2014; Cheng, 2012). Equally, many have lamented the inadequate 'soft skills', such as communication and collaboration competencies, among Malaysian graduates (Yusuf & Nabeshima, 2009b, p. 134; Bernama, 2016b; Cheah, 2014; Cheng, 2012; Sukumaran, 2015).[3] Outsourcing Malaysia chairman David Wong noted that many shared services and outsourcing (SSO) companies struggle to hire suitable graduates beause of a mismatch between the skilsl of graduates and "the necessary communication skills, creative and analytical problem solving capabilities" (Ooi, 2015). A *McKinsey Quarterly* report supports these anecdotes: HR professionals in Malaysia estimated that only 35 percent of engineering graduates, 25 percent of finance and accounting graduates, and 20 percent of graduates with generalist degrees would meet employment standards in their firms (Guthridge, Komm, & Lawson, 2008, p. 52). In a 2014 survey by TalentCorp and the World Bank, 81 percent of the 200 respondent companies reported that fresh graduates lack communication skills; and roughly half the respondents reported deficits in creative and critical thinking, analytical skills, and problem solving (myStarJob, 2014).

Supporting government development plans

Over the last several years, major development plans produced by the Malaysian government have included a skilled workforce as a pillar of future national growth and well-being. In the *Eleventh Malaysia Plan 2016-2020*, three out of six strategic thrusts require schools to develop students' proficiency Four Cs: not only Strategic Thrust 3, "Accelerating human capital development for an advanced nation", but also Strategic Thrust 1, "Enhancing inclusiveness towards an equitable society" (because, as noted in Strategy A1, raising the income and wealth of the bottom 40 percent of households requires greater school access and quality), and also Strategic Thrust 6, "Re-engineering economic growth for greater prosperity" (because revitalising each key sector requires a stock of skilled human capital) (Economic Planning Unit, 2015b).

However, this emphasis does not translate into detailed and research-driven plans for developing the Four Cs in the desired skilled workforce.[4] For example, one component of Strategic Thrust 3 (accelerating human capital development) is "Enhancing the curriculum to build 21st century skills".

3 While English language proficiency is often listed among skills in short supply among young Malaysian workers (e.g. Yusuf & Nabeshima, 2009b, p. 134; Bernama, 2012), I do not address it directly. English-language education in Malaysia is a complex and contentious matter, and the policies proposed in this project will boost communication skills in all languages used in classrooms, including English.

4 The scanty details on education development here contrast markedly with the *Tenth Malaysia Plan 2011–2015*, which laid out a 20-page proposal for improving the performance of the education system (Economic Planning Unit, 2010). Many of these proposals were later incorporated into the *Education Blueprint 2013–2025* and PEMANDU's Government Transformation Programme.

However, it only goes as far as saying that "Teachers will embed HOTS in their lessons to develop critical, creative, and innovative thinkers", with no mention of specific policy studies or initiatives to facilitate this (Economic Planning Unit, 2015b, p. 5-27)—despite the fact that the Ministry of Education has been incorporating HOTS elements in the primary and secondary school curricula since the mid-1990s, with little apparent effect. Similarly, one element of Strategic Thrust 6 (re-engineering economic growth) is "Promoting higher order thinking skills to develop a dynamic society". Policy prescriptions here are limited to: (a) scaling up the i-THINK mind maps programme, which has yet to show clear success in improving HOTS despite significant spending and several training courses targeting every teacher nationwide (which will be described in Chapter 4); (b) scaling up Genovasi, a training centre for a method of innovation called "design thinking", which, as of 22 August 2016, only listed five short courses and one 26-day course for 2016 on its website;[5] and (c) emphasising science and mathematics in education and career opportunities, without any elaboration on why these subjects promote HOTS more than their counterparts (Economic Planning Unit, 2015b, p. 8-33).

Other major government planning documents that support the need for skills growth in the Malaysian workforce include:

- the New Economic Model, which emphasises "greater reliance on productivity to drive growth" and includes "Developing a quality workforce and reducing dependency on foreign labour" as one of eight Strategic Reform Initiatives (National Economic Advisory Council, 2009, pp. 100–103, 123);
- the Ministry of Human Resources' Strategic Plan, which lists "developing the human capital of a competitive country (membangunkan sumber manusia negara yang berdaya saing)" as one of six strategic cores (Kementerian Sumber Manusia Malaysia, 2011, pp. 74–81);
- the Services Sector Blueprint, which includes "human capital development (pembangunan modal insan)" as one of four policy levers (Economic Planning Unit, 2015a, p. 13); and
- the 2016 Budget Speech, which places "empowering human capital (mempersiaga modal insan)" as the third of five priorities listed (Najib Razak, 2015, paras 113–133).

Nevertheless, as with the *Eleventh Malaysia Plan*, these documents do not describe any practicable, research-driven policies to enhance the Four Cs.

Facilitating national unity and civic consciousness

Cultivating the Four Cs is vital not only for the country's economic health, but also for its civic health. In a nation state as young and as multicultural as Malaysia, critical thinking and creativity are indispensable tools for constructing national identity. In order for young Malaysians to respect differences and affirm similarities across ethnolinguistic groups, they must first be able to thoughtfully move beyond prejudices to analytically identify these convergences and divergences. This is a non-trivial task, given that many Malaysian children do not have frequent, extended interactions beyond their ethnolinguistic

5 http://www.genovasi.my/programmes/design-thinking and http://www.genovasimalaysia.com/programmes/dleadership

groups: in 2011, 96 percent of ethnically Chinese primary school students attended Chinese vernacular schools (SJK(C)), and that 97 percent of students in national primary SK schools were Bumiputeras (Kementerian Pendidikan Malaysia, 2013c, p. E-7). Skills in communication and collaboration, which can be transferred across contexts, will help to bridge these divides. To build strong relationships and work towards shared goals with fellow citizens, we must synthesise knowledge about different social and cultural protocols, and respond constructively—whether or not we actively realise that we are using these skills. Moreover, to make prudent choices at the ballot box, we must be prepared to evaluate the platforms and track records of different candidates and parties, sifting through multiple sources of information to assemble an adequate understanding (Weinstein, 1991).

Thus, the Four Cs are key to sustaining sociopolitical stability as well as economic survival. Many Euro-American educationists have long regarded critical thinking as a central component of citizenship education (e.g. ten Dam & Volman, 2004). Malaysians would do well follow suit.

How can Four Cs cultivation help Penang?

Driving a shift to knowledge-intensive industries

As shown in the previous section, Malaysia has much to gain from cultivating the Four Cs among primary and secondary school students. Such skills development would yield benefits not only at the national level, but also the regional. In the case of Penang, the state government has initiated a push into two skills-intensive industries: business process outsourcing and information technology outsourcing (BPO-ITO), as well as creative multimedia (Lim, 2014; Ong, 2015). This accords with World Bank recommendations that Penang should diversify from electronics manufacturing into strategic higher value-added sectors (Yusuf & Nabeshima, 2009a, p. 2). The BPO initiative is also aligned with both the national Economic Transformation Programme's Entry Point Project 2 in the Business Services category, which focuses on building competitive capacity in BPO-ITO as well as knowledge process outsourcing (KPO) (Pemandu, 2015). Between 2009 and 2014, investments in such shared services and outsourcing in Penang totalled RM4.1 billion (Lim, 2015a).

This focus on BPO-ITO and creative multimedia is also strategic in that it replicates elements from Penang's golden age of manufacturing. First, a hallmark of Penang's industrialisation in the 1970s was a shift from import substitution to manufacturing for the export market (Wan Fairuz Wan Chik, Selvadurai, & Er, 2013, p. 79). Similarly, both BPO-ITO and creative multimedia have an international orientation. Second, a key selling point for Penang's manufacturing heyday were the hard and soft infrastructures provided through industrial parks in the Free Trade Zone and coordination services through the Penang Development Corporation (PDC) (Hutchinson, 2010; Yusuf & Nabeshima, 2009a). Today, the PDC continues to play its role in attracting and coordinating investment, in tandem with InvestPenang. The state government has also invested in a RM3.3 billion multi-site BPO-ITO Hub, as well as a Creative Animation Triggers hub in a retrofitted colonial heritage building (InvestPenang, 2014a, 2014b).

However, one distinct difference between the 1970s manufacturing push and the current knowledge-intensive push is that the former required its workers to deploy only routine skills in electronics assembly lines; while higher-value-added output today depends on non-routine skills, whether

in the creative multimedia industry, or in higher-level BPO-ITO. For BPO-ITO, this is a particular challenge because Penang faces competition not only from other recent entrants to the shared services and outsourcing industry, but also from India and the Philippines, which are regarded as the most established providers of global shared services (Gereffi & Fernandez-Stark, 2010, p. 31). Both of these mature BPO-ITO providers have workforces many times larger and, on average, many times more fluent in English than Malaysia's. Moreover, despite very robust growth in BPO and ITO—with estimated annual growth rates of 25 and 26 percent, respectively, between 2005 and 2010—growth is even stronger in KPO, at 58 percent for the same period (OECD, 2009c, p. 150). This suggests that long-run competitiveness in shared services and outsourcing will require Penang to move into KPO, a complex, judgement-based field that requires staff with advanced technical qualifications (KPMG, 2008, p. 12).

Besides shared services and creative multimedia, other target industries in the Northern Corridor Economic Region—light-emitting diode/solid state lighting; medical devices/technology; medical tourism; cultural heritage tourism—also face gaps in skills related to the Four Cs: creativity and innovation skills, interpersonal skills, problem solving skills, English language proficiency (PWC, 2013).

Consequently, the state government must build on its celebrated provision of industry-relevant skills training through the Penang Skills Development Corporation (Hutchinson, 2010, p. 88), in order to address emerging shortages in the high-skill job market. Penang chief minister Lin Guan Eng recently highlighted this need, calling human capital one of the "key drivers" of the state economy, while noting that worker shortages were the 'main concern' of the state government and of major employers (2015b). Moreover, this shortage of high-skilled labour threatens not only the new target industries, but also Penang's long-standing electronics sector (Chua, 2011; Yusuf & Nabeshima, 2009b, p. 103). Besides stopgap re-skilling and talent recruitment programmes, Penang needs long-range education reform that cultivates cohorts of Penangites equipped with the Four Cs and relevant content knowledge. Programmes to build skills in primary and secondary school would also support existing state initiatives to develop a skilled talent pool. One such initiative is the Penang Future Foundation, a privately funded and publicly administered scholarship programme which requires recipients to work in Penang upon completion of their studies; and which prioritises applicants who show "good cognitive skills" (Looi, 2015; Penang Future Foundation, 2016).

Enriching the legacy of excellent public schools

In addition to playing a critical role in the future of Penang's historically unique economic trajectory, cultivating the Four Cs could also invigorate Penang's tradition of excellent public schooling. Before Malaysia gained independence, Penang had established a reputation for a centre of high-quality English, Islamic, and Chinese education; whether at the Penang Free School, St Xavier's Institution, Madrasah Al-Mashoor, or Chung Ling School (Goh, 2012; Harper, 2009, p. 14; Hutchinson & Saravanamuttu, 2013, p. xv; Rosnani, 2004, pp. 30, 44–45; F. H. K. Wong & Ee, 1971, pp. 13–14).

At a time when the education system in Malaysia is struggling to overcome complex challenges, coordinated state-level efforts to cultivate the Four Cs could strengthen the draw of Penang's schools. Such efforts would, in fact, be a continuation of an old legacy: the founder of Al-Mashoor, Kaum Muda reformist Sheikh Ahmad Al-Hadi, had already "abandoned the memorization method of study and the

narrow religious curriculum and initiated student activities such as debate and rhetoric" nearly a century ago (Rosnani, 2004, p. 30)—long before such methods became popular forms of student-centred, skills-oriented learning.

How can Four Cs cultivation help individual Malaysian children?

Raising social mobility and employability

As discussed above, the Four Cs are among the key skill sets that employers seek, and the demand for these skills will grow as the global economy responds to new technologies. Thus, Four Cs cultivation is crucial not only for national economic survival, but also for the life chances of individual Malaysian schoolchildren. In 2010, the majority of jobs—44.3 percent—in Malaysia in 2010 were low-skilled, with another 27.0 percent mid-skilled and 28.7 percent high-skilled. However, only 2.1 percent of the net increase in jobs between 2000 and 2010 came from the low-skilled sector, whereas 46.6 percent of the net increase came from mid-skilled jobs, and 51.3 percent from high-skilled jobs (World Bank, 2012, p. 47).[6] This indicates that those with lower levels of education and skills, who already face a higher likelihood of poverty,[7] will be increasingly left behind as the job market modernises.

Hence, developing the Four Cs through primary and secondary schools is not just a matter of national economic betterment, but also one of equity and justice. This is recognised in the *Eleventh Malaysia Plan*, which names inclusive growth as the first of its six strategic thrusts. One focus area in the *Plan* proposes strategies for uplifting households in the bottom 40 percent of the income distribution—such as "reducing school dropouts; enhancing accessibility to higher education and skills training; increasing productivity through adoption of modern technology" (Economic Planning Unit, 2015b, pp. 3–16). As commendable as these approaches are, they will not succeed unless other interventions raise these students' capacity to apply non-routine skills to a variety of challenging and market-demanded situations.

Improving quality of life through increased capabilities

Moving away from economistic perspectives, broader theories of human development also offer support for Four Cs cultivation. Amartya Sen proposed a theory of development called the capabilities approach, on the basis that development was not mainly about raising incomes, but rather was "a process of expanding the real freedoms that people enjoy" (2001, p. 3). Consequently, national development should be measured in terms of the "capabilities", or types of functioning, that the populace can achieve.

In Martha Nussbaum's elaboration of the capabilities approach, two of her ten Central

6 In this classification, 'low-skilled' jobs include agricultural and fishery workers, craft and related trade workers, plant and machine operators and assemblers, and elementary occupations. 'Mid-skilled' jobs include clerical workers, service workers and shop and market sales workers. 'High-skilled' jobs include legislators, senior officials, managers, professionals, technicians and associate professionals (World Bank, 2012, p. 47).

7 In 2010, the incidence of poverty among households headed by someone with no formal education was 12 percent, as compared to 4 percent among households headed by someone with secondary school education (World Bank, 2010b, p. 74).

Capabilities require critical thinking and creativity: First, "[s]enses, imagination and thought: [b]eing able to use the senses, to imagine, think, and reason—and to do these in … a way informed and cultivated by adequate education…"; and, second, "[p]ractical reason: [b]eing able to form a conception of the good and to engage in critical reflection about the planning of one's life" (2011, pp. 33–34). Aspects of two other Central Capabilities entail communication and collaboration skills: first, "being able to live with and toward others, to recognise and show concern for other human beings, to engage in various forms of social interaction", under the "Affiliation" capability; and second, under the "Control over one's environment" capability, "[b]eing able to participate effectively in political choices that govern one's life; having the right of political participation, protections of free speech and association". In Nussbaum's argument, Central Capabilities are fundamental to human dignity, so it is the task of all governments to ensure that all citizens attain a basic level of these capacities.

Even without subscribing fully to the capabilities approach, it is clear that competence in evaluating and synthesising a wide range of information and ideas, and in expressing oneself and participating in meaningful collaborations, adds meaning and value to life—and that all children deserve opportunities to develop such competencies.

Why focus on primary and secondary schools, rather than on other levels of education?

Optimising cognitive development during formative years

Although the Four Cs are most visible in productive tasks during adulthood, the development of such skills begins far earlier. Each level and form of education—whether kindergarten, postgraduate research, or in-house skills training—has unique roles in raising and maintaining workforce competitiveness, but primary and secondary school are an indispensable foundation for further skills development. Cognisant of this, programmes such as the World Bank's Skills Toward Employment and Productivity (STEP) framework emphasise cumulative skills development throughout workers' life cycles, with foundational employment skills being fostered during the school years (Banerji et al., 2010). Another recent World Bank study argued that the primary school years are the best time to develop social-emotional skill development for the labour market (Guerra, Modecki, & Cunningham, 2014).

Cognitive and interpersonal skills accumulate: simpler skills provide the basis for more complex and non-routine skills. One scholar, building on Jean Piaget's seminal work, describes cognitive development as "the construction of hierarchically ordered collections of specific skills", which increase in complexity as age progresses, contingent on the person's environment (Fischer, 1980, p. 477). This supports the rather obvious, but often neglected, fact that the cultivation of thinking skills in primary and secondary school is a prerequisite for proficiency in technical and abstract modes of learning in universities and vocational training institutes. As a major review of economic studies of cognitive and noncognitive skills development in children concluded, "early investments feed into later investments … [s]kill begets skill; learning begets learning" (Cunha, Heckman, Lochner, & Masterov, 2006, p. 799).

Training in cognitive and interpersonal skills has greatest impact at early ages, so we must invest strategically and extensively in early childhood education, especially to compensate for socioeconomic differences that set children on divergent paths (Heckman & Masterov, 2007). That said, this paper focuses on primary and secondary schooling, for two reasons. First, primary and secondary education are

centralised under government administration, and thus have great potential for skills gains through coordinated system-level policy reform. Second, although early childhood development is vital, children's capacities for reasoning and analysis develop most rapidly "from late childhood to middle adolescence" (Steinberg, 2005, p. 70). For example, capacities for memory, concentration, goal setting, and cognitive flexibility develop rapidly through the primary school years (Anderson, 2002; Casey, Giedd, & Thomas, 2000). During secondary school, adolescent brains become more specialised; with greater capacities for self-directed inquiry and for differentiating between multiple interpretations of reality. These years also see increasing variation between people's capacities for complex thought, depending on the mental activities they engage in (Kuhn, 2006; Kuhn & Dean, 2004; Kuhn & Pease, 2006). Hence, policies to cultivate higher-order thinking skills and other non-routine skills, whether cognitive or interpersonal, must not bypass the primary and secondary school years. Remediation during tertiary education, as in many Malaysian government blueprints, comes too late.

Ensuring efficient use of public education funds

While weak development of the Four Cs leads to wastage in higher education investments, it also constitutes unconscionable waste in primary and secondary school spending—which, in 2014, amounted to RM40.1 billion of public funds, with another RM15.1 billion spent on higher education (Kementerian Kewangan Malaysia, 2015, pp. 633, 653).

There is ample anecdotal evidence of dissatisfaction with Malaysian primary and secondary schools and their capacity for growing the Four Cs. To provide some concrete evidence on thinking skills, the performance of 14-year-old Malaysian students in TIMSS, an international assessment that is designed to test both content mastery and thinking skills, has been declining. Malaysia's declines in TIMSS mathematics (79 points from 1999 to 2011) and science (84 points from 2003 to 2011) represent the biggest ever drops for any country in TIMSS 8th grade maths and science assessments since their inception in 1995 (M. O. Martin, Mullis, Foy, & Stanco, 2012, pp. 54–57; Mullis, Martin, Foy, & Arora, 2012, pp. 56–59). Moreover, these drops occurred over a period when the education budget more than tripled from RM13.5 billion in 1999 to RM48.4 billion in 2011 (Kementerian Pendidikan Malaysia, 2001, p. 6-2; Kementerian Kewangan Malaysia, 2010, pp. 38, 40). Whatever flaws there may be in the global methodology and Malaysian administration of TIMSS, it is clear that there are severe shortcomings in the use of public education funds.[8] Public stewardship demands better deployment of these resources.

Conclusion

Flexible skills such as the Four Cs are important for the well-being of Malaysia's economy and citizenry, and there are many indications that such skills will become even more important in the future. The Four Cs can play a significant role in boosting productivity across the workforce; and in enhancing

8 One possible cause of the low 2011 scores could be rapid policy changes: students who sat for the 2011 TIMSS tests would have entered Standard 1 in 2004, learning mathematics and science under the PPSMI English-medium policy; which was retracted in 2009, when they were in Standard 6. I will discuss Malaysia's TIMSS and PISA data further in Chapter 4.

both the material and non-material quality of life for individual Malaysians. In the next chapter, I look at schools elsewhere that focus on skills development, and at cognitive science, in order to gain insight into how best to cultivate the Four Cs through Malaysia schools.

Chapter 3: What works in Four Cs cultivation? Insights from successful schools and cognitive science

Education systems around the world are scrambling to figure out and deliver what students need for the future. Proposed solutions abound. Numerous schools dotting the globe, often in futuristic buildings, purport to teach the necessary skills in the best ways.[9] In this chapter, I look at approaches taken towards Four Cs cultivation in schools around the world. I also summarise some cognitive science research on how people develop complex skills.

How do schools elsewhere cultivate the Four Cs?

Table 3.1 lists a selection of education initiatives that target the development of cognitive and interpersonal skills. This listing is far from exhaustive. For clarity, it only includes self-contained programmes that have some evidence of direct impact; rather than systemwide policies whose effects are harder to disentangle.

Table 3.1: Education initiatives for skills development in children

Initiative	Location	Evidence of efficacy
Modules for developing the Four Cs: integrated into curriculum		
Cognitive Acceleration through Science Education (CASE)	United Kingdom	https://www.letsthinkinenglish.org/wp-content/uploads/2012/06/TheEffectsofCognitiveAcceleration.pdf
Everyday Mathematics	United States	http://everydaymath.uchicago.edu/research/efficacy_research/
Thinking Through Geography	United Kingdom, Netherlands	(Schee, Leat, & Vankan, 2006)
Evidence-Based Argumentation	United States	http://www.bostondebate.org/in-school/the-basics
Facing History and Ourselves	United States	https://www.facinghistory.org/our-impact
Activating Children's Thinking Skills	Northern Ireland	(Dewey & Bento, 2009)
Eric Mazur's Peer Instruction	United States	(Mazur, 1997, Chapter 2)
Modules for developing the Four Cs: standalone courses		
Feurstein's Instrumental Enrichment	various	(Blagg, 1990)
PATHS Education Worldwide	various	http://www.pathseducation.com/paths-works/elementary-school-findings
Edward de Bono's CoRT Thinking	various	http://www.cortthinking.com/front-page-experimental-research-and-graphs
Philosophy for Children	various	https://educationendowmentfoundation.org.uk/public/files/Projects/EEF_Project_Report_PhilosophyForChildren.pdf

9 For one overview, Alfredo Hernando's *A journey to 21st century education* (2015) whizzes through 48 schools in twenty countries.

Initiative	Location	Evidence of efficacy
Personalised learning: technology-based		
Green Shoots Maths Curriculum Online	South Africa	http://www.greenshootsedu.co.za/impact.html
Teach To One	United States	http://www.newclassrooms.org/resources/Teach-to-One_Report_2013-14.pdf
Personalised learning: through teacher facilitation		
Escuela Nueva	Columbia	(Psacharopoulos, Rojas, Echavarria, & Mundial, 1992)
Kunskapsskolan	Sweden	http://www.kunskapsskolan.com/nyheter/10ofkunskapsskolanschoolsrankedamong100bestinsweden.5.3bbea29912bc181832f80002653.html
Big Picture Learning	United States	http://www.bigpicture.org/apps/pages/index.jsp?uREC_ID=389377&type=d&pREC_ID=882376
Olds High School	Canada	http://www.oecd.org/edu/ceri/50300850.pdf
Blended learning		
Innova Schools	Peru	*See Case Study 2 below.*
Avanti Learning Centres	India	http://avanti.in/our-students/
Project-based learning		
High Tech High	United States	*See Case Study 1 below.*
College Catts Pressoir	Haiti	http://www.educationinnovations.org/program/college-catts-pressoir
New Tech Network	United States	http://www.newtechnetwork.org/services/resources/new-tech-network-2015-student-outcomes-report
Studio Schools	United Kingdom	*See Case Study 3 below.*
Competency-based assessments		
College and Work Readiness Assessment & Collegiate Learning Assessment	United States	http://cae.org/images/uploads/pdf/Comparing_Alternatives_in_the_Prediction_of_College_Success.pdf
New York Performance Standards Consortium	United States	http://performanceassessment.org/consortium/cfaq2.html
Impact Academy of Arts and Technology	United States	http://www.es-impact.org/es-impact/wp-content/uploads/2012/07/2015_School_Accountability_Report_Card_CDE_Impact_Academy_of_Arts__Technology_20160129.pdf
Extracurricular programmes: arts		
Room 13	United Kingdom	http://room13international.org/wp-content/uploads/2012/06/Room13-Case-Study-Report-Nesta-2006.pdf
Mobile Art School in Kenya	Kenya	http://mobileartschoolinkenya.org/AD%20Magazine%20May%202015%20all%20pages.pdf
El Sistema	Venezuela	http://sistemaglobal.org/literature-review/
Extracurricular programmes: technology		
Introduction to Basic Technology	India	http://www.educationinnovations.org/program/introduction-basic-technology-ibt-course
Girls Who Code	United States	https://girlswhocode.com/about-us/#outcomes-impact

Initiative	Location	Evidence of efficacy
Extracurricular programmes: other		
Injaz	Jordan	http://www.injaz.org.jo/EchoBusV3.0/SystemAssets/dbdf7cb1-f800-4b18-be49-050f15b443df.PDF
The Future Project	United States	http://www.thefutureproject.org/program/#results
Magic Bus	India	http://www.magicbus.org/impact

All websites were accessed on 16 June 2016.

However innovative an education programme may be, its success also depends on numerous other elements of the school system, many of which are never given slick names on shiny websites. In the rest of this section, I look at the trajectories and challenges of three school networks that have demonstrated efficacy in cultivating the Four Cs. None of these models could—or should—be transplanted directly to our national education system, but the case studies give insight into the process of school improvement, and illustrate a range of possibilities for Malaysian primary and secondary schools.

Case study 1: Project-based learning at the High Tech High schools, the U.S.A.

How can you prove that you understand linear equations? At the Gary and Jerri-Ann Jacobs High Tech High in San Diego, California, one way of doing this is creating a portrait of the 17th century philosopher and mathematician René Descartes using Microsoft Excel, as in Figure 3.1. When mathematics and physics teacher Alfred Solis wanted his 9th graders to master linear equations, he told each student to find a picture of a historical figure, identify data points in the image, and derive linear equations to reproduce the lines of the image on an X-Y graph in Excel (High Tech High, 2009). Welcome to the interdisciplinary, project-filled world of High Tech High.

Origins of the High Tech High schools

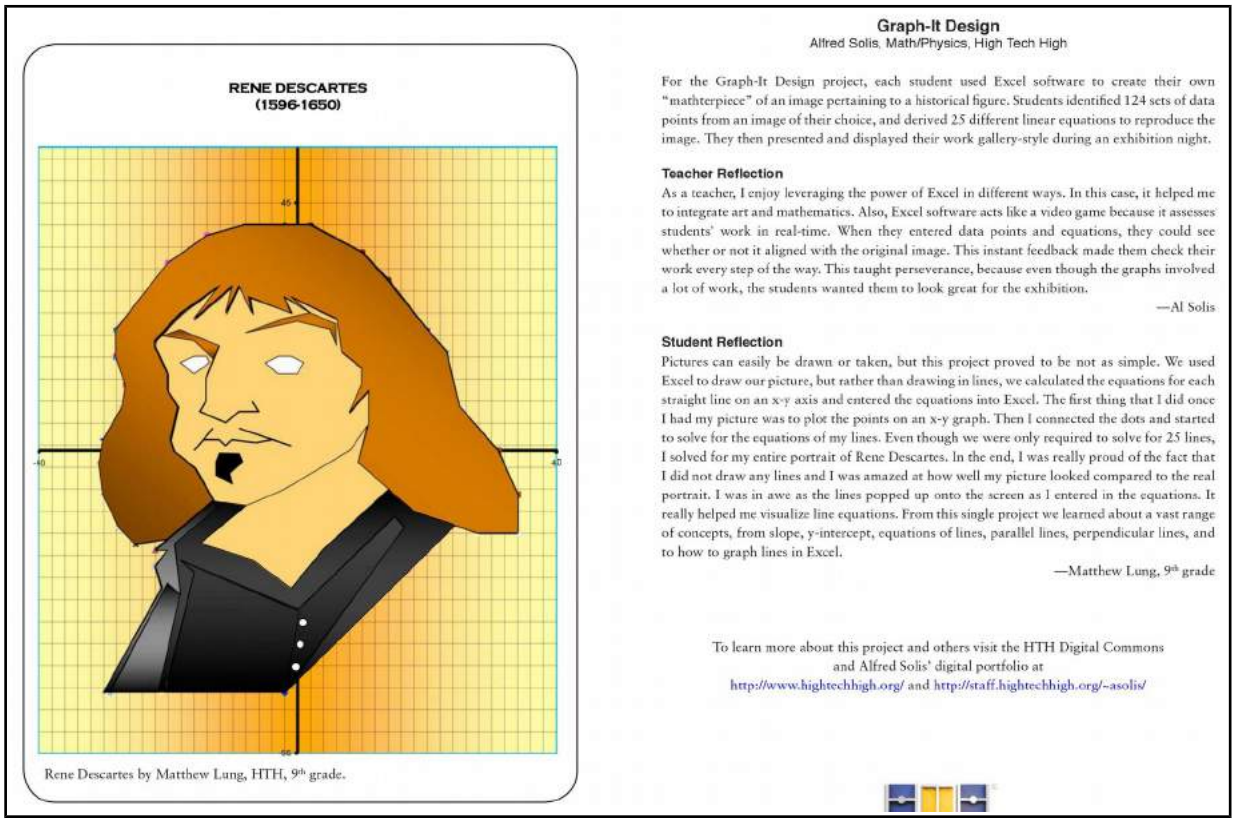
In the late 1990s, a group of civic and industry leaders in San Diego convened to address the difficulties of finding skilled high-technology workers, especially among women and ethnic minorities. They decided to start a publicly funded independent school to fill these gaps. The first school, High Tech High, opened in 2000. Today, there are thirteen schools in the High Tech High network, with students from kindergarten to 12th grade, as well as a graduate school of education for training teachers (High Tech High, n.d.). High Tech High has been featured in the documentary *Most likely to succeed*, an official selection at the 2015 Sundance Film Festival, and in books such as Tony Wagner's (2010) *The global achievement gap* and Yong Zhao's (2012) *World class learners*.

Key traits of project-based learning at High Tech High

The mission of the High Tech High schools is "to develop and support innovative public schools where all students develop the academic, workplace, and citizenship skills for postsecondary success" (High Tech High, n.d.). This preparation for future success is achieved through learning that is linked to

the adult world, including projects, public presentations, and work experience. Students regularly produce projects that combine skills and academic disciplines. Some projects are sold as published books.[10] Others have been displayed as museum exhibits (Wagner, 2010, p. 226). In 11th grade, all students complete three-week internships, during which they must develop projects that use their classroom learning to further the host organisation's work. Past internship projects have included writing a user guide for an obsolete but necessary computer in the nuclear reactor division of an engineering firm, and designing animated games to educate children about the Environmental Service Department's Project Orca (Wagner, 2010, pp. 225–226). In 12th grade, they conduct yearlong senior projects of their own choosing, which are assessed by a panel of adults, including experts from outside the school (High Tech High, 2015a).

Figure 3.1: Graph-It Design project at High Tech High



Source: (High Tech High, 2009)

At High Tech High, students are not streamed by academic achievement or ability. Assessment is based on performance in tasks rather than on exams. These tasks are judged using rubrics, and students learn about standards for excellence by discussing the qualities of exemplary work done by their peers (Wagner, 2010, p. 223). All of this is supported by extensive planning by teachers, who reach school an hour before students arrive every day to focus on planning, and who meet regularly in interdisciplinary teams to collaborate and to discuss student work (Stephen & Goldberg, 2013).

10 See http://www.hightechhigh.org/projects/ for examples of student projects and books.

Student outcomes

Although High Tech High schools avoid exams and tests, students consistently perform well in state-level standardised tests. In the 2015 California Assessment of Student Performance and Progress (CAASPP), only 4 percent of 11th graders in the Gary and Jerri-Ann Jacobs High Tech High School failed to meet the state standard in English language literacy, compared to the state average of 20 percent; while 31 percent exceeded the standard, compared to the state average of 23 percent. In Mathematics, 25 percent of High Tech High students failed to meet the standard and 16 percent exceeded it, compared to the state averages of 45 percent and 11 percent, respectively (California Department of Education, 2015a, 2015b).

The schools appear to fulfil their mission of preparing students for postsecondary success, at least in higher education admissions. Out of the 594 students in the Class of 2015 across the five high schools in the High Tech High network, 95 percent subsequently enrolled in university, with 389 students entering four-year colleges and 180 students entering two-year colleges (High Tech High, 2015a, 2015b, 2015c, 2015d, 2015e). The Class of 2009 has a 60 percent admission rate to the University of California system, compared to the state average of 23 percent (Stephen & Goldberg, 2013, p. 15).

Could the High Tech High model work in Malaysia?

Unlike expensive, exclusive private schools, all the High Tech High schools operate within the standard state-level budget allocations. Sixty-three percent of students are ethnic minorities, and 42 percent qualify for free or reduced-price meals, an indicator of low household income. Although the school's impressive track record has led to great popularity, with thousands of applications each year, students are selected through a blind, computerised lottery that does not consider prior academic achievement (High Tech High, n.d.).

While the success of High Tech High does not depend on a homogeneous student body or large incomes, it is unlikely that the model could translate from thirteen schools in California to 10,000 schools in Malaysia. The High Tech High network prizes school culture, and it sustains this by opening each new school with a team of teachers and administrators who have worked at existing High Tech High schools for at least two years (Stephen & Goldberg, 2013, p. 8). The network also places a premium on excellent school leadership, helmed by CEO Larry Rosenstock, who became the founding principal of the first High Tech High school, after years of experience as a carpentry teacher, attorney, principal, and director of a U.S. Department of Education research project (Wagner, 2010, pp. 208–209). To maintain quality, the High Tech High network has only opened its schools in three locations in California, all within an hour's drive.

Case study 2: Blended learning at the Innova Schools, Peru

When the PISA 2012 results were released in December 2013, opinion columns in Malaysian newspapers bristled with accusations about who was to blame for our dismal ranking—52nd out of 65 participating education systems. Half a world away, in the lowest-ranked PISA 2012 country, a group of low-cost private schools was completing the first year of its signature blended learning programme, and was getting exam results that far exceeded the national average (ILE-OECD, 2014). Using carefully

designed institutions and a suite of digital technology, this Peruvian for-profit chain, called the Innova Schools, is on a quest to build better Peruvians by building better schools.

Origins of the Innova Schools

In 1995, Carlos Rodríguez-Pastor Jr. inherited Banco Internacional del Perú from his father. It has since become the Intercorp Group, a conglomerate of companies across sectors like finance, retail, real estate, and, recently, education (Intercorp, 2016). Rodríguez-Pastor's goal in all his enterprises is to serve the country's growing middle class. Peru's private schools were generally low-quality and the public schools worse, and Rodríguez-Pastor thought Intercorp could do better. In 2007, Intercorp launched an annual award that gave a car to the best teacher in each of the country's 25 regions. In 2010, they bought a network of three private schools. In 2011, they recruited the San Francisco firm IDEO to design a comprehensive new school system (Brown & Martin, 2015). The new framework was piloted in two classrooms in 2012, then in eight schools in 2013, before being deployed for over 10,000 students in all 22 Innova Schools in 2014 (ILE-OECD, 2014). Today, there are 24 Innova Schools in greater Lima, and 11 in the provinces; with another 35 slated for opening by 2020 (ILE-OECD, n.d.; Innova Schools, 2016).

Key traits of blended learning at the Innova Schools

The Innova Schools want to be three things: affordable, scalable, and excellent (IDEO, 2015). To achieve all of this quickly with neither a large pool of highly experienced teachers nor large salaries to lure them with, the Innova Schools use blended learning. In blended learning, some lessons are delivered by teachers and some by technology. At Innova, students spend 70 percent of school hours in conventional classrooms, often working in small groups; and 30 percent of school hours in self-paced individual lessons, usually in computer labs (Moreno Alcázar, 2014). Thus, the schools deliver personalised teaching without needing tiny student-teacher ratios and encyclopaedic teacher expertise. In addition to problem-solving and collaboration during group time, two weeks of each year are devoted to a schoolwide Innovation Programme, in which all students together take on a question rooted in the local setting, such as "How might we improve health in our community?" or "How might we help our community build confidence in our national heritage?" (ILE-OECD, n.d.).

Amid its rapid expansion, Innova monitors quality. For example, most materials for computer-based learning come from existing online providers such as Khan Academy, but when the schools couldn't find a satisfactory platform for secondary school reading comprehension, they commissioned one themselves. Teachers are regularly observed in the classroom, and student performance is tracked by the central Innova Schools management (ILE-OECD, 2014). The Innova system also invests in professional development through initiatives such as the Teacher Resource Centre, a database of thousands of lesson plans to which Innova teachers contribute. Innova also has a long-range collaboration in which it provides English-language lecturers to a local teacher training college, in order to improve the communication skills of teacher trainees, some of whom later join the Innova staff (ILE-OECD, n.d.; C. Martin, 2014).

Student outcomes

The Innova Schools are too new to boast improved postsecondary prospects for its students, but they do outscore their peers in national exams. In the 2014 Evaluación Censal de Estudiantes for 2nd grade students, 71 percent of Innova second-graders met the proficiency benchmark in mathematics, compared to 26 percent of students nationwide, and 26 percent among all private schools. In reading comprehension, 85 percent of Innova 2nd graders scored above the benchmark, compared to 44 percent nationwide and 57 percent in private schools (Fortune, 2015; Innova Schools, 2015). In 2013, 71 percent of students and 80 percent of parents and teachers surveyed were satisfied with the schools (Moreno Alcázar, 2014).

Could the Innova Schools model work in Malaysia?

Given free rein and infinite funds, the Innova model might work in Malaysia. Our populations are similar in size and in ethnic diversity, and both countries have big urban-rural disparities. Our larger school system appears to perform somewhat better than Peru's, if PISA is taken as a measure. While internet connectivity in Malaysian schools is hardly adequate, our broadband penetration rate exceeded 70 percent in the middle of 2015, compared to 4 percent in Peru in 2014 (Malaysian Communications and Multimedia Commision, 2015; Moreno Alcázar, 2014). In these aspects, improving schools through blended learning may be easier in Malaysia than it has been for the Innova Schools.

But budgets are limited, and systems have constraints. The Innova Schools charge an average of US$110 per month, or 12 percent of the monthly income of the middle-income families who make up their student body (Moreno Alcázar, 2014). Building a network of 35 fee-paying schools over less than a decade has been possible because Peru already has 21,000 private schools, attended by 22 percent of students nationwide (ILE-OECD, n.d.). In Malaysia, only 4 percent of primary and secondary students were enrolled in private schools in 2015 (Kementerian Pendidikan Malaysia, 2015d). Innova-style private schools would barely nudge the achievement curve. Even if there were sufficient funds to roll out blended learning across government schools, countrywide implementation faces other constraints. Offered as free public education, the model would lose fee-motivated parental buy-in. Expanded across all schools, the pool of enthusiastic teachers would be even shallower. The Innova model may be replicable, but at the national level it would struggle to stay affordable and excellent.

Case study 3: Work-based learning at the Studio Schools, England

The German model of vocational education is admired by educationists and policymakers in countries where skilled workers are in demand but vocational training is seen as second-rate. In Germany, vocational training at the upper secondary level attracts half the students in each cohort, including a large number who are academically qualified for university entry (Hoeckel & Schwartz, 2010). This is not the case in England. However, several years ago, the U.K. Department for Education introduced a new type of school to tackle a range of systemic shortcomings, including unfavourable perceptions of vocational education. These Studio Schools enrol students aged 14 to 19 years, and require weekly work placement, but also offer GCSEs, the culminating exam for compulsory education at age 16.

Origins of the Studio Schools

Studio Schools were pioneered by the Young Foundation, whose founder was instrumental in numerous social enterprises, including the Open University (Mulgan, 2011). To address the twin issues of students who underperformed and were disengaged, and employers who were dissatisfied with the abilities of new graduates, the Young Foundation proposed a new type of state-funded but independently run school, in which all students work outside the school and much of the curriculum is covered through real-world projects (Studio Schools Trust, n.d.). After a pilot programme with 30 students in 2007, the first two Studio Schools opened in 2010 (U.K. Department for Education, 2013). Today, more than thirty Studio Schools operate across England.

Key traits of work-based learning at the Studio Schools

To balance academic rigour and career readiness, Studio Schools offer instruction for academic qualifications alongside work placements. 14- and 15-year-old students work for at least four hours a week. Older students work two days a week, and are paid (Studio Schools Trust, n.d.). Most Studio Schools choose to specialise in dominant local industries. Specialisations range from catering and hospitality to space exploration and science (U.K. Department for Education, 2013). To accommodate both the academic and vocational elements, Studio Schools run for more days than the normal school calendar, on a daily schedule closer to office hours than a school day (Hendry & Sharpe, 2013). Hands-on aspects extend to the classroom, where the national curriculum is delivered through group projects on themes such as "Understanding the world" and "Discovering through technology" rather than conventional subject divisions (Studio Schools Trust, 2013). Learning in both domains is harmonised using the skills-based CREATE framework: Communication, Relating to others, Enterprise, Applied, Thinking, and Emotional intelligence (Studio Schools Trust, 2012). Each student also has a "personal coach", who helps develop individualised work plans combining studies and work placements (Studio Schools Trust, n.d.).

Each Studio School is run by a charitable trust, but funded by the state and monitored by Ofsted, the national schools inspectorate (U.K. Department for Education, 2014). They are coordinated by the Studio Schools Trust, which works with the Department for Education as well as individual schools to improve curriculum and share best practices (Hendry & Sharpe, 2013). School leaders also work with local authorities, which manage admission for 14-year-old students; and collaborate with local employers to design work placements and support students throughout their placements (Hendry & Sharpe, 2013; U.K. Department for Education, 2014).

Student outcomes

Partly because the Studio Schools are a new model, and partly because they are run by different trusts, performance data is limited and mixed. In 2012, 90 percent of students at the Creative & Media Studio School in Kirklees gained 5 GCSEs at grades A* to C, compared to the local average of 59 percent

(Hendry & Sharpe, 2013, p. 24). In 2015, Ofsted rated the Rye Studio School in East Sussex as outstanding in all areas (Ofsted, 2015). However, out of the 47 Studio Schools that have opened since 2010, fourteen have closed or are slated for closure—including the initial Studio School in Luton, which had only 66 pupils in the 2015-16 school year (Camden, 2016). Even the exemplary Rye Studio School struggles to attract pupils: Studio Schools aim to be "small schools" of 300 students, but Rye only managed to enrol 120 in 2015 (Ofsted, 2015). Nonetheless, an evaluation of the Studio Schools Trust based on visits to three Studio Schools concluded that, despite under-enrolment, incomplete implementation, and disappointing local buy-in, Studio Schools are promising both because of their pedagogical model and the commitment of staff to improve their schools (Hendry & Sharpe, 2013).

Could the Studio Schools model work in Malaysia?

Any attempts to introduce Studio Schools in Malaysia would be caught in the same perception conundrum facing English Studio Schools: to prove that the model works, the Studio Schools need committed students and supportive local businesses, but the students won't commit and the businesses won't offer support till they see success. In Malaysia, as in the U.K., vocational education is usually considered lower-status than academic tracks—a fact noted in the *Higher Education Blueprint* (Kementerian Pendidikan Malaysia, 2015c). That said, the Malaysian government appears committed to strengthening technical and vocational education options to fill skills gaps, and similar forms of hybrid work-based education have shown clear success in other countries, such as career academies in the United States (Kemple & Willner, 2008).

Lessons for Malaysia from the case studies

Only time will tell whether High Tech High schools, the Innova Schools, and the Studio Schools have really prepared their students for future challenges. Still, these case studies show some instructive patterns, which find support in other research.

To cultivate skills, students need both interaction and independence in their learning.

In all three case studies, students had many opportunities for group learning, alongside opportunities to practise self-direction. At both the High Tech High schools and the Studio Schools, group projects and work placements make students learn together with peers, communicate with adults, and manage tasks and decisions without a teacher's hand-holding. At the Innova Schools, group time focuses on interactive learning, while computer-based learning requires independence. All of these modes of learning are coordinated and scaffolded by individual attention from teachers, whether in High Tech High's advisory groups, through the Innova Schools' technology-assisted facilitation, or by personal coaches in Studio Schools. This blend of interaction and self-direction matches the prescriptions in studies of 21st-century learning (Istance & Dumont, 2010; Wagner, 2010, Chapter 5).

Student learning is enhanced when it has connections to the real world.

These three school networks all refuse to operate in an academic bubble. Besides the compulsory internships, High Tech High students consistently showcase their projects in public exhibitions, thus grounding them in broader contexts. The annual Innovation Programme at Innova Schools requires all students to take on significant questions about the quality of life in the local community. In addition to the workplace focus at the Studio Schools, academic work is organised in themes about community, health, enterprise, and technology, rather than subjects. Such an emphasis on real-world connections in classroom learning is also a common theme in studies of how to prepare students for the future (Istance & Dumont, 2010; Perkins, 2014; Zhao, 2012).

Ambitious education programmes need strong support, which must be based on a common vision.

All three of these schools were founded on a common vision for solving a local problem that many people regarded as important —for High Tech High, a shortage of skilled technology workers; for the Innova Schools, inadequate education to meet middle-class aspirations; for the Studio Schools, student disengagement and employer dissatisfaction. In all cases, a lot of effort went into building and maintaining support for these visions, using leadership, research, and phased implementation. High Tech High was started by prominent local leaders, and helmed by Larry Rosenstock, an educator with an impressive track record. The Innova Schools' parent company started with a carefully designed process to build expertise and credibility in education, including a pilot project in two schools, before launching its ambitious expansion. The Studio Schools offer both positive and negative evidence for this observation. Many Studio Schools are floundering because of a lack of buy-in. In contrast, Ofsted celebrated the Rye Studio School for its "impressive and pioneering vision of its role and purpose"; its principal, who "leads with vision and determination"; and external support in the form of "very strong partnerships with local businesses and organisations" (Ofsted, 2015). Other studies have also found that a shared sense of purpose among educators is crucial for school transformation (Benitez, Davidson, Flaxman, Sizer, & Sizer, 2009; Kirp, 2013).

What does cognitive science research say about skills development?

Turning from case studies to cognitive science research, one key idea from cognitive science that will underlie my policy proposals is that s*tudents cultivate the Four Cs when they spend time practising the Four Cs*. This may seem obvious, but it is often sidelined in policy proposals centred on technological gimmicks or catchy acronyms. In the book *Why don't students like school?*, cognitive psychologist Daniel Willingham (2010) explains that practice is key to proficiency in any mental task—including communication and collaboration, which require countless mental connections, just as critical thinking and creativity do. Practice not only builds competence and accuracy when first learning a skill; but also reinforces the skill, once mastered, so that proficiency lasts and can be transferred to other tasks and settings. A similar finding—that learning must be carried out by the learner—is emphasised in a major OECD review of education research (Schneider & Stern, 2010). Hence, to be competent in the Four Cs, students must practise them; not only using and experiencing the skill, but noticing their strengths and weaknesses, and targeting areas of improvement; with the aid of feedback explaining why they went

wrong (National Research Council, 2012, Chapter 4). The need for learners to actively and reflectively practice desired skills is not new, with antecedents in the work of John Dewey and Jean Piaget (Kolb, 2014). Neither is it limited to studies of formal education: it has significant overlaps with K. Anders Ericsson's work on deliberate practice for developing expert performance across a range of professional, artistic, and athletic fields (Ericsson, Krampe, & Tesch-Römer, 1993).

That said, the manner in which students practise the skills also matters. Throughout the primary and secondary school years, human brains develop in ways that facilitate different mental processes and social interactions that would not have been possible at younger ages (Anderson, 2002; Kuhn, 2006). In these pivotal years, different contexts and activities can result in vastly different levels of cognitive and social-emotional skills (Kuhn, 2005; OECD, 2015a). Thus, students should be encouraged to extend the boundaries of their skills. However, they must not be pushed to completely unfamiliar ground. Students need cognitive challenges, but they also need to enjoy success so they don't shrink from future trials (Willingham, 2010, Chapter 1). As many studies have made clear, people are only motivated to complete a task when they feel competent in it (Boekaerts, 2010, pp. 96–97). Hence, students should practise the Four Cs on tasks that are challenging, but attainable.

Another important insight from cognitive science is that skills and content must be taught together. Scholars concur that non-routine skills such as the Four Cs are best learned not through standalone courses, but within particular domains of knowledge; and that increasingly complex skills are most effectively practised on knowledge that the student has already mastered (National Research Council, 2012; Rotherham & Willingham, 2009). Such a blend of content and skills was found in the mathematics lessons of high-scoring countries in the TIMSS 1995 and 1999 Video Studies. Although teaching strategies varied greatly across these high-achieving countries, lessons in all of these countries required students to struggle actively with key mathematical concepts, rather than mechanically applying formulas or recalling information (Stigler & Hiebert, 2009). Other studies also find cognitive advantages, such as longer-term content retention and stronger skills development, when students grapple with problems and investigations (Boaler & Staples, 2008; Strobel & van Barneveld, 2009).

Conclusion

There are myriad ways to cultivate the Four Cs through primary and secondary schools. However, as we have seen, there are some general principles for facilitating such skills development. The case studies of the High Tech High schools, Innova Schools, and Studio Schools showed that students are likely to develop a balanced skill set when they have opportunities for both group work and independent work; when their learning is connected to a range of real-world contexts; and when their schools have a strong sense of vision. Cognitive science research suggests that students cultivate the Four Cs by spending time actively engaged in applying these skills to meaningful content; in ways that provide appropriate but not overwhelming challenge. Later, in Chapter 7, I incorporate these insights into a set of policy proposals for cultivating the Four Cs in Malaysian schools. But first, the next three chapters examine the current state of skills development in primary and secondary schools; beginning with an analysis of TIMSS and PISA microdata.

Chapter 4: TIMSS and PISA data on the Four Cs and classroom practices

The Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA) are two of the largest education assessment programmes in the world. TIMSS is held every four years, and Malaysian Form 2 students have participated in it five times, since 1999. PISA is held every three years, and Malaysian 15-year-olds have participated three times, since 2009. PISA aims to assess the sort of literacy in reading, maths, and science that can be applied to many contexts and problems (OECD, 2014b). While TIMSS focuses more on mastery of academic content, the TIMSS database provides separate scores for each student's performance on different thinking skills (M. O. Martin, Mullis, & Foy, 2008). Hence, PISA and TIMSS can serve as gauges of students' critical thinking skills.[11]

Some argue that TIMSS and PISA scores can be proxies for even more than thinking skills. In a major, 15-year research project, Eric Hanushek and Ludger Woessmann have found strong evidence that a country's level of human capital, as measured by international student achievement tests, is a strong predictor of its economic growth. In their analysis, a rise of one standard deviation in test scores is associated with a rise of 2 percentage points in per capita GDP growth (2012)—a difference roughly equal to the gap between China's and Malaysia's per capita GDP growth in 2014 (World Bank, 2016b). This relationship between test performance and economic growth has proven robust to a wide range of specifications and causal controls (Hanushek & Woessmann, 2015). Hence the authors assert that national economic growth hinges on the average level of cognitive skills in the workforce, and that the most accurate available measure of cognitive skills levels are international assessments such as TIMSS and PISA.

Besides testing student proficiency in science and mathematics (and reading, in PISA), the assessment programmes use detailed questionnaires to collect background information on education. TIMSS surveys students, principals, and maths and science teachers; while PISA surveys students and principals. Although these rich datasets are freely available online, few Malaysian researchers have worked with them.[12] A number of TIMSS and PISA analyses have been conducted under the auspices of the Southeast Asian Ministers of Education Organisation's Regional Centre for Education in Science and Mathematics (SEAMEO-RECSAM) (e.g. Thien, Nordin, Keeves, & Darmawan, 2016), though most of

11 TIMSS and PISA data have their share of flaws. For example, Irish students in PISA 2009 later said that they answered the survey questions inaccurately because some questions appeared intrusive; and because the long questionnaires followed an exhausting battery of test questions (Ruiac, 2011). The questionnaires are also subject to the usual survey measurement errors, such as some respondents' interpretation of the questions differing from that of the researchers, or of respondents in other countries. Others hypothesise that student ratings of the classroom environment may depend more on teacher popularity than actual classroom activities; and that teachers' self-reports may be inflated in self-serving ways (Kunter & Baumert, 2006, pp. 233–34). Flaws notwithstanding, TIMSS and PISA are the richest education datasets available for Malaysia today, and offer many insights into the public education system.

12 To facilitate the use of TIMSS and PISA data in research on Malaysian education, I merged and cleaned all of Malaysia's TIMSS and PISA survey data, from all test cycles, into one dataset each; and wrote a guide for analysing these data, with an accompanying codebook for the compiled Malaysian datasets. The guide and codebook can be accessed at http://bit.do/timsspisaguide and http://bit.do/timsspisacodebook respectively.

these do not appear to be accessible electronically. Researchers at Universiti Malaya have published an exploratory study using descriptive statistics from TIMSS 2003 (Rohaida & Noor Azina, 2006), and another using a linear regression to investigate the effect of some student background characteristics on TIMSS 2007 mathematics achievement (Noor Azina & Halimah, 2012).

In this chapter, I use TIMSS and PISA data to gain insight into how classroom practices influence student performance in these cognitively demanding tests. Using PISA survey data, I also construct an approximate gauge of students' experience with the Four Cs in daily life, giving another outcome measure to complement the proficiency scores. Though my TIMSS and PISA analyses cannot offer causal or conclusive evidence, they support the propositions that: (a) students' Four Cs capacities grow when they spend more time practising the Four Cs, as discussed in Chapter 3; and (b) such Four Cs activities are hampered by traits of the Malaysian education system, which I discuss in the next two chapters.

TIMSS 2007 data on classroom activities, critical thinking, and creativity

Data and method

Among the four TIMSS datasets available for Malaysia (1999, 2003, 2007, and 2011),[13] I used the 2007 data because it had the most questions related to the Four Cs in the classroom. A total of 4,111 Malaysian Form 2 students participated in TIMSS 2007.

I conducted separate regressions for mathematics and science, using the reasoning subscale in each subject as the outcome variable. In TIMSS 2007, questions that required reasoning "[went] beyond the solution of routine problems to encompass unfamiliar situations, complex contexts, and multistep problems" (M. O. Martin et al., 2008, p. 113). Thus, despite TIMSS being a conventional paper-and-pen test, the reasoning subscale captures elements of critical thinking and creativity, as defined in Table 1.1.

The explanatory variables stood for different classroom activities that engaged students in the Four Cs. Each variable measured the percent of students in the class stating that a particular activity took place in "every or almost every lesson" or "about half the lessons" in maths or science. Such an aggregation of individual student perceptions to the classroom level is a common way of measuring teaching efficacy, as it reflects student experiences of the learning environment, while minimising individual perception biases (Lüdtke, Trautwein, Kunter, & Baumert, 2007). In this analysis, replacing individual student responses with class averages increased the explanatory power of the model, from an R^2 of 0.169 to an R^2 of 0.267 for mathematics reasoning; and from 0.221 to 0.376 for science reasoning. There were seven such explanatory variables in the maths regressions, and eight variables in science. Four of these overlapped: *working together in small groups*, *explaining what is being studied*, *relating learning to daily lives*, and *reviewing homework*. The other three explanatory variables for mathematics were: *working problems on their own*, *deciding their own procedures for solving complex problems*, and *writing equations and functions to represent relationships*. For science, three of the other explanatory variables focussed on experiments and investigations: *planning* them; *conducting* them; and *making observations and describing what is seen*. The final science explanatory variable was *using scientific formulas and laws to solve problems*. The percentage of students in each class saying that their lessons regularly included such

13 At the time of writing, results from the 2015 TIMSS assessment had yet to be released.

activities ranged from 36.4 percent (*deciding their own procedures for complex maths problems*) to 69.1 percent (*making observations in science lessons*).

In both regressions, I used three control variables for each student: *the highest level of education among both parents*, *the number of books in the students' home*, and *interest in the tested subject*. Parental education is a common proxy for socioeconomic privilege, while the number of books captured a combination of family wealth and family emphasis on learning. Although both variables relate to socioeconomic background, they capture different aspects of that background, as indicated by the relatively low correlation between them (0.318). *Interest in the tested subject* was represented by how much the student agreed with the statement "I like mathematics [/science]".[14] Full descriptions and summary statistics for each variable are listed in Table 4.4 at the end of this chapter.

The TIMSS sample is designed and weighted to represent the whole Malaysian Form 2 cohort in the test year, so I used weighted linear regressions to estimate the following model for both mathematics and science:

$$reasoning\ score_{ij} = \beta_0 + \beta_1(student\ background)_{ij} + \beta_2(classroom\ components)_j + u_{ij}$$

where i = student and j = class. I followed the IEA's recommendations for ensuring accurate statistics and standard errors, using the provided SPSS macros to conduct 75 jackknife replications for each of the five Rasch imputed scores (plausible values) of maths or science reasoning, before averaging the final statistic and aggregating the standard errors appropriately (Foy & Olson, 2009). Regression results for mathematics and science are presented in Tables 4.1 and 4.2, respectively.

Results

In both the maths reasoning and science reasoning regressions, the largest effects come from problem-solving activities. For mathematics, an increase of one standard deviation in the proportion of classmates saying that at least half their maths lessons involved *working on problems independently* led to a gain of 18.7 points (0.23 standard deviations) in the maths reasoning score. Similarly, an equivalent increase in *deciding on their own procedures for solving complex problems* led to an 11.8-point rise (0.15 standard deviations). For science, a rise of one standard deviation in the proportion of classmates saying that at least half their science lessons involved *using scientific formulas and laws to solve problems* was associated with science reasoning gains of 26.1 points (0.32 standard deviations). To put that into perspective, the difference between a class in which no students report that at least half their science lessons involve *using formulas and laws to solve problems*, and a class in which all students report that they do, is 163 points, or 1.98 standard deviations—over twice the difference between Malaysia's and Singapore's performance in the science reasoning subscale in TIMSS 2007 (M. O. Martin et al., 2008, p. 117).

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14 Although *highest parental education* and *interest in the subject* were ordinal variables, I left them as numeric rather than recoding them as sets of dummy variables. These variables served as controls, so it was more important that they parsimoniously capture as much variation as possible, than for them to have statistically accurate effect sizes.

Table 4.1: TIMSS 2007 mathematics reasoning regression results

Variable	Value	Std. error
intercept	394.11**	(24.66)
Controls:		
highest parental education level (reverse coded)	-7.00**	(2.63)
number of books at home	.19**	(.03)
liking mathematics (reverse coded)	-14.06**	(2.20)
Mathematics lesson components:		
work in small groups	-.30	(.20)
explain answers	.79**	(.26)
relate learning to daily lives	.09	(.28)
review homework	.26	(.24)
write equations and functions to represent relationships	-.71*	(.28)
decide own procedures for solving complex problems	.79**	(.31)
work on problems independently	1.15**	(.33)
n	3671	
R^2	.267	

**significant at the 5-percent level, **significant at the 1-percent level*

Table 4.2: TIMSS 2007 science reasoning regression results

Variable	Value	Std. error
intercept	348.49**	(21.16)
Controls:		
highest parental education level (reverse coded)	-4.38**	(1.54)
number of books at home	.15**	(.03)
liking science (reverse coded)	-7.58**	(1.71)
Science lesson components:		
work in small groups	.77**	(.27)
give explanations for what is being studied	.13	(.29)
relate learning to daily lives	.81*	(.34)
review homework	-.26	(.25)
design or plan an experiment or investigation	-1.01**	(.28)
conduct an experiment or investigation	-.03	(.25)
make observations and describe what is seen	.23	(.29)
use scientific formulas and laws to solve problems	1.63**	(.35)
n	3671	
R^2	.376	

**significant at the 5-percent level, **significant at the 1-percent level*

While problem-solving approaches were associated with higher scores in both maths and science reasoning, other explanatory variables that had a significant effect on science reasoning scores were insignificant in the maths reasoning regression, and vice versa. *Working together in small groups* and *relating learning to daily life* were both insignificant to the maths reasoning score, but highly significant and fairly large for the science reasoning score. Specifically, a one-standard-deviation rise in the proportion of classmates saying that they *worked together in small groups* in at least half of their science lessons was associated with a rise of 14.8 points (0.18 standard deviations) in the science reasoning score. For *relating science learning to daily life*, the corresponding increase in the science reasoning score is 12.2 points (0.15 standard deviations).

Some of these differences between the science and maths regressions may result from how science and mathematics are taught in Malaysia. For example, maths problems in textbooks and exams often use everyday objects, but in artificial and highly simplified situations. Thus, such problems would not give students practice in mathematical reasoning, but students would report in the survey that their lessons *relate maths learning to daily life*; hence the insignificant results. Similarly, an analysis of PISA 2012 international data found that students in disadvantaged schools tend to be taught "applied" mathematics problems using mechanical procedures, but without critical engagement with pure mathematical concepts (OECD, 2016; Barshay, 2016). As we saw in Chapter 3, such critical wrangling with mathematical relationships is a hallmark of lessons in high-achieving countries (Stigler & Hiebert, 2009). As for *working in small groups*, a study using the TIMSS 2007 data for Jordan found that "student-centred" teaching, which includes small groups, had a significant and positive effect on science achievement, but no significant effect on maths achievement (Sabah & Hammouri, 2010). Analyses of earlier TIMSS data found that student-centred teaching has a significant but negative effect on maths performance; whether in Turkey in TIMSS 1999 (Yayan & Berberoglu, 2004), or in country means for all TIMSS 1995 participants (Pelgrum & Plomp, 2002). Hence, student-centred learning, as measured here by *working in small groups*, may indicate a similar watered-down, "applied" form of maths teaching.

The type of questions asked in typical lessons may explain another difference between the science and maths regressions: *explaining one's work* was not significant to the science reasoning score; but highly significant for maths reasoning, with a 1-standard-deviation increase leading to a gain of 11.5 maths reasoning points (0.14 standard deviations). Given that Malaysian mathematics exams rarely require students to justify their work, requiring students to explain their answers in class may grow their reasoning skills through critical engagement with maths concepts, as described above. In contrast, many science exam questions ask students to explain scientific phenomena, but full marks can be awarded to prescribed and parroted explanations. Practising such explanations would not improve science reasoning skills—hence the insignificant result for *giving explanations for what is being studied* in science lessons. Standard public exam questions and classroom drills may also account for the insignificance of the *reviewing homework in class* variable in both the maths and science regressions. Going over completed homework can sharpen students' awareness of their thought processes, thus developing thinking skills. However, if most homework assignments are binary right-and-wrong drills, discussing them would have little effect on reasoning skills, which appears to be the case here.

Some other unexpected regression results may be due to students misinterpreting the questions. For example, *writing equations and functions to represent relationships* has a significant but unexpectedly negative effect on maths reasoning performance. However, the data suggest that students differ widely in

how they interpret this statement. The correlation between (a) each student's perception of how frequently they write equations and functions to represent relationships, and (b) the percent of classmates saying this takes place in at least half of their maths classes, is only 0.256, tied (with the variable on *relating maths learning to daily life*) for the lowest such correlation among all the science and maths explanatory variables here. In the science reasoning regression, experiments and investigations would be expected to raise science performance by sparking interest and by grounding textbook content in first-hand experience. However, *conducting experiments* and *making observations* are both insignificant; and the coefficient on *designing experiments* is highly significant, large, and negative. Two explanations are possible. First, students may have misinterpreted the survey question on designing and planning experiments. The proportion of students who say that at least half their lessons involve *planning experiments* has almost no relationship with teachers' reports of how frequently they do so (correlation = 0.007).[15] Second, a major U.S. study found that laboratory experiments most effectively develop student understanding when they are well-sequenced and integrated with science instruction, and include clear learning goals and opportunities for reflection (National Research Council, 2005). In contrast, one Malaysian field study observed a school in which science experiments were conducted as routine reproductions that mimicked exam drills (Tan, 2010, p. 99). Given the strong exam orientation in Malaysian schools, such drill-like experiments may be the norm.

In both regressions, the controls for *parental education*, *the number of books at home*, and *interest in the tested subject* were all highly significant, and in the expected directions.

Summary of the TIMSS 2007 regression results

Although the regressions for Four Cs classroom activities and maths and science reasoning scores in TIMSS 2007 were probably muddled by students misinterpreting the survey questions and the national obsession with exams skewing lessons towards cut-and-dried answers, two observations are clear. First, problem-solving activities are associated with better performance in maths and science reasoning, which, as noted, involves both critical thinking and creativity. Second, student-centred approaches such as working in small groups and relating learning to daily life improves science reasoning, but not maths reasoning, as measured by TIMSS 2007.

PISA 2012 data on classroom activities and the Four Cs

Data and method

Of the two PISA datasets available for Malaysia (2009 and 2012),[16] I used the 2012 data because it had more questions related to the Four Cs during lessons and in students' lives. A total of 5,197 Malaysian 15-year-olds participated in PISA 2012. Although PISA tests students for reading, maths, and science proficiency in every test cycle, it focuses on a different subject each cycle, with more test questions and the bulk of survey questions allocated to the focus subject. In 2012, the focus subject was mathematics.

15 For comparison, the corresponding correlation for *conducting experiments* is 0.218—which is still somewhat low, but not anywhere near as random.

16 At the time of writing, results from the 2015 PISA assessment had yet to be released.

I used two separate outcome variables. First, the overall PISA mathematics score. I used the overall score rather than a subscale (as in TIMSS) because all three PISA maths subscales involved elements of critical thinking or creativity.[17] Besides the *maths achievements score*, I constructed another outcome variable using eight survey questions on student behaviours and attitudes that demonstrate the Four Cs. This was possible because the PISA 2012 questionnaires clearly distinguished between (a) what teachers did during maths lessons, which I used as explanatory variables, and (b) students' own actions and practices, which became components of this *self-reported Four Cs behaviours* outcome variable. To calculate the *self-reported Four Cs behaviours score*, I identified eight questions that demonstrated aspects of the Four Cs—such as seeking explanations for things and easily linking facts together—and scaled each response so that the highest value was 1 (e.g. "always or almost always" seeking explanations for things) and the lowest was 0 (e.g. "never or rarely" discussing seeking explanations for things). The *self-reported Four Cs behaviours score* was the sum of these eight scales responses, with a minimum value of 0 and a maximum value of 8.[18]

For explanatory variables, I identified 15 student-survey questions about how frequently their mathematics teachers act in ways that are likely engage students in the Four Cs; such as *asking students reflective questions*, or *telling students to work in small groups to come up with joint solutions for a task*. Although four (two pairs) of these variables looked similar, they were included because they appeared to measure different classroom practices, as indicated by relatively low correlations.[19] Each classroom question was coded as a dummy variable, with 1 representing "every lesson/most lessons" or "always or almost always/often", and 0 representing "some lessons/hardly ever or never" or "sometimes/rarely or never". While TIMSS is administered to intact classes of students, PISA samples are randomly chosen from among all 15-year-olds within selected schools, so it was impossible to aggregate student responses at the classroom level. Thus, PISA explanatory variables were student-level variables, unlike the classroom-level TIMSS explanatory variables. Full descriptions and summary statistics of the PISA variables used are in Table 4.5 at the end of this chapter.

In both the maths achievement and self-reported Four Cs behaviours regressions, I used the same three controls from the TIMSS regressions: the *highest level of education among both parents*, *the number of books in the students' home*, and *interest in the tested subject*. As in the TIMSS data, correlations between the three variables were small, and in the expected direction. (The correlation between *parental education* and *the number of books at home* was 0.202.) In the PISA regressions, *interest in mathematics* was represented by how much the student agreed with the statement "I do mathematics because I enjoy it."[20] However,

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17 The PISA 2012 mathematics process subscales were: "formulating situations mathematically"; "employing mathematical concepts, facts, procedures, and reasoning"; and "interpreting, applying, and evaluating mathematics outcomes" (OECD, 2014a, p. 79).

18 I summed the eight responses for Four Cs behaviours and attitudes rather than creating a factor variable because I was not interested in a latent measure of how "Four-Cs-like" each student was, but simply wanted a measure of how much they practised the Four Cs in their daily lives.

19 The correlation between *teacher presents problems that require students to apply what they have learned to different contexts* and *teacher presents problems in different contexts so that students know whether they have understood the concepts* was 0.322. The correlation between *teacher asks you and your classmates to explain how you solved a problem* and *teacher asks you and your classmates to present your thinking or reasoning at some length* was 0.166.

20 As in the TIMSS regressions, I left the ordinal variables for *highest parental education* and *interest in mathematics*

PISA 2012 used three different student survey booklets, and the question on enjoying mathematics only appeared together with the explanatory variables in one of the three survey booklets. Consequently, the regression with all three control variables only includes one-third of the students (OECD, 2014c, p. 61). To increase the sample size, I also conducted a regression for maths achievement without the control for *interest in maths*. (The self-reported Four Cs behaviours questions came from two different question sets that overlapped in only one of the three surveys. This particular survey also included the *interest in maths* control, so running a second regression without the "enjoying maths" control would not increase the sample size.)

As in TIMSS, the PISA sample is designed and weighted to represent all school-going Malaysian 15-year-olds in the test year. Accordingly, I used a weighted linear regression to estimate the following model for maths achievement (with and without the control for enjoying maths):

$$\textit{maths score}_i = \beta_0 + \beta_1(\textit{student background})_i + \beta_2(\textit{lesson components})_i + u_i$$

where i = student. I estimated a similar model for the self-reported score:

$$\textit{self-reported Four Cs behaviours score}_i = \gamma_0 + \gamma_1(\textit{student background})_i + \gamma_2(\textit{lesson components})_i + u_i$$

where i = student. I followed the OECD's recommendations for ensuring accurate statistics and standard errors, using the provided SPSS macros to conduct Bay's Repeated Replications (with a Fay's factor of 0.5) before aggregating the standard errors appropriately. For maths achievement, the macros also computed the statistics of interest for each of the five Rasch imputed scores (plausible values) and averaged them to get the final statistic (OECD, 2009b). Table 4.3 shows results from all three regressions.

Results for the mathematics achievement regressions

The PISA 2012 data and the TIMSS 2007 data were similar in that variables related to student-centred learning did not improve critical thinking performance in mathematics. In the PISA 2012 regression, student-centred variables were either insignificant (i.e. *opportunities to express one's opinions during maths lessons*); or highly significant, large, and negative (*working in small groups to solve problems together*, *working on projects that take more than a week to complete*, *and helping to plan classroom activities or topics*). The largest effect came from *planning classroom activities*: in Model 2, all other things equal, a student who reported that their teacher asked them to help with classroom planning in every lesson or most lessons scored 27.4 points lower (0.34 standard deviations) than a student who did not report this.

as numeric variables rather than recoding them into sets of dummy variables. This would lead to statistical inaccuracies if I were to interpret the effect sizes of these variables, but I am not interested in their effect sizes here as they only serve as controls.

Table 4.3: PISA 2012 mathematics regression results

Variable	Model 1 maths score, without "enjoy maths"	Model 2 maths score, with "enjoy maths"	Model 3 self-reported Four Cs behaviours score
intercept	377.08**	412.46**	4.21**
	(7.07)	(9.31)	(.25)
highest parental education level	6.99**	8.25**	.014
	(1.18)	(1.64)	(.022)
number of books at home	.087**	.059**	.00074**
	(.015)	(.017)	(.00023)
enjoying mathematics (reverse coded)	—	-17.94**	-.459**
		(2.32)	(.044)
Mathematics lesson components:			
clear goals for learning	.99	7.05	-.086
	(3.83)	(5.69)	(.072)
present thinking or reasoning at length	-4.19	-4.42	.007
	(3.07)	(3.63)	(.069)
opportunity to express opinions	-1.88	-6.91	.040
	(3.47)	(4.44)	(.063)
projects that require at least one week to complete	-25.22**	-23.08**	.138*
	(3.25)	(4.08)	(.068)
small groups to come up with joint solutions	-17.39**	-17.90**	.281**
	(3.83)	(5.01)	(.062)
students help plan activities or topics	-28.66**	-27.35**	.171*
	(3.45)	(4.31)	(.086)
questions to check understanding of what was taught	15.62**	14.42**	-.018
	(3.65)	(5.01)	(.083)
questions to reflect on the problem	6.71	11.26*	.089
	(3.76)	(4.90)	(.066)
problems requiring thinking for an extended time	7.62**	8.70*	.177**
	(2.51)	(3.53)	(.060)
decide on own procedures for solving complex problems	-.84	-1.95	.163*
	(2.81)	(4.56)	(.079)
problems with no immediately obvious method of solution	-2.63	-3.10	.072
	(3.30)	(4.50)	(.066)
problems in different contexts to ascertain understanding of concepts	17.02**	16.73**	.089
	(2.77)	(3.97)	(.068)
explain how you solved a problem	-4.76	-7.03	.199**
	(3.29)	(4.31)	(.068)
problems that apply learning to different contexts	17.00**	13.86**	.156*
	(3.17)	(3.98)	(.071)
problems that can be solved in several different ways	7.71**	1.94	.062
	(2.99)	(4.22)	(.066)
n	3278	1626	1549
R^2	.195	.223	.222

**significant at the 5-percent level, **significant at the 1-percent level*

Also matching the TIMSS 2007 data, some types of problem-solving activities in the PISA 2012 data were associated with significant increases in mathematics achievement. Maths problems that (a) were *presented in different contexts*, (b) *applied learning to new contexts*, and (c) *required thinking for an extended time* all had a positive and highly significant effect on maths scores; with effect sizes of 16.7 points (0.21 standard deviations), 13.9 points (0.17 standard deviations), and 8.7 points (0.11 standard deviations), respectively. However, other problem-solving activities were insignificant; i.e. *problems that can be solved in several different ways*,[21] *problems with no immediately obvious solution*, *explaining how you solved a problem*, and *choosing your own procedures for solving complex problems*.

Results were also mixed for lesson features that would be expected to improve thinking skills by raising students' awareness of their thought processes. Maths performance saw a significant gain of 14.4 points (0.18 standard deviations) for students who report that, in most lessons, the *teacher asks questions to check if they understand the material*. However, there was no significant effect from the *teacher setting clear goals for learning*, *asking students to present their reasoning at some length*, or *prompting students to reflect*. As in the TIMSS regressions, it is possible that the Malaysian preoccupation with exams affected interpretation of some questions: *setting clear goals for learning*, for instance, may have been construed as setting exam targets, which may raise conventional test scores, but would not necessarily improve metacognition and analytical skills.

In the maths achievement regression, all the control variables were significant and in the expected directions. The achievement regressions with and without the control for interest in maths differed in significance and relative effect size for two variables (i.e. *questions prompting reflection*, and *problems that can be solved in several different ways*), but the differences were not large.

Results for the self-reported Four Cs behaviours regression

In the regression on students' self-reported engagement with the Four Cs in their daily lives, one thing that stood out was that almost all the coefficients were positive (except for *setting clear goals* and *questions to check students' understanding*, which were negative but insignificant). This aligns with the cognitive science observations described in the previous chapter: that students cultivate the Four Cs when they spent time practising the Four Cs (even if these skills gains are not as evident in the cognitively challenging PISA maths questions). Another clear feature was that the student-centred variables were significant and positive, unlike the significant negative effects on maths achievement. By far the largest impact came from *working in small groups toward joint solutions*, which raised the self-reported Four Cs behaviours score by 0.22 standard deviations. While *opportunities to express opinions* remained insignificant, as in the maths achievement regression, this may be because none of the eight available self-reported Four Cs behaviours related to whether the students communicated their opinions (see Table 4.5).

As in the maths achievement regression, some problem-solving approaches significantly improved the self-reported Four Cs behaviours score, while others were insignificant. However, the only approaches that had significant positive effects on both maths achievement and the self-reported Four Cs

21 *Problems that can be solved in several different ways* was significant in the regression that did not control for interest in mathematics; but insignificant in the regression that did control for it.

behaviours were *problems that require an extended period of thinking* and *problems that apply learning to new contexts*, with effect sizes of 0.14 and 0.12 standard deviations, respectively, on the self-reported Four Cs behaviours score. *Explaining one's answers* and *choosing one's own procedures for solving complex problems* also significantly raised the self-reported Four Cs behaviours score, though they were insignificant in the maths achievement regression. Conversely, *problems presented in different contexts* was significant in the maths achievement regression but did not affect the self-reported behaviours score. Two variables, i.e. *problems with no immediately obvious solution* and *problems that can be solved in several different ways*, affected neither score.

Surprisingly, none of the classroom variables that should have improved metacognition had a significant effect on the self-reported score—despite some of the self-reported Four Cs traits requiring such an awareness of one's thinking processes (i.e. handling a lot of information and linking facts together). Specifically, the coefficients on (a) *clear goals for learning*, (b) *presenting one's thinking at length*, (c) *questions to prompt reflection*, and (d) *questions to check for understanding* were all insignificant.

Among the control variables, the *number of books at home* and *enjoyment of mathematics* were significant and in the expected directions. Interestingly, the level of *parental education* was not significant in the self-reported score. The numerous factors and measurement biases at play here preclude any conclusions, but the possibility of good classroom lessons overcoming socioeconomic differences in Four Cs development is encouraging.

Summary of the PISA 2012 regression results

As in the TIMSS 2007 analysis, student-centred approaches seem to present a tradeoff: while they enhance students' daily practice of Four Cs, these approaches also decrease PISA mathematics performance. Another observation from the PISA 2012 data that agrees with the TIMSS 2007 observations is that certain problem-solving activities improve student skills, whether measured in maths achievement or self-reported Four Cs behaviour scores. However, the data do not permit definitive conclusions about which aspects of problem solving develop the Four Cs—we know too little about how students interpreted the many survey questions, and how the various approaches interact with classroom and school circumstances.

Conclusions from the TIMSS and PISA analyses

Classroom activities that engage students in the Four Cs can cultivate corresponding skills.

Even within the constraints of the Malaysian education system, and even with measurement biases clouding regression results, both the TIMSS and PISA data show that some ways of integrating Four Cs practice into classroom lessons cultivate students' skills, whether measured in paper-and-pencil tests or in students' own reports of how much the Four Cs play into their daily lives. As shown in Chapter 3, sustained and reflective practice with non-routine skills can develop those skills, and school systems have found many different ways to create opportunities for such practice.

We need classroom approaches that cultivate the Four Cs and content mastery concurrently.

One consistent result in the TIMSS and PISA analyses is that student-centred classroom approaches helped some outcomes (i.e. TIMSS science reasoning and self-reported Four Cs practices in PISA), while hindering others (i.e. maths achievement in both assessments). To turn the tradeoff into all-round benefit, we need to identify teaching approaches that develop the Four Cs while building mastery of subject matter at the same time. As noted in the previous chapter, cognitive science research shows that students develop critical thinking most effectively when the skills are embedded in subject-specific content (Willingham, 2007). Besides, classroom approaches that develop both content and skills are more likely to gain traction in a school system focussed on content-heavy exams.

We must pay attention to attention to school culture and setting.

Besides looking at how cognitive skills grow and how other countries facilitate this growth, we must pay attention to local culture and conditions. The interplay of such factors doubtless contributed to the messiness of the regression analysis; as in the puzzling distribution of significant and insignificant problem-solving variables in PISA 2012 data. Other studies also find that national circumstances influence classroom outcomes in unpredictable ways. For example, one analysis of TIMSS maths achievement in ten European countries did not find consistent cross-country effects across a range of teacher and classroom characteristics; in fact, some teaching methods had significant positive effects in some countries, and significant negative effects in others (Akyuz & Berberoglu, 2010).

We need better ways of measuring skills development in schools.

One theme throughout this chapter is that Malaysia's exam orientation hampers student learning in different ways. Correcting this one-right-answer skew will require not only new modes of assessment, but also policies that generate new mindsets about assessment. In the TIMSS and PISA regressions, some of the classroom activities that have insignificant or negative impact on the Four Cs outcomes appear to be distorted by this preoccupation with grades.

With this in mind, the Ministry's emphasis on TIMSS and PISA performance as a national benchmark (Kementerian Pendidikan Malaysia, 2013c, p. 2-2) is worrying. TIMSS, which tests student achievement on established curricula in a conventionally academic way, is clearly inadequate for measuring the skills that governments and employers fret about. Supporters regard PISA as a measure of applied literacies that facilitate future success (Schleicher, 2007; Wu, 2010); but others contest this, on the grounds that PISA questions are decontextualised (rather than real-life) and administered in artificial test settings (Sjøberg, 2007; Deng & Gopinathan, 2015). In my PISA 2012 analysis, the divergence between factors affecting maths achievement and those affecting students' everyday practice of the Four Cs suggests that PISA scores leave out many important skills. Moreover, one analysis found significant negative correlations between national average PISA scores and the Global Entrepreneurship Monitor's measures of both (a) beliefs about entrepreneurship and (b) actual entrepreneurial activity (Zhao, 2012, Chapter 4). All of this indicates that we urgently need to rethink assessments in Malaysia.

Table 4.4: Descriptions and summary statistics of TIMSS 2007 variables

Variable	Description	n	Mean	Std. Dev.	Minimum	Maximum
Individual-level variables						
bsmrea01	plausible value 1 for the mathematics reasoning subscale	4111	467.783	80.289	151.43	695.53
bsmrea02	plausible value 2 for the mathematics reasoning subscale	4111	466.489	82.479	158.03	721.97
bsmrea03	plausible value 3 for the mathematics reasoning subscale	4111	466.812	82.016	114.20	706.87
bsmrea04	plausible value 4 for the mathematics reasoning subscale	4111	467.723	81.097	141.13	735.10
bsmrea05	plausible value 5 for the mathematics reasoning subscale	4111	466.327	80.875	160.28	719.65
bssrea01	plausible value 1 for the science reasoning subscale	4111	480.820	83.311	150.79	761.31
bssrea02	plausible value 2 for the science reasoning subscale	4111	480.876	82.573	69.65	723.03
bssrea03	plausible value 3 for the science reasoning subscale	4111	483.776	82.169	143.51	753.01
bssrea04	plausible value 4 for the science reasoning subscale	4111	482.735	81.313	130.90	755.38
bssrea05	plausible value 5 for the science reasoning subscale	4111	484.145	81.376	98.89	734.21
bsdgedup	highest education level among both parents *1 if finished university or higher; 2 if finished post-secondary but not university; 3 if finished upper secondary; 4 if finished lower secondary; 5 if finished some primary or lower secondary; 6 if not applicable/do not know*	3671	2.893	1.113	1	5
book	number of books at home *original ordinal variable recoded to midpoint of each category: 5 if 0–10 books; 18 if 11–25 books; 63 if 26–100 books; 151 if 101–200 books; 251 if > 200 books*	4111	52.228	61.515	5	251
bsbm14e	"I like mathematics." *1 if agree a lot; 2 if agree a little; 3 if disagree a little; 4 if disagree a lot*	4111	1.90	.812	1	4
bsbs17f	"I like science." *1 if agree a lot; 2 if agree a little; 3 if disagree a little; 4 if disagree a lot*	4111	1.89	.809	1	4

Variable	Description	n	Mean	Std. Dev.	Minimum	Maximum
Class-level variables:						
	% of students stating that _____ in about half or more of mathematics lessons					
amgroup	"We work together in small groups."	4111	41.330	14.612	3	83
amexplain	"We explain our answers."	4111	61.158	14.526	5	89
amdaily	"We relate what we are learning in mathematics to our daily lives."	4111	55.027	5.027	10	88
amreview	"We review our homework."	4111	66.841	14.983	7	100
amreprel	"We write equations and functions to represent relationships."	4111	41.103	12.673	0	78
amcomplex	"We decide on our own procedures for solving complex problems."	4111	36.391	14.983	4	81
amproblem	"We work problems on our own."	4111	48.828	16.227	5	89
	% of students stating that _____ in about half or more of science lessons					
asgroup	"We work together in small groups."	4111	66.460	19.261	0	100
asexplain	"We give explanations for what we are studying."	4111	48.778	14.439	4	85
asdaily	"We relate what we are learning in science to our daily lives."	4111	58.577	15.018	11	89
asreview	"We review our homework."	4111	63.743	15.255	15	96
asplan	"We design or plan an experiment or investigation."	4111	46.561	15.756	5	100
asconduct	"We conduct an experiment or investigation."	4111	62.103	20.325	0	100
asobserve	"We make observations and describe what we see."	4111	69.144	14.821	0	100
asformula	"We use scientific formulas and laws to solve problems."	4111	59.600	16.036	10	100

Table 4.5: Descriptions and summary statistics of PISA 2012 variables

Variable	Description	n	Mean	Std. Dev.	Minimum	Maximum
pv1mapi	plausible value 1 in mathematics	5197	422.788	80.763	174.646	691.626
pv2mapi	plausible value 2 in mathematics	5197	422.138	80.718	81.251	696.534
pv3mapi	plausible value 3 in mathematics	5197	421.893	80.439	138.113	696.690
pv4mapi	plausible value 4 in mathematics	5197	421.465	80.624	194.200	707.595
pv5mapi	plausible value 5 in mathematics	5197	421.543	80.627	81.251	694.353
selfscore	Sum of self-reported responses on 8 behaviours demonstrating the four Cs. For each behaviour, response is coded as 1 for the highest value ("*always or almost always*", "*very much like me*", or "*very confident*"), and 0 for the lowest value ("*never or rarely*", "*not at all like me*", or "*not at all confident*"). 1. *"I help my friends with mathematics."* 2. *"I talk about mathematics problems with my friends."* 3. *"I like to solve complex problems."* 4. *"I can handle a lot of information."* 5. *"I seek explanations for things."* 6. *"I can easily link facts together."* 7. *"How confident would you feel about understanding graphs presented in newspapers?"* 8. *"How confident would you feel about calculating the petrol consumption of a car?"*	3305	4.489	1.261	0.00	8.00
hisced	highest education level among both parents *0 if none; 1 if primary education; 2 if lower secondary education; 3 if vocational upper secondary; 4 if upper secondary and non-tertiary post-secondary; 5 if vocational tertiary; 6 if theoretically oriented tertiary and post-graduate*	5174	3.997	1.424	0	6
book	number of books at home *original ordinal variable recoded to midpoint of each category: 5 if 0–10 books; 18 if 11–25 books; 63 if 26–100 books; 151 if 101–200 books; 351 if 201–500 books; 551 if > 500 books*	5156	94.484	124.477	5	551
mst29q04	"I do mathematics because I enjoy it." *1 if strongly agree; 2 if agree; 3 if disagree; 4 if strongly disagree*	3403	2.029	.804	1	4
pvmathave	mean of the 5 plausible values for mathematics achievement	5197	421.966	77.381	146.68	687.81
opinion	<u>*During mathematics lessons:*</u> teacher gives students an opportunity to express opinions *1 if every lesson or most lessons; 0 if some lessons, hardly ever, or never*	3284	.710	.454	0	1

Variable	Description	n	Mean	Std. Dev.	Minimum	Maximum
goal	teacher sets clear goals for your learning *1 if every lesson or most lessons; 0 if some lessons, hardly ever, or never*	3407	.736	.441	0	1
present	teacher asks you or your classmates to present your thinking or reasoning at some length *1 if every lesson or most lessons; 0 if some lessons, hardly ever, or never*	3415	.382	.486	0	1
project	teacher assigns projects that require at least one week to complete *1 if every lesson or most lessons; 0 if some lessons, hardly ever, or never*	3412	.382	.487	0	1
group	teacher has you and your classmates work in small groups to come up with joint solutions to a problem or task *1 if every lesson or most lessons; 0 if some lessons, hardly ever, or never*	3415	.528	.499	0	1
helpplan	teacher ask you and your classmates to help plan classroom activities or topics *1 if every lesson or most lessons; 0 if some lessons, hardly ever, or never*	3408	.374	.484	0	1
cfu	teacher asks questions to check whether you and your classmates have understood what was taught *1 if every lesson or most lessons; 0 if some lessons, hardly ever, or never*	3407	.803	.398	0	1
reflect	teacher asks questions that make you and your classmates reflect on the problem *1 if always, almost always, or often; 0 if sometimes, rarely, or never*	3393	.576	.494	0	1
extended	teacher gives problems that require you and your classmates to think for an extended time *1 if always, almost always, or often; 0 if sometimes, rarely, or never*	3393	.403	.490	0	1
procedure	teacher asks you and your classmates to decide on your own procedures for solving complex problems *1 if always, almost always, or often; 0 if sometimes, rarely, or never*	3388	.307	.461	0	1
noobvious	teacher presents problems for which there is no immediately obvious method of solution *1 if always, almost always, or often; 0 if sometimes, rarely, or never*	3383	.352	.478	0	1
context	teacher presents problems in different contexts so that students know whether they have understood the concepts *1 if always, almost always, or often; 0 if sometimes, rarely, or never*	3386	.648	.477	0	1
explain	teacher asks you and your classmates to explain how you have solved a problem *1 if always, almost always, or often; 0 if sometimes, rarely, or never*	3380	.636	.481	0	1
apply	teacher presents problems that require students to apply what they have learnt to new contexts *1 if always, almost always, or often; 0 if sometimes, rarely, or never*	3381	.553	.497	0	1
several	teacher gives problems that can be solved in several different ways *1 if always, almost always, or often; 0 if sometimes, rarely, or never*	3383	.655	.476	0	1

Chapter 5: Four Cs cultivation in Malaysian schools today

> It was a content-loaded curriculum ... Teachers burdened with large classes and heavy workloads hurried through content ... Scant attention was paid to those who fell by the wayside and never acquired the basic skills of reading, writing and numeracy. ... Those who had gained the basic skills had to rely heavily on texts and rote learning. ... Public opinion at this time began to be heard in terms of letters to the press .... Parents, aware of the importance of good grades in a heavily examination-oriented school system, were investing to a considerable extent in private tuition, a 'remedy' beyond the reach of the socially disadvantaged. (Mukherjee & Singh, 1983, pp. 249–251)

For over thirty years, Malaysian educationists have struggled to move schools away from focussing on exams and memorisation of content, as described in the quote above, towards balanced, holistic development, including the cultivation of skills. Policies targeting this shift to holistic education have, so far, been lacklustre. In this chapter, I give an overview of skills development policies in Malaysian schools since the 1980s. I also look closely at four current policies related to the Four Cs: Pentaksiran Berasaskan Sekolah (PBS), Pentaksiran Tingkatan 3 (PT3), the inclusion of higher-order thinking skills (HOTS) questions in public exams, and i-THINK mind maps. I discuss the origins, implementation, and outcomes of each policy.

The history of policies targeting the Four Cs in Malaysian schools

Skills cultivation has been a consistent emphasis of Malaysian education policy documents for more than three decades, as outlined in Table 5.1. The 1979 *Report of the Cabinet Committee to Review Education Policy Implementation* identified skills as a key component of curriculum; and underscored the link between economic growth and well-rounded student development (Mahathir, 1979). Such holistic education—balancing intellect, spirituality, emotions, and physique—later became a prominent theme in the National Education Philosophy,[22] which was enacted in 1988 and has since adorned countless policy statements and school murals. In the official elaboration of the National Education Philosophy, the intellectual component of holistic development includes critical and creative thinking ("berfikir secara kritis dan kreatif"); as well as the ability to elaborate, investigate, reason, summarise, and produce good ideas ("menghurai, mencerakin, menaakul, merumus dan menghasilkan idea-idea yang bernas") (Pusat Perkembangan Kurikulum, 1997, p. 5). This focus on skills development for national growth continued

22 "Education in Malaysia is an ongoing effort towards further developing the potential of individuals in a holistic and integrated manner, so as to produce individuals who are intellectually, spiritually, emotionally, and physically balanced and harmonious, based on a firm belief in and devotion to God. Such an effort is designed to produce Malaysian citizens who are knowledgeable and competent, who possess high moral standards and who are responsible and capable of achieving high levels of personal well-being as well as being able to contribute to the harmony and betterment of the family, the society, and the nation at large" (Kementerian Pendidikan Malaysia, 2013b, p. 2-2).

in the Education Act 1996, which regards the purpose of education as "to enable the Malaysian society to have a command of knowledge, skills and values necessary in a world that is highly competitive and globalised, arising from the impact of rapid development in science, technology and information" (Laws of Malaysia, 1996).

Table 5.1: Events influencing skills cultivation policies in Malaysian schools

Year	Event and intended impact on skills cultivation
1979	Report of the Cabinet Committee to Review the Implementation of Education Policy published, affirming the need for skills and holistic education for economic development.
1983	Kurikulum Baru Sekolah Rendah (KBSR)—emphasising communication, thinking skills, and student-centred learning—launched for Year 1 students.
1988	National Education Philosophy adopted, echoing the Cabinet Committee Report's focus on balanced education.
1989	Kurikulum Bersepadu Sekolah Menengah (KBSM) launched for Form 1 students.
1993	Curriculum Development Centre rolls out resources to enhance the teaching of thinking skills.
1999	Smart Schools programme piloted in 88 schools, attempting to foster a well-rounded skill set through technology.
2011	Kurikulum Standard Sekolah Rendah (KSSR) and Pentaksiran Berasaskan Sekolah (PBS) launched for Year 1 students, emphasising the assessment of a range of skills.
2012	PBS launched for Form 1 Students.
2012	i-THINK mind maps programme, a toolkit for thinking skills development, launched; with plans to reach all schools by 2014.
2013	Following the *Education Blueprint 2013-2025*, questions testing higher-order thinking skills are included in public exams.
2014	Under PBS, the Pentaksiran Tingkatan 3 (PT3) replaces the PMR.

Cultivating skills was also a formal priority in the major curricular revision that resulted in the Kurikulum Baru Sekolah Rendah (New Primary School Curriculum, KBSM), which was rolled out for all Year 1 students in 1983, after a trial launch in 305 schools one year prior. The KBSR emphasised, among other things: basic skills, including communication and problem solving; thinking skills, both critical and creative; student-centred learning; and enrichment activities, such as projects (Lee, 1999; Pusat Perkembangan Kurikulum, 1997). Six years later, the Kurikulum Bersepadu Sekolah Menengah (Integrated Secondary School Curriculum, KBSM) extended this emphasis on skills to secondary schools (Pusat Perkembangan Kurikulum, 1992). To integrate thinking skills into actual lessons, the Ministry introduced an extensive set of supports in 1993; including teacher training sessions, suggested classroom activities, sample lesson plans, and a guide detailing the application of four models of thinking skills development, among them Edward de Bono's CoRT tools. Guidelines and all, this thinking skills programme did not appear to revolutionise classroom teaching (Rajendran, 2001).

With the new millennium looming, the government attempted to turn an economic threat into

an educational ally, by bringing computers into the classroom before they made local workers obsolete. Both the National Education Philosophy and the national vision of economic development demanded urgent educational reforms; and "the catalyst for this massive transformation [would] be technology-supported Smart Schools" (Smart School Project Team, 1997, p. 9). The Smart Schools programme aimed to use computers and multimedia courseware to reach the elusive goal of all-round development: "effective oral and written communication", "problem-solving and creativity", "team-player characteristics", and "work-place skills", among others (1997, p. 29). The programme began with 88 schools in 1999; with the goal of turning all 10,000 primary and secondary schools into Smart Schools by 2010 (Smart School Project Team, 1997, p. 130). Instead, the Cabinet terminated the initiative in 2002. The reason given for the closure was, perplexingly, identical to its initial goal: that all schools, and not just a select few, become Smart Schools (Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, 2012a, p. 42).[23]

This pattern—catchphrases endorsing skills; blueprints detailing best practices; and policies floundering in classrooms—continued in the 2000s. The *Education Development Plan 2001–2010* continued to emphasise digital technology and preparation for the knowledge economy, defining a quality education system as one that "raises a workforce that can be a global player, with exemplary personal characteristics, such as a strong identity, innovativeness, productivity, skills, competitiveness, endurance, and creativity in overcoming national challenges and the wave of globalisation" (Kementerian Pendidikan Malaysia, 2001, p. 1-16, my translation). However, nothing came of its flagship proposal to restructure the educational progression to a K-12 model with universal kindergarten, six years of primary school, four years of secondary school, and two years of pre-university education (2001, pp. 1-19–22). Before the official end of the 2001–2010 *Plan*, the Ministry released the *Education Development Master Plan 2006-2010*, which discussed the need to review the KBSR and KBSM to incorporate an emphasis on higher-order thinking skills (Kementerian Pelajaran Malaysia, 2006, pp. 65, 67).

In 2012, the Ministry published the *Interim Strategic Plan 2011–2020* (Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, 2012b). This *Plan* laid much of the groundwork for current education programmes that attempt to develop skills. It discussed the need to meet future challenges and the importance of students who master 21st-century skills (defined as knowledgeable people capable of becoming balanced individuals).[24] Among the policies it describes are the Kurikulum Standard Sekolah Rendah (Standard Primary School Curriculum, KSSR) and the Kurikulum Standard Sekolah Menengah (Standard Secondary School Curriculum, KSSM), as well as their respective start dates (2012b, Chapter 5), which the Ministry has adhered to. Under Initiative 6, "Transforming Assessment", the *Interim Plan* also outlines what is now called Pentaksiran Berasaskan Sekolah (School-Based Assessment, PBS) and its various components, stating that PBS would reduce the negative effects of an exam-oriented system (2012b, p. 59). Initiative 8, "Innovation and creativity", describes four actions for fostering critical thinking and creativity: widening IT usage; spurring innovation in cluster schools and high-performing schools, building partnerships with parents, universities, and local experts; strengthening the culture of

23 The only comprehensive, government-commissioned study of the impact of Smart Schools (Frost & Sullivan, 2006) seems to be based entirely on survey questionnaires given to students and teachers; without examining any actual classroom lessons, student work, or school infrastructure.

24 "Melahirkan murid yang menguasai kemahiran abad ke-21 iaitu berpengetahuan dan berupaya menjadi insan yang seimbang" (Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, 2012b, p. 50).

innovation in schools through various standalone projects such as competitions for young inventors (2012b, Chapter 9). In the next section, I discuss the implementation of some of these policies.

Current policies targeting Four Cs cultivation in Malaysian schools

Over the last several years, the focus on developing skills in schools has intensified considerably. The *Education Blueprint 2013–2025*, the most comprehensive government education plan to date, names "thinking skills", "leadership skills", and "bilingual proficiency" as three of the six Student Aspirations that constitute its touchstones for education quality at the student level (Kementerian Pendidikan Malaysia, 2013c). There is a similar emphasis on skills in the new curriculum: the Kurikulum Standard Sekolah Rendah (KSSR), which was introduced in 2011, and the Kurikulum Standard Sekolah Menengah (KSSM), which will be launched in 2017 (Bahagian Pembangunan Kurikulum, 2016a, 2016b).[25] In the following sections, I discuss four recent skills-focussed policies in detail: Pentaksiran Berasaskan Sekolah; the Pentaksiran Tingkatan 3; the inclusion of higher-order thinking skills questions in public exams; and i-THINK mind maps.

Pentaksiran Berasaskan Sekolah

Origins of PBS

Pentaksiran Berasaskan Sekolah (School-Based Assessment, PBS) was first mentioned in the *Education Development Master Plan 2006–2010*, which described school-based assessment as one aspect of an intended shift towards more holistic student evaluation (Kementerian Pelajaran Malaysia, 2006, p. 75). The next major education plan, the *Interim Strategic Plan 2011–2020*, laid out the components of what was to become PBS: school assessments; centralised assessments; assessments of physical, sports, and cocurricular activities; psychometric assessments, and centralised exams. These broader forms of assessment were meant to mitigate the harms of the existing exam-oriented system (Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, 2012b, Chapter 7). PBS was formally introduced in primary schools for Year 1 students in January 2011. The following year, it was launched for Form 1 students in secondary schools.

PBS implementation

Although PBS attempted to radically change the way Malaysian students are educated, it did so without a clear statement of aims or outcomes—whether in the official performance standards, management guides, or the *Education Blueprint 2013–2025* (Kementerian Pendidikan Malaysia, 2013a, 2013c, Lembaga Peperiksaan, 2012b, 2014a). Descriptions of PBS often mention "holistic assessment", but "holistic" and "balanced" had been buzzwords in national education documents since the 1980s. PBS did emphasise higher-order thinking skills (HOTS; known in Malay as Kemahiran Berfikir Aras Tinggi, or

25 I do not discuss these new curricula in detail here because they are still in the process of being introduced. The implementation of KSSR has been entangled with that of PBS, which I examine here.

KBAT), with PBS performance standards mapped onto the six levels of thinking in Bloom's Taxonomy (remembering, understanding, applying, analysing, evaluating, creating). However, PBS was not consistently integrated into documents on the HOTS initiative, which was launched in 2013. While PBS appears in documents such as *Elemen KBAT dalam pentaksiran* (Bahagian Pembangunan Kurikulum, 2014b), it is not mentioned in the two main publications explaining the KBAT programme (Bahagian Pembangunan Kurikulum, 2013, 2014c); even though PBS was in full swing—albeit off-kilter—when these were published.

Complications also developed because PBS implementation differed across existing curricula and national exams. PBS was introduced in primary school concurrently with a new curriculum, the KSSR, which matched the PBS standards for content, learning, and performance (Bahagian Pembangunan Kurikulum, 2016a). In secondary school, however, it was tacked on to the existing syllabus; pending better integration when the KSSM starts for Form 1 students in 2017. PBS affected public exams in an equally patchy way: replacing the lower secondary exam, the PMR; factoring into final grades for the terminal primary school exam, the UPSR; and bypassing the terminal secondary school exam, the SPM (Kementerian Pendidikan Malaysia, 2013c, p. 4-4). Different components of PBS also demanded different amounts of effort: the psychometric assessments happened only four times in nine school years; the extracurricular activities assessment was annual; fitness and body mass index were checked twice a year; but the in-class academic assessments entailed hours of lessons and paperwork every week (Lembaga Peperiksaan, 2012b).

Perhaps it was this lack of streamlining—towards particular aims or consistent forms—that triggered the preoccupation with procedures. This preoccupation dominated PBS implementation. Even the oft-mentioned goal of "holistic assessment" described a desired process rather than desired student learning. Thus, the challenges and controversies in PBS implementation were also focussed on procedures. Guidelines for carrying out PBS were delayed: while PBS was officially introduced in January 2011, teachers were only briefed on PBS performance standards in March, and on the online reporting system in May and June (Lembaga Peperiksaan, n.d.-b). The following year, when PBS was launched in secondary schools, teachers were only briefed a few months into the school year; forcing them to re-teach topics that had already been covered, in order to conduct the required assessments (Hasniza, 2014). When operational guidelines did appear, teachers found them unclear (Suhaimi, 2013; J. K. T. Wong, 2013).

Further problems resulted from the complicated Dokumen Standard Prestasi (Performance Standard Documents), which described tasks that students should be able to perform, and acceptable categories of evidence for proficiency in these tasks. Figure 5.1 shows a page from the Form 3 English Language Dokumen Standard Prestasi used for the initial round of PBS. While each of the 21 task descriptors corresponds to one of the 68 skills specifications in the prevailing curriculum document,[26] there are no clear criteria for which specifications became task descriptors (Kementerian Pendidikan Malaysia, 2003, 2013a). The standards documents were even more complicated for content-heavy subjects: Form 3 science, for example, had 122 task descriptors (Kementerian Pendidikan Malaysia, 2013b). Some students complained of stress from the constant assessment—in every subject, every day (Hasniza, 2014).

The elaborate standards and finicky procedures led to a massive reporting burden for teachers in affected years. Teachers were required to record each student's progress on the PBS standards into an

26 i.e. the Huraian Sukatan Pelajaran, or Syllabus Elaboration.

online system. They also had to file each piece of performance evidence into individual files for each student; alongside other forms of documentation at the class and school levels (Lembaga Peperiksaan, 2012b). It didn't help that every teacher taught several classes, often spanning subjects and cohorts; and that the online reporting system had grossly inadequate bandwidth (Lina, 2012). Some teachers resorted to completing their PBS records between 2 a.m. and 5 a.m., when server traffic was minimal (Hasniza, 2014; Kulasagaran, Spykerman, & Kang, 2014).

Figure 5.1: Extract from the Form 3 English Language PBS Dokumen Standard Prestasi

BAND	PERNYATAAN STANDARD	DESKRIPTOR	EVIDENS
3 **Tahu, Faham dan Boleh Buat**	**B3** Use knowledge acquired through listening, speaking, reading and writing.	**B3 DL1** Requesting assistance, expressing appreciation and gratitude	**B3 DL1 E1** Able to request assistance when facing a problem and to express gratitude for the assistance rendered
		B3 DL2 Listening to and understanding reports	**B3 DL2 E1** Able to show understanding of a report by sequencing main ideas and supporting details
		B3 DB1 Processing texts read by using contextual clues	**B3 DB1 E1** Able to derive the meaning of words through contextual clues
		B3 DB2 Understanding cause and effect relationships in a text	**B3 DB2 E1** Able to use logical connectors in a text to show cause and effect relationships
		B3 DT1 Writing speeches	**B3 DT1 E1** Able to write out a speech on a particular topic: • using the correct format • in paragraphs • in not less than 120 words

Source: (Kementerian Pendidikan Malaysia, 2013a, p. 11)

PBS outcomes

It is hard to tell if PBS improved student outcomes. No key performance indicators have been defined, and no information from the copious data collections has been shared. Nonetheless, PBS does not appear to have moved the focus from content-heavy exams toward cultivating the Four Cs and related skills. What is clear is that PBS sparked a great deal of ire against the Education Ministry, especially from overworked teachers. These complaints were aired even in pro-government print and broadcast media (e.g. Bernama, 2013b; Kulasagaran et al., 2014; Suhaimi, 2014); and led to a public denunciation of the policy by the usually conciliatory National Union of the Teaching Profession Malaysia (Bernama, 2013b; Lok, 2014). As of 6 July 2016, the Facebook group Kami Mahu PBS Dimansuhkan[27] (We Want PBS Retracted) had 79,768 "likes", despite the repercussions facing teachers who express opposition to the government. One such teacher, Mohd Nor Izzat Johari, was first transferred to a faraway school, and later fired, for organising a protest against PBS (Salmiyah, 2015).

On 18 March 2014, just over three years after PBS was introduced, the Ministry announced that

27 https://ms-my.facebook.com/KamiMahuPBSDimansuhkan/

the convoluted Dokumen Standard Prestasi would be replaced with simpler guidelines; the cranky online system would be replaced with offline Excel sheets for recording student progress; and that teachers no longer needed to compile evidence of students' performance in individual files. The same announcement also introduced the Pentaksiran Tingkatan 3 (Form 3 Assessment, PT3), which was to replace the former Form 3 public examination (Lembaga Peperiksaan, 2014d; Muhyiddin, 2014)—and which would soon overshadow PBS.

Designed as a holistic assessment, PBS had much more potential to encourage Four Cs learning than the UPSR and PMR, which were dominated by multiple-choice questions. In the classroom component, the assessment tasks were drawn from skills specified in the curriculum; and ranked by the level of cognitive challenge. In most subjects, some of the higher-level tasks lent themselves to collaboration and creativity. Also, the inclusion of cocurricular activities in the PBS scheme added some weight to the skills development that can occur when student groups work towards shared goals. In theory, PBS could have fostered the Four Cs. In practice, the focus on process over product—especially when the process was bureaucratic, onerous, and hasty—prevented PBS from substantially improving skills cultivation.

Pentaksiran Tingkatan 3

Origins of the PT3

The possibility of changing the lower secondary examination from a centrally administered exam to a school-based assessment first appeared in the *Pelan Pembangunan Pendidikan 2001–2010*. This development plan outlined a shift from three years of lower secondary school to two years, followed by a school-based student evaluation to determine streaming in upper secondary school (Kementerian Pendidikan Malaysia, 2001). Although nothing was to come of the proposal to shorten secondary schooling, the Ministry announced in October 2010 that the Penilaian Menengah Rendah (PMR) exam would be replaced with school-level assessments beginning in 2016 (Malaysiakini, 2010). However, this was brought forward to 2014, with the introduction of PBS for Form 1 students in 2012. The original PBS guidelines state that the Ministry would issue standardised instructions for the centralised assessments (pentaksiran pusat), which could include written assignments, practical work, projects, performances, or traditional written and oral tests. The centralised assessments would be administered by subject teachers throughout Forms 2 and 3 (Lembaga Peperiksaan, 2012b). In at least one official briefing, teachers were told that students' PBS scores would be combined with those from the centralised assessments, giving a single grade for each subject (Hasniza, 2014).

By November 2013, the first PBS cohort had completed Form 2, but the Ministry had yet to issue instructions about the centralised assessments. Teachers speculated that a standardised test would return (Hasniza, 2014). The next month, the Ministry announced that PBS students would be centrally assessed in Form 3, with exams for the languages, science, and mathematics; and various assignments for other subjects (Lembaga Peperiksaan, 2013d). In March 2014, the same Ministry circular announcing sweeping simplifications of PBS also gave a name to the centralised assessment—the Pentaksiran Tingkatan 3—and added written exams for Living Skills and Islamic Studies (Lembaga Peperiksaan, 2014d).

PT3 implementation

While the Ministry announced the PT3 in March 2014, it said nothing about the assessment format until late June 2014—roughly one week before the case study projects for History and Geography were to begin. Speaking and listening tests for Malay and English were scheduled for August, and the written exams for September (Kementerian Pendidikan Malaysia, 2014b). Shortly after the June 2014 announcement, teachers in each subject were called to district-level briefings, at which they marked answers to a sample PT3 exam. Still, Ministry officials could not answer many questions that teachers raised about how the test would be administered and how it would factor into student academic progression and school rankings. In the weeks that followed, teachers scrambled to finish teaching the mandated syllabus, while getting themselves and their students accustomed to the PT3 format. Students, teachers, and parents all complained of insufficient time to prepare (Choong, 2014; Khor, 2014; The Star, 2014). Haphazard progress and all, the PT3 assessments were administered more or less as stipulated in the March 2014 circular. Teachers were then required to grade, moderate, and record marks for the answer scripts (Lembaga Peperiksaan, 2014c); all tasks that had previously been allocated to paid markers. When students received their results in December 2014, they were given separate results slips for the PT3 exams and for in-class PBS assessments; and the latter received little attention.

PT3 outcomes

As with PBS, there is no way of knowing if student learning improved under the PT3, because the tests papers are not comparable to their predecessor, the PMR. Moreover, while PMR grades were assigned according to a Ministry-determined grading curve, PT3 grades followed a set marks-to-grades scheme. Arguing that the PT3 was a "school-based" exam rather than a national exam, the Ministry did not release an analysis of overall national performance, as with other public exams. However, many schools reported drops in pass rates and straight-"A" scorers (NST, 2014). Reactions from students, teachers, and parents ranged from despair at disappointingly low results; to concern that rural students would be disadvantaged because they had less access to the latest information about the exam format; to rage about a cohort of students being used as guinea pigs; to appreciation for the shift to more challenging exam questions, despite the confusingly hasty implementation and the extra teacher workload (Gan, 2014; Iqbaal, 2014; Khor, 2014; Liang, 2014; Yuen & Hemananthani, 2014). The following year, results appeared to improve, and outrage to dissipate; although students still struggled with the HOTS questions, and parents still questioned the change in exam formats midway through the school cycle (Bernama, 2015e; Yasmin & Lee, 2015).

Although PBS was supposed to progress to a broader mode of assessment and learning, its PT3 component shifted the focus back to standardised exams. Even the project-based assessments for Geography and History were solo assignments, hindering collaboration. That said, PT3 questions require more critical thinking than the PMR, which had been dominated by multiple-choice questions (with the exception of papers for Malay and English writing, and mathematics problem-solving). The PT3 also had speaking and listening tests for Malay and English, emphasising the hitherto-neglected oral communication skills. Unfortunately, the last-minute introduction of the new exam created more anxiety, confusion, and last-minute drilling than opportunities to practice creativity and critical thinking.

Higher-order thinking skills questions in public exams

Origins of HOTS questions in public exams

The higher-order thinking skills (HOTS) questions that frustrated PT3 candidates should have been thwarting students years earlier, according to Education Ministry plans. In 1994, the Ministry had announced that 60 percent of public examination questions by the year 2000 would assess analytic thinking and creativity (Rajendran, 2001). It is unclear what happened to this plan, but the target for HOTS stated in the *Education Blueprint 2013–2025* was more modest: 40 percent of UPSR questions and 50 percent of SPM questions, by 2016 (Kementerian Pendidikan Malaysia, 2013c, p. 4-6). This renewed emphasis on creativity and problem solving was influenced by Malaysia's poor performance in PISA 2012, which the Ministry attributed to the disregard for HOTS in the existing curriculum (Bernama, 2013c)—despite the fact that critical and creative thinking skills were among the stated emphases in the KBSR and KBSM, which had been in place since the 1980s (Pusat Perkembangan Kurikulum, 1992, 1997). Whatever the earlier plans may have intended, the *Blueprint*'s concern about HOTS was not unfounded: an independent benchmarking study in 2013 found that only 22 percent of UPSR questions, 40 percent of SPM science questions, and 15 percent of SPM additional mathematics questions required HOTS (Kementerian Pendidikan Malaysia, 2014a, p. 50).

Implementation of HOTS questions in public exams

Various Ministry agencies introduced programmes to facilitate this shift towards HOTS questions. The main mechanism for changing classroom pedagogy was a teacher training course on a set of mind maps, called i-THINK, which will be discussed below. Besides i-THINK, other Ministry initiatives appear to be confined to hundreds of pages' worth of books and pamphlets explaining the HOTS project and how teachers could implement it: *Pentaksiran Kemahiran Berfikir Aras Tinggi* by the Examinations Syndicate (2013a) *Panduan Aplikasi Kemahiran Berfikir Aras Tinggi Tingkatan 4 dan Tingkatan 5* by the Textbooks Division (n.d.); and a slew of publications from the Curriculum Development Division, such as *Inisiatif Kemahiran Berfikir Aras Tinggi di Sekolah* (2013) and *Elemen KBAT dalam Pentaksiran* (2014a).

Whether or not these publications made it into lesson plans and classrooms is unclear, but teachers and students seemed blind-sided when HOTS questions started appearing in public exams. In 2013, furore erupted when the SPM Moral Studies exam moved away from questions requiring word-perfect canned answers, toward open-ended HOTS questions, without students and teachers being briefed in advance (Kulasagaran & Tan, 2013; The Star, 2013). Similar complaints recurred in 2014 and 2015 (Concerned teacher, 2014; Azizi, 2015). Others reported that schools were teaching students to answer HOTS questions using rigid strategies, which did not push students' thinking, and which sometimes led to factually incorrect answers (Hot over HOTS, 2015). Also, the open-endedness of the new HOTS questions led to marking errors from teachers who, accustomed to black-and-white marking schemes, did not award marks to student opinions they personally disagreed with (Gan, 2014).

Outcomes from having HOTS questions in public exams

While the inclusion of HOTS questions in national exams has raised awareness about problem solving and creativity, it is difficult—and possibly too early—to tell whether the HOTS emphasis has improved students' critical and creative thinking skills. SPM 2014 results declined relative to the previous year, but the Education Minister said that the size of the decline was acceptable, as it was not a significant deviation from the trend, despite an increase in HOTS questions (Sinar Harian, 2015). However, results dropped again in 2015, and the director-general attributed the fall partly to an increase in higher-order and creative thinking questions (Bernama, 2016a).[28] This attribution contradicts the 2015 *Blueprint* annual report, which stated that both the 2014 and 2015 SPM exams were 20 percent HOTS questions—which was also the figure given for the 2014 and 2015 UPSR papers (Kementerian Pendidikan Malaysia, 2016a, p. 153). This is quite a long way from the 2016 targets of 50 percent of SPM questions and 40 percent of UPSR questions requiring HOTS. Much could have been done to smooth the transition and change not only question papers, but also classroom lessons. I shall propose such measures in Chapter 7.

i-THINK mind maps

Origins of i-THINK

In 2011, the Ministry of Education and Agensi Inovasi Malaysia initiated a partnership with Thinking Schools International, a U.S.- and U.K.-based group that uses various tools to develop thinking skills in schools. The partnership aimed to introduce the i-THINK "thinking maps", a set of eight mind maps developed by educationist David Hyerle (1996), in all 10,000 primary and secondary schools under the Ministry's purview (Thinking Schools International, 2013). The programme was publicly launched in 2012 by Prime Minister Najib Razak; targeting ten pilot schools in 2012; 1000 schools in 2013; and all schools in 2014. At the launch, Najib spoke about an "education transformation" that would "motivate students to think" and "create a generation which can think creatively, innovatively and critically", to prepare for a changing future (Bernama, 2012b). The eight i-THINK maps are shown in Figure 5.2 below.

i-THINK implementation

In the ten i-THINK pilot schools, feedback from both students and teachers in the government-linked media was very positive. Some students said they used the thinking maps to organise their own study notes, and had shared the maps with siblings and cousins (Ng & Chapman, 2013). Once the programme was rolled out to more schools, the focus quickly shifted from student learning to compliance with the required procedures, as in the case of PBS. This happened in a variety of ways. The i-THINK guidelines stated that thinking maps can only be created following a fixed sequence of steps; and that the thinking maps could not use any shapes but the stipulated circles, rectangles, and straight lines (Kementerian Pendidikan Malaysia, 2015a). While a uniform language for describing thought processes

28 Comparing national exam results across years may be not be very informative, as cut-off marks for grades within each subject are set internally and confidentially by the Examinations Syndicate every year; and could be modified to produce desired grade distributions.

can facilitate schoolwide cognitive development (Ritchhart, 2015, Chapter 3), the i-THINK guidelines were rigid, constraining student creativity and exploration of thought processes. Procedure was also put before product when some schools required class teachers to feature posters of the eight thinking maps prominently on classroom walls (without equally strict requirements to include the maps in lessons), as Ministry officials would look out for such displays on walkabouts.[29]

Figure 5.2: The eight i-THINK thinking maps

Source: (i-THINK, n.d.)

But the biggest procedural roadblock was the computer-based i-THINK course that all teachers were required to complete. The course was initially rolled out in October 2014, with the requirement that teachers complete the 16 hours of courseware and pass a multiple-choice assessment on the material before the end of the year. However, the animated course materials strained both central servers and teachers' slow internet connections in many parts of the country, so the programme was put on hold, also in October 2014 (Kementerian Pendidikan Malaysia, 2014c). The next June, the Ministry released an optional offline version of the course, which teachers could download and complete at leisure (Kementerian Pendidikan Malaysia, 2015f). In January 2016, the online i-THINK course was re-launched on a different host website, this time with orders for all teachers to complete the course before the end of 2016 (Kementerian Pendidikan Malaysia, 2016b). Teachers continued to face technical difficulties in accessing the online courseware—and, this time, broadcast their complaints on social media—so the completion order was, again, put on hold in June 2016, pending a system upgrade (Kementerian Pendidikan Malaysia, 2016c).

29 Personal communication with teachers, 29 December 2014 and 8 July 2016.

i-THINK outcomes

Despite being a flagship programme under the *Education Blueprint*, i-THINK does not appear to have any pre-determined KPIs beyond the number of schools using it in some way, and the number of teachers who have participated in training sessions. In 2014, Ministry reported an "80 percent success rate" for i-THINK, with no details on how the rate was derived (Maizatul, 2013). The *Education Blueprint* annual report for 2013 states that the thinking maps reached 510 schools in 2010 and another 548 in 2013, thus meeting the target of 1000 schools by 2012 (Kementerian Pendidikan Malaysia, 2014a, p. 52). However, the online course began drawing ire the next year, and the 2014 annual report makes no mention at all of i-THINK, despite the programme being one of the main initiatives under the "thinking skills" aspiration in the *Blueprint* (Kementerian Pendidikan Malaysia, 2015b). i-THINK reappears in the 2015 *Blueprint* annual report, which states that 227,036 teachers (a little over half the teachers nationwide) had received online training in i-THINK, and with quotes from two teachers who appreciate the thinking maps (Kementerian Pendidikan Malaysia, 2016a, pp. 54, 57, 62). Four years after its launch and two years after it was supposed to be a centrepiece in all classrooms nationwide, the i-THINK programme has yet to make a convincing difference to thinking skills cultivation in Malaysian schools.

Conclusion

As we have seen, policies aiming to cultivate the Four Cs among Malaysian primary and secondary have achieved, at best, partial success. Despite high aspirations and years of planning, these policies were stymied by a range of implementation failures and misalignments. In the next chapter, I discuss three systemic factors that drive many of these failures.

Chapter 6: What hinders Four Cs cultivation in Malaysian schools?

The skills cultivation policies described in the previous chapter were hampered not only by the resource limitations and socioeconomic inequalities that constrain most education systems, but also by a number of deeply rooted impediments. In this chapter, I discuss three such hindrances: overemphasis on exam results, an excess of paperwork-heavy directives, and pervasive blame and cynicism throughout the education system.

Success in content-heavy public exams is regarded as the overarching measure of success.

> After the inaugural PT3 results were released, a student wrote:
>
> All of the tactics, tips and tricks we were taught for answering PMR years ago must be scrapped to pave the way for PT3. ... We were the unfortunate lab rats in a failed experiment, and our effort and time put into studying were all in vain. There is nothing that the Education Ministry can do to compensate for our losses. (Gan, 2014)

Melodramatics aside, these sentiments represent a widespread and deeply felt preoccupation with the results of public examinations in Malaysia. Since Malayan independence in 1957, the national education system has been punctuated with standardised examinations that mark the completion of a phase of schooling and determine a student's eligibility for the next phase (Abdul Razak, 1956; Sri Murniati, 2010, pt. 1). The system is opaque. Marking schemes, as well as the tables that translate exam scores into grades, fall under the Official Secrets Act—so when the Education Ministry claims that national exam results have been improving (e.g. Kementerian Pendidikan Malaysia, 2013c, p. 3-6), it is impossible to tell if this is a real improvement in student learning, or mere statistical manipulation.

Still, impressive exam results are the overarching motivation in Malaysian education, with a corresponding fixation on "tactics, tips and tricks" to correctly answer the content-focussed questions in public exams. University entry, the gatekeeper of academic prestige, is determined by a "merit score", 90 percent of which is a simple aggregation of examination grades (Bahagian Pengurusan Kemasukan Pelajar, 2015; Bernama, 2013a). In the OECD's Teaching and Learning International Survey (TALIS), which covered 200 schools in each of the 22 participating countries in 2007–08, Malaysia had the largest proportion of teachers and principals stating that student test scores were of high or moderate importance in school evaluations and teacher appraisals (OECD, 2009a, pp. 145, 153). Since 2010, schools have been ranked based on their "composite scores"—70 percent of which derive from students' test scores (Kementerian Pendidikan Malaysia, 2015e). This creates incentives for administrators and teachers to concentrate on nudging up exam results.

This obsession with exams has withstood various reform efforts, whether the KBSR's stated emphasis on flexibility in all aspects of teaching and learning (e.g. adapting the national syllabus to suit individual student and classroom needs) (Lee, 1999; Pusat Perkembangan Kurikulum, 1997), or the more recent policies described in the previous section. Even the glossy *Education Blueprint 2013–2025* betrays a preoccupation with standardised tests. For example, one of its five "practices of rapidly improving or

good schools that make a difference" is using data aggressively; based on schools in Johor and Terengganu that scrutinise examination data, so that "teachers are able to determine groups of students who are at the threshold between grades, particularly those on the verge of a pass grade, or others who are 'near-misses' for achieving A grades" (Kementerian Pendidikan Malaysia, 2013c, p. 4-26). This fixation on marks and grades runs counter to the *Blueprint*'s endorsement of balanced growth and holistic assessments. The exam fixation similarly undermines the Ministry's attempts to improve higher-order thinking skills. By zooming in on TIMSS and PISA results as an indicator of HOTS, efforts have skewed away from real growth in cognitive skills toward teacher training, mock tests, study camps, and motivational talks intended to boost TIMSS and PISA scores (Bahagian Pembangunan Kurikulum, 2013, p. 21; Hotssm, 2015; Lembaga Peperiksaan, 2013c; SMK Kempas, 2015; The Star, 2015).[30]

Effects of the exam-orientation on Four Cs cultivation

With primary and secondary schools geared towards exam success, and with Malaysian public examinations that have traditionally focussed on content over skills, classroom teaching tends to stress the memorisation of facts, at the expense of skills development. Students are familiar with the phenomenon of "kejar syllabus" (literally, chasing the syllabus), when their teachers rush to cover the prescribed curriculum before exams start (Fieeq, 2011). School-level tests and exams tend to focus on recall of facts and straightforward applications. As shown in Table 6.1, according to the teacher background questionnaires in TIMSS 2011, Malaysian students were far less likely than their counterparts in other countries to encounter questions in their school-level tests and exams that required explanations or justifications. Just 11.1 percent of Malaysian Grade 8 (Form 2) students had mathematics teachers who "always or almost always" include explanation or justification in tests, compared to an international average of 36.9 percent. For science, the proportions were 37.7 percent for Malaysian students and 54.4 for other countries (IEA, 2012a).

Numerous studies of Malaysian classrooms have observed a pattern of lecture-style teaching and exam-based drills. The *Education Blueprint* cited a 2011 study of 41 schools, in which half of the 125 lessons observed were unsatisfactory, with lessons delivered as lectures targeting "surface-level content understanding for summative assessment purposes, rather than on cultivating higher-order thinking skills" (Kementerian Pendidikan Malaysia, 2013c, p. 5-2). Other studies echo this (Habsah Hussin, 2006; Renuka, 2016; Sidhu & Chan, 2010; Tan, 2010, p. 75). In the words of a mathematics teacher, "It seems not only our students have been made into robots to go after marks ... [but also] we teachers ... [who] feed them with answers ... without making sense [of] what Mathematics and education mean in shaping a person's life" (Tan, 2010, p. 130).

30 The Education Ministry decision-makers responsible for these programmes should have considered Campbell's Law—"The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor" (Campbell, 1979)—and designed the TIMSS and PISA interventions to minimise such exam-focussed distortion of the HOTS campaign.

Table 6.1: TIMSS 2011 questions on school-level tests in Grade 8 (Form 2)

	Teacher background questionnaire: "How often do you include questions involving/requiring/based on _____ in your tests or examinations?	**% of students whose teacher responded "always or almost always" (weighted)**	
		Malaysia	International average*
Mathematics	*Recall of facts and procedures*	57.6	59.5
	Application of mathematical procedures	58.1	77.1
	Searching for patterns and relationships	26.5	31.5
	Explanations or justifications	11.1	37.5
Science	*Knowing facts and concepts*	84.8	71.7
	Application of knowledge and understanding	64.0	77.8
	Developing hypotheses and designing scientific investigations	36.6	20.5
	Explanations or justifications	37.7	54.8

*Average of the 41 participating countries, excluding Malaysia; with each country weighted equally.
Source: (IEA, 2012a)

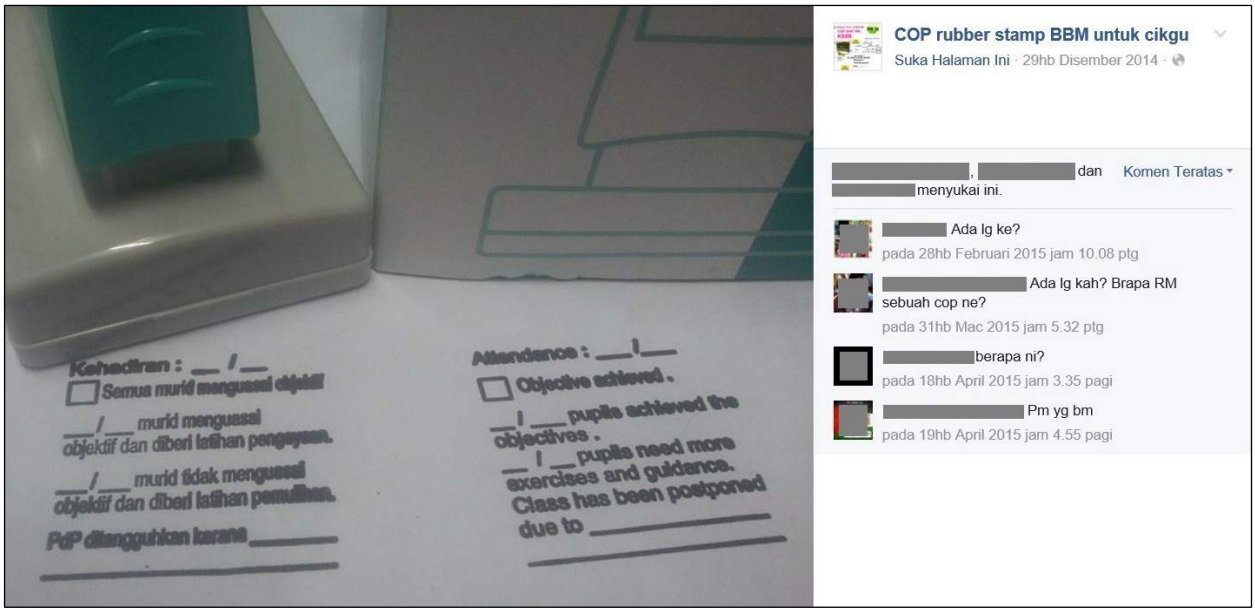
The fixation on exam results not only skews pedagogy towards lectures, drills, and rote memorisation, but also weakens confidence in the alternative assessments that can create incentives for students and teachers to cultivate skills. For example, there was widespread doubt about the reliability of PBS results (Suhaimi, 2014; Hasniza, 2014; Parent Action Group for Education, 2014). In response, the Exams Syndicate published a detailed *PBS quality assurance guide* (2014b), but this did little to build trust in the system. Everyone was used to knowing which students were "smart", and which weren't, by looking at their rigidly standardised—if opaque—exam results (Raziatul Hanum, 2013). Few could believe that teachers had both the competence and integrity to evaluate their students' abilities.

Teachers are subject to numerous paperwork-heavy directives from various Ministry agencies.

The photo in Figure 6.1 shows a rubber stamp helping teachers to write the post-lesson reflections required at the end of every lesson plan. A teacher using this rubber stamp could technically fulfil the requirement just by noting down the number of students who achieved the lesson objective, and the number of those who need additional help. A later advertisement for a similar rubber stamp explains: "Why did I produce this reflection stamp? Because I'm a teacher too. Because I want to ease teachers' workloads, which increase daily" (CopMenandaBuku, 2015, my translation). This rubber stamp illustrates the administrative burden problem: faced with reams of paperwork, much of which has no direct impact on the quality of student learning, teachers find short cuts where they can, inadvertently compromising their core work. Writing lesson reflections dozens of times a week can feel like drudgery, but reflection is

a crucial part of improving the practice of teaching (Bolton, 2010). However, many Malaysian teachers are so overloaded with government directives and paperwork that they see lesson reflections as yet another bureaucratic box to be ticked.

Figure 6.1: Facebook advertisement for a rubber stamp for teacher's daily lesson "reflections"



Source: (CopMenandaBuku, 2014)

This problem is not new. In 2008, the National Union of the Teaching Profession reported that teachers complained of bureaucratic higher-ups who demanded excessive clerical work from teachers, creating overwhelming stress (Tan, 2010, p. 85). In 2010, the Education Ministry established a special committee to deal with the issue of teachers' burdensome workloads. However, by the time the committee published its recommendations in 2012, PBS paperwork was consuming far more time consuming far more time and energy than the duties addressed in the committee's recommendations (Sektor Operasi Pendidikan, 2012). More recently, the National Blue Ocean Strategy initiative conducted a pilot project in which administrative and technical assistants were placed in some Melaka and Kedah schools to help teachers with special duties, such as managing the school library. On average, the assistants took on 3 to 7.4 hours of teachers' non-core work per week. Although the Ministry has repeatedly said that it wishes to expand this programme nationwide, it recently admitted that it lacks the funds to do so (Bernama, 2015b, 2015d, Dewan Rakyat, 2014, 2016).

A 2012 UNESCO review of Malaysian education policy identified several shortcomings in policy delivery, some of which aggravate teachers' paperwork burden. First, schools receive orders from all three levels of the Ministry—federal, state, and district—to carry out scores of programmes each year, sometimes over 100. Second, poor coordination across Ministry agencies leads to duplication of some tasks and neglect of others. Third, the Ministry monitors execution of directives rather than whether particular directives improve student outcomes (Kementerian Pendidikan Malaysia, 2013c, pp. 6-2, 6-3). This last point has been a major hindrance to recent skills-related programmes, such as PBS and i-THINK, as discussed in the previous chapter. For PBS, all the studies conducted prior to its highly problematic implementation were based on the opinions of teachers, students, and members of the public,

whether gathered through surveys or roundtables. Stakeholders' views matter, but so do proven outcomes: even the PBS pilot studies did not appear to include classroom observations, analyses of students' work, or assessments of student performance (Lembaga Peperiksaan, n.d.-a). Perhaps it is unsurprising that some observers either were sceptical of the quality of these studies (Kulasagaran et al., 2014), or did not believe that any prior research had been conducted at all (J. K. T. Wong, 2013). It is also unsurprising, though tragic, that a headmaster interviewed in 2007 said: "Schools have now become piles of directives. There is no coordination whatsoever from those higher up. New orders are handed down non-stop" (Tan, 2010, p. 130, my translation).

Effects of the paperwork burden on Four Cs cultivation

The most obvious effect of all these directives and the associated reporting burden is, in the words of the Ministry's 2010 special committee on teachers' workloads, that "all kinds of odd jobs compromise quality time for carrying out the process of teaching and learning, which is teachers' main duty" (Sektor Operasi Pendidikan, 2012, my translation). According to 2011 survey of 7,853 teachers, teachers spend 15 to 30 percent of their working hours on administrative work (Kementerian Pendidikan Malaysia, 2013c, p. 5-6). Teachers interviewed anonymously estimated that administrative work composes 40 to 60 percent of some teachers' workload; and complained of "[e]ndless awards, abundant competitions, and continual contest[s] introduced by the Ministry", as well as "unnecessary compulsory seminars and courses" and orders to conduct academic clinics, enrichment classes, and minute analysis of exam results—all of which sap teachers of time and motivation (Hanna, 2014; Tan, 2010, p. 25). This became acute under PBS, when teachers were initially required to maintain: (a) individual student files that collated every piece of evidence from every subject; (b) showcase files that collated the best piece of student work for each task descriptor in the performance standards document; (c) printed forms recording each piece of evidence in each file; and (d) online records of each student's progress (Lembaga Peperiksaan, 2012b). Some teachers resorted to using PBS-specific workbooks, in which each page was a tear-out sheet of exercises fulfilling a particular task descriptor (Alwazir, 2012)—hardly the flexible, holistic assessments that PBS was intended to encourage.

Another problem with the copious documentation is that teachers have developed the survival skill of demonstrating compliance on paper without changing what happens in the classroom. This posturing affects student work, as well as paperwork submitted to managers. The *Education Blueprint 2013–2025* reports that such on-paper inflation happens in schools' internal assessments: while 63 percent of schools said that they had "good or excellent" teaching and learning practices, the Ministry's inspectorate[31] put just 13 percent of schools in this category (Kementerian Pendidikan Malaysia, 2013c, p. 5-2). Similarly, a nationwide study of 121 Form 1 teachers by the Education Faculty of Universiti Malaya found that while 89.2 percent of teachers said that they shared learning targets with students during lessons, thus helping students to focus their attention and work systematically; only 18 percent actually did in practice (Renuka, 2016). This self-serving inflation appears to be encouraged by Ministry officials: teachers have reported being pressured by school administrators and by Ministry officials at briefings to produce good grades for student work, presumably to make both their school districts and the new

31 i.e. the Jemaah Nazir dan Jaminan Kualiti.

assessment programme look good (Raziatul Hanum, 2013; Tan, 2010, p. 73; IDEAS Malaysia, 2016). Some teachers in Tan Ai Mei's field study of school-based assessment[32] went as far as reporting students' scores for science experiments and Living Skills projects that had not actually been carried out (2010, pp. 99–100). Other teachers conducted drills to maximise marks; provided sample answers for students to copy; or structured the content of assignments according to the assessment rubric, thus boosting grades and easing the marking process (2010, pp. 12–13, 15, 115). Students were also culpable in the masquerade; copying work from their friends; using model answers provided by tuition teachers; and, in one case, paying a classmate to complete a project (2010, pp. 18–19). Such student copying has found a new tool in the internet, where numerous blogs post sample answers for coursework and PBS assignments. While students do need to learn from examples, model answers to high-stakes assessment questions tempt cheating. For example, a teacher posted a sample essay for the 2012 PMR history course work assignment, and received dozens of comments from students around the country, asking him how much of the essay they could safely copy verbatim, and how much they had to modify (Cikgu Razak, 2012).

Finally, the endless directives and nit-picky monitoring stunt school leadership and innovative, collaborative teaching. As Molly Lee observed, the problem is twofold: some Ministry officials mistrust their subordinates and hence do not devolve decision-making power; and some teachers prefer to rely mechanically on instructions from the centre to minimise the risk of being blamed for errors (2006, pp. 154–155). This contrasts sharply with celebrated education systems of Finland and Japan, where teachers are expected to take the initiative to improve their craft, often through professional collaborations—rather than bowing to an onslaught of directives (Green, 2015, Chapter 4; Sahlberg, 2012, Chapter 3).

Cynicism and blame, heightened by frequent policy change, distort relationships among school stakeholders.

Commentators discussing the Malaysian education system often speak of policy flip-flops (e.g. Ruekeith, 2016; Zairil, 2016; Hazlina, 2016; Bernama, 2014; Sta Maria, 2011). It is easy to see why. Table 6.2 shows education policies from the last 15 years that were dramatically altered after large investments—planning, instructional materials, teacher training, time, and money—from teachers, students, and parents. Besides the many iterations of skills cultivation programmes, as detailed in the previous chapter, other major policy changes have involved science practical testing, a paperwork-heavy form of teacher performance management, and English Language teaching. For example, in 2015, Education Ministry retracted its 2013 announcement that SPM 2016 candidates would have to pass English (in addition to Bahasa Melayu and History) in order to receive an SPM certificate. In an interview, Deputy Education Minister P. Kamalanathan said that the Ministry postponed the English compulsory pass after projecting that a quarter of SPM candidates would fail the certificate if it went into effect (Sumisha, 2015)—a projection that should have been part of the decision-making process two years prior.

32 Tan's study was published in 2010, and looks at types of school-based assessment (oral tests, science practical assessments, projects and folios) that were in place prior to the nationwide roll-out of the PBS system in 2011. Nonetheless, it is a valuable source of interview data, and the implementation issues she observed are similar to those that affected PBS, as reported in newspapers and by teachers of my acquaintance, and in my experience as a secondary school teacher in 2014–2015.

Table 6.2: Recent education policies altered after significant investments of resources and time

Year	Initial policy	Subsequent policy alterations
2002	Science and mathematics to be taught in English (PPSMI) beginning for Year 1, Form 1, and Lower 6 in 2003 (Ketua Pengarah Pendidikan Malaysia, 2002)	**2009**: PPSMI to be phased out gradually, beginning in 2010 (Ketua Pengarah Pelajaran Malaysia, 2010)
2011	From 2016, UPSR grades to comprise 60% centralised tests in Year 6 and 40% school-based assessment from Years 1 to 6 (Lembaga Peperiksaan, 2011b)	**2015**: UPSR grades revert to 100% centralised test scores (Lembaga Peperiksaan, 2015c)
2011	Teachers are required to file students' PBS evidence in Fail Perkembangan Murid and Fail Showcase; and to record PBS achievement in Rekod Perkembangan Murid and the online system (Lembaga Peperiksaan, 2011c, 2012b)	**2014**: PBS evidence no longer needs to be filed; PBS achievement no longer recorded online but in offline Excel sheets; simplified standards documents introduced (Lembaga Peperiksaan, 2014d)
2011	The PMR will be completely replaced by PBS in 2014, with both teacher-designed and Ministry-designed assessment tasks (Lembaga Peperiksaan, 2011a, 2012b)	**2013**: centralised tests to be held for languages, science, and maths (Lembaga Peperiksaan, 2013d) **March 2014**: new Form 3 assessment named as PT3; centralised tests also to be held for Living Skills and Islamic Studies; assessment tasks for other subjects (Lembaga Peperiksaan, 2014d)
2013	English to be a compulsory pass subject beginning with SPM 2016 (Kementerian Pendidikan Malaysia, 2013c, p. 4-14; Lembaga Peperiksaan, 2014f)	**2015**: implementation postponed indefinitely (Lembaga Peperiksaan, 2015b)
2013	Practical testing to be introduced for science subjects beginning in 2015 (Kementerian Pendidikan Malaysia, 2013c, p. 4-8; Lembaga Peperiksaan, 2014e)	**March 2015**: implementation postponed to SPM 2016 (Lembaga Peperiksaan, 2015a) **August 2015**: implementation postponed indefinitely (Lembaga Peperiksaan, 2015b)
2014	Teachers must complete the 16-hour Kursus i-THINK Dalam Talian (Online i-THINK Course) by the end of 2014 (Kementerian Pendidikan Malaysia, 2014c)	**2014**: completion requirement postponed (Kementerian Pendidikan Malaysia, 2014c) **2015**: offline version of the course released **January 2016**: online course re-launched; teachers to complete by the end of 2016 (Kementerian Pendidikan Malaysia, 2016b) **June 2016**: completion requirement postponed (Kementerian Pendidikan Malaysia, 2016c)
2014	*Pelan Pembangunan Profesionalisme Berterusan* (Continuous Professional Development Plan) includes teacher portfolios in its Continuous Professional Development Kit (Bahagian Pendidikan Guru, 2014). No circulars are released, but most schools instruct teachers to prepare these individual files (e.g. SMK Benut Pontian, 2015).	**2016**: Bahagian Pembangunan dan Penilaian Kompetensi (Competency Development and Evaluation Division) releases a letter stating that it never directed teachers to maintain individual files (Bahagian Pembangunan dan Penilaian Kompetensi, 2016)

These policy changes are problematic not only in their frequency, but also because they are often rolled out before adequate information has been disseminated to parents, teachers, and even Ministry officers (e.g. Rebecca, Khor, & Tan, 2014), thus compromising their success. Equally important, these frequent changes generate cynicism about policy reform, and heighten blame games about who is responsible for which failures in the education system.

One of the most prominent instances of blame-passing occurred on national television: in an October 2015 dialogue on TV1 about the new assessment system, Examinations Syndicate director Nawal Salleh said that her agency was "surprised" when they became aware that schools had reserved rooms for storing students' PBS files:

> We never said that the children's [PBS] evidence needed to be collected and filed. But, actually, I think [it was] the way they interpreted that understanding [of PBS] that diverged from its true basis.[33] (Suhaimi & Shahril, 2015, my translation)

A few minutes later, Nawal strongly affirmed the host's summary of her comments: that we do not fully experience the efficacy of PBS because of a lack of understanding among educators (Suhaimi & Shahril, 2015). Teachers were livid about the accusation that they did not understand PBS and the instructions they had been given. One commentator in *Berita Harian* accused Nawal of dissembling and contradicting other Ministry officials; and said he "hoped that there would not be any comments and critiques from higher-ups based solely on what is on paper without looking at on-the-ground realities" (Ishak, 2015, my translation). In this instance, even the on-paper records belied Nawal's statements: a 2011 public circular letter (surat siaran) and the 2012 *PBS management guide,* both of which were issued by the Examinations Syndicate, state that it is compulsory for teachers to file students' PBS evidence in individual student files and showcase files (2011, 2012b, p. 42). Although I could not find any documents directing schools to designate a room for PBS files, the Syndicate's 2012 annual report shows pictures of what appear to be PBS file storage rooms (2012a, p. 46); so Nawal's claiming surprise at the existence of such rooms was disingenuous or, at best, inexcusably ill-informed. The Ministry responded to the *Berita Harian* letter by explaining that the upgraded PBS system, which no longer required individual student files, had been in place since April 2014 (Unit Komunikasi Korporat, 2015). However, the Ministry neither retracted Nawal's assertion that it had never required such files; nor apologised for her attributing blame to teachers' misunderstanding of the PBS system.

Although it is unclear how much of the recrimination is due to policy flip-flops, and how much stems from other factors; it is clear that these blame games abound. Teachers accuse lazy students and demanding administrators of leaving them no choice but to fabricate PBS results ("terpaksa menipu") (e.g. Raziatul Hanum, 2013). Students likewise accuse teachers of laziness (e.g. Wan Mohamed, 2015); with one student concluding that, when students fail exams, "it's not entirely the teacher's fault, but 80%, the

33 "Sebenarnya saya tertarik dengan apa yang Encik Suhaimi bagi tahu tadi: sekolah yang berhampiran dengan Putrajaya yang menyediakan satu bilik yang begitu besar untuk menyimpan Fail-fail Perkembangan Murid. Sebenarnya, kami pun agak ... boleh dikatakan terkejut juga, kan, sebab dalam masa kami menatarkan pelaksanaan PBS itu, kita tidak pernah pun mengatakan bahawa anak-anak itu perlu dikumpul evidens-evidens itu dan difailkan. Tapi sebenarnya saya rasa cara mereka menginterpretasi, kefahaman itu, yang lari daripada landasan sebenar" (Suhaimi & Shahril, 2015, my transcription).

blame is on the teacher" (Melanie, 2007). Parents, in turn, publicly shame teachers on social media for lapses in instructional quality (e.g. The Rakyat Post, 2015). One teacher lamented the "constant bashing of teachers and educators in this country", including accusations that "teachers 'makan gaji buta'" (i.e. get paid for negligible work) (Massicks, 2015). As a temporary teacher summarised: "The teachers are giving up, the parents are hopeless, the system is troublesome, the environments are demotivating, the students lack interest" (Izz, 2014).

Table 6.3: PISA 2012 questions on students' maths perceptions/failure attributions

Survey question	**Blame attribution**	**Malaysia**	**International average***
Thinking about your school: to what extent do you agree with the following statements?		**% "strongly agree" or "agree"**	
If I put in enough effort I can succeed in school.	own effort	92.5	93.6
If I wanted to, I could perform well at school.	own effort	88.5	86.2
If I had different teachers, I would try harder in school.	teachers	69.4	41.6
It is completely my choice whether or not I do well at school.	own effort	66.4	82.7
Family demands or other problems prevent me from putting a lot of time into my school work.	family/ circumstances	43.5	35.1
I do badly in school whether or not I study for my exams.	circumstances	26.2	21.2
Each week, your mathematics teacher gives a short quiz. Recently you have done badly on these quizzes. Today you are trying to figure out why. How likely are you to have these thoughts or feelings in this situation?		**% "very likely" or "likely"**	
Sometimes the course material is too hard.	circumstances	61.5	69.4
I'm not very good at solving mathematics problems.	circumstances	52.9	58.5
This week I made bad guesses on the quiz.	luck	47.5	46.6
Sometimes I am just unlucky.	luck	44.0	49.4
The teacher did not get students interested in the material.	teacher	38.7	49.3
My teacher did not explain the concepts well this week.	teacher	30.5	44.7

*Average of the 64 participating economies, excluding Malaysia; with each economy weighted equally.
Source: my calculations from (OECD, 2014a)

This toxic atmosphere is reflected in the TIMSS and PISA survey questions about students' perceptions of their teachers. PISA 2012 asked if 15-year-old students agreed with the statement "If I had different teachers, I would try harder in school," 69.4 percent of Malaysians agreed—as compared to the international average of 41.6 percent, as shown in Table 6.3. This large difference is even sadder when

considered together with two other observations in the PISA 2012 data. First, 92.5 percent of Malaysian students agreed with the statement that "If I put in enough effort I can succeed in school". Second, when asked to imagine they had been doing badly in mathematics quizzes, students attributed much more blame to circumstances (e.g. "sometimes the course material is too hard") and luck (e.g. "this week I made some bad guesses on the quiz") than to inadequate teacher actions (i.e. failing to get students interested in the material, and explaining concepts poorly). Taken together, these PISA 2012 data suggest that over two-thirds of Malaysian students choose to be less successful in school because of poor relationships with their teachers; even though they do not believe teachers are particularly boring or unclear in class.

Table 6.4: TIMSS 2011 questions on students' perceptions of teacher expectations

How much do you agree that your teacher thinks you can do well in _____ with difficult materials?	**% "disagree a little" or "disagree a lot"**				
	Malaysia	*International average*	*Singapore*	*Thailand*	*Indonesia*
Mathematics	62.1	35.5*	33.9	33.7	45.1
Science	65.5	34.3[+]	41.7	27.5	—^

*Average of the 41 participating countries, excluding Malaysia; with each country weighted equally.

[+]Average of the 26 participating countries that answered the Integrated Science questionnaire, excluding Malaysia; with each country weighted equally

^Indonesian students answered this question separately for biology, chemistry, and physics.

Source: my calculations from (IEA, 2012a, pp. 64, 90)

Table 6.5: TIMSS 2011 average student scores by their perceptions of teacher expectations

How much do you agree that your teacher thinks you can do well in _____ with difficult materials?	**International average***			
	agree a lot	*agree a little*	*disagree a little*	*disagree a lot*
Mathematics	495.0	483.9	467.3	446.0
Science	499.9	488.1	470.2	445.4

*Category averages for all 42 participating countries, with each country weighted equally.

Source: (IEA, 2012a, pp. 64, 90)

In TIMSS 2011, 62.1 percent of Malaysian Form 2 students stated that they did not believe their teacher thought they could do well in mathematics with difficult materials, as shown in Table 6.4. For science, the figure was 65.5 percent. These Malaysian data are much higher than not only the international average (36.1 percent for maths and 35.5 percent for science); but also our neighbouring countries, including Singapore (33.9 for maths and 41.7 for science), despite its notoriously exacting standards. Teacher beliefs about whether students can do well are crucial to student success. This is clear from the TIMSS 2011 data: the more students believed that their teachers thought they could do well in maths or science, the higher their scores in that subject, as shown Table 6.5. Other studies, such as the

classic Rosenthal experiment (Rosenthal & Jacobson, 1968), also demonstrate that teacher expectations strongly condition student performance. Healthy relationships between students and teachers are not optional froth. They are the substrate of impactful teaching and learning.

Effects of flip-flops and the blame game on Four Cs cultivation

Negative relationships within the education system not only compromise the quality of student learning, but also thwart the implementation of new skills-focussed policies. If recent history indicates that new education policies always revert to their prior, more traditional forms, then teachers and students have no reason to invest effort in the new policies. After the messy introduction of PBS, a teacher summarised one popular sentiment:

> As usual, government policies are always influenced by the political environment. They go ahead, and then turn back when unsuccessful. If the minister changes, policies can change too. (Hatta, 2012, my translation)[34]

Such an atmosphere offers few incentives for improving what you do in your classroom, especially if your managers check your paperwork regularly but almost never observe your lessons. Apart from dampening the motivation to attempt a new policy reform wholeheartedly, such cynicism and blame aversion also inhibit healthy critique from front-line implementers, whose perspectives could help improve the new policies—if they felt free to express them. Initially, teachers frustrated by the online PBS system were even reluctant to "like" a Facebook page requesting the system's removal, because they feared disciplinary measures (Raziatul Hanum, 2013); such as being transferred to a rural school, or being fired, both of which happened to the anti-PBS activist Mohd Nor Izzat Johari (Salmiyah, 2015).

The unhealthy relationships and lack of trust between different actors in the education system also mean that new policies will probably have little credibility and support at the outset. This is problematic because education policy reform is a long game; with effects taking over a decade to cycle through the system from the beginning of primary school to the end of secondary school. With weak grassroots support, education ministers are likely to back-pedal; especially when a new minister assumes office amid fierce opposition to his predecessors' policies. Thus Muhyiddin Yasin announced the retraction of PPSMI shortly after assuming office in 2009 (Lotbinière, 2009); and Mahdzir Khalid indefinitely postponed the SPM science practical testing and English compulsory pass in 2015 (Bernama, 2015c).

A teacher described the situation thus:

> We have people blaming teachers for poor literacy, poor thinking skills, poor discipline, etc. But there's not much training given to teachers to handle these scenarios. ... I used to think that Professional Learning Communities (PLC), where teachers develop by collaborating and seeking advice from one another, were the way forward. This year, it was introduced in our school. The

34 Original quote: "Seperti biasa, dasar kerajaan selalunya dipengaruhi oleh persekitaran politik. Mereka buat dulu, bila tak berjaya baru pusing balik. Kalau menteri bertukarpun, dasar boleh berubah" (Hatta, 2012).

> training was poor and I'm doubtful the teachers understand it fully. Teachers grumbled about "more work"—basically the tagline that teachers use for any initiative by the MOE [Ministry of Education]. (Hanna, 2014)

As public management scholar Christopher Hood observes, blame games can lead public servants to many counterproductive behaviours, which often persist despite new legislation and policy statements (2010). To move from blame games among education stakeholders towards partnerships that help students develop their cognitive and interpersonal skills, we need much more than another policy gimmick.

Implications for skills cultivation in primary and secondary schools

Any attempts to cultivate the Four Cs in Malaysian schools are constrained by past skills cultivation policies, and the resultant patterns of behaviour among Ministry officials, teachers, and students. For example, decades of overemphasis on content-heavy exam results means that there will be little confidence in a new system that eliminates all standardised tests. Instead, *alternative forms of assessment must be introduced gradually, and non-traditional teaching approaches must boost exam results while cultivating the Four Cs.* It isn't necessarily bad to focus on content: research on cognitive development shows conclusively that skills can only develop in the context of factual knowledge, as noted in Chapter 3 (Schneider & Stern, 2010, pp. 82–83; Willingham, 2010, Chapter 2). This has two implications. First, standalone modules on the Four Cs are probably an inefficient use of the education budget. Second, policies for developing skills (especially critical thinking) in Malaysian schools should aim to build these skills through engagement with the familiar content-heavy curriculum, to aid both student learning and public acceptance.

Another challenge results from the procedure-focussed and paperwork-heavy directives that the Ministry frequently issues to teachers. On one hand, endless nit-picky instructions obviously limit teachers' time, autonomy, and creativity for maximising student learning. However, it would be foolhardy to swing to the other pole, and eliminate all forms of reporting: too much public money, and too much of the nation's future, is at stake. Rather, to practice and cultivate the Four Cs, *teachers need to be held accountable through mechanisms that are more flexible and more focussed on learning—and more difficult to inflate.* Shifting the emphasis from procedural compliance and targeted exam scores towards student learning will not only give teachers more room to exercise non-routine skills in their teaching, but it is also likely to give students richer opportunities for learning. An experiment in the United States found that 4th-grade students performed better in puzzle-solving tasks (anagrams and sequencing) when their teachers were told to "help the students learn how to solve the problems", as compared to students whose teachers were told to "ensure that the children perform well". Teachers in the latter category also appeared more tense; and gave students more hints and criticism, rather than opportunities for independent discovery (Flink, Boggiano, & Barrett, 1990).

In addition to better accountability mechanisms, *policy approaches will have to build trust, relationships, and a shared vision of excellence*. As we have seen, relationships and expectations may be intangible, but they are far from inconsequential. For example, the successful schools in the Chapter 3

case studies invested significantly in building shared vision, and benefited tremendously because of the effort, efficiency, and responsibility resulting from this common purpose. Besides these cases, there is a considerable evidence of vision-driven schools that help students achieve tremendous cognitive growth despite challenging socioeconomic backgrounds (e.g. Bryk, Sebring, Allensworth, Luppescu, & Easton, 2010; Kirp, 2013; Martinez & McGrath, 2014).

Two final constraints are worth noting. First, despite the trendiness of educational technology in developing "21st-century skills", any technological approaches must be introduced with great caution and extensive field tests. ICT may have great potential for developing students' skills, but it is tricky to use well in classrooms; and shiny gadgets can quickly become a distraction (e.g. Hall, 2015; Ripley, 2014, p. 386). In PISA 2012, countries that had invested considerably in educational ICT fared no better than others in reading, mathematics or science (OECD, 2015b).[35] Moreover, virtually every form of educational technology introduced to Malaysian schools has been fraught with technical difficulties and other inconveniences; whether the online PBS system and the i-THINK online course discussed above, or other programmes not related directly to skills (e.g. KPPK, 2014; Unit NKRA, 2011). Moreover, the size of the education system entails huge spending for every injection of computer hardware—RM6 billion between 1999 and 2010—with little evidence that this hardware is changing classroom instruction (Kementerian Pendidikan Malaysia, 2013c, p. 6-20). For now, the priority should be improving internet speeds to make the existing Frog Virtual Learning Environment (VLE) usable rather than frustrating; so that new policies can build on the VLE, a familiar, expensive, and underutilised investment. Also, the Ministry should consider low-cost ways of enhancing teachers' learning and collaboration through their smart phones and computers.

This points to the second constraint: funding. Because the education budget is unlikely to increase significantly in the near future, realistic policies for cultivating the Four Cs should make use of existing resources in the school system—such as in-house expertise; the Frog VLE; and established structures for teacher training—rather than calling for an entirely new set of resources, however promising. This rules out some programmes that have shown great success in developing students skills elsewhere; such as intensive arts extracurriculars, which would require scores of trained personnel; and work-based learning, as compulsory internships would incur massive transportation costs. Despite all these constraints, there is still a large menu of policy approaches that could fuel skills cultivation among students in Malaysian primary and secondary schools; as I demonstrate in the next chapter.

35 Even with sophisticated adaptive learning technology, results are mixed. A detailed five-year study of 12 large post-secondary digital courseware projects found that only one project had large effects on student outcomes (Means, Peters, & Zheng, 2014).

Chapter 7: Policy proposals for Four Cs cultivation in Malaysian schools

As shown in the previous chapter, new education policies in Malaysia have failed to effect the desired changes to students' skills cultivation. Many of these failures resulted from challenges in implementation: overwhelming paperwork, shoddy online systems, unprepared stakeholders, and poor buy-in. However, as political scientist Kent Weaver noted, many such problems can be avoided—or, at least, mitigated—by systematically analysing new policies to identify problems, many of which recur across policies (2010). Below, I outline some crucial considerations in Malaysian education policy reform.

Key considerations for education policy change in Malaysia

Scale and sequencing

As Malaysia's primary and secondary school system is centralised and standardised at the federal level, proposed policy reforms must be replicable at scale, across the 10,000 schools under the Ministry's purview. In addition, policies must be carefully sequenced: teachers must be trained before students can be taught; and students must learn foundational skills before tackling more complex challenges.

Incentives

Centralisation also affects another pivotal aspect of policy change: how actors respond to incentives. Because teacher recruitment and placements are also centralised, schools do not have the luxury of selecting a lineup of highly motivated teachers who strongly believe in cultivating students' skills—as in the celebrated High Tech High school network described in Chapter 2. Consequently, certain resource-intensive reforms should be introduced as opt-in policies rather than blanket directives. Thus, the school administrators, teachers, and students who volunteer as early adopters will be more motivated, and hence more likely to deliver the new policies successfully. Higher success rates will, in turn, raise buy-in among other educators. Although Malaysian education policies are usually compulsory across all schools in the pertinent categories, a precedent for opt-in policies was set in 2016 with the Dual Language Programme; which gives schools the option of teaching science and mathematics subjects in English, if the schools meet certain criteria (Ketua Pengarah Pelajaran Malaysia, 2015).[36]

More generally, both opt-in and compulsory policy reforms must offer benefits commensurate with the effort demanded. The student-centred learning approaches that have been known, for decades, to develop students' capacities for creativity, problem-solving, and collaboration place huge demands on teachers (Rotherham & Willingham, 2009). The more demanding a policy, the more appealing the incentives must be—whether enhanced student skills, improved KPI performance, or reduced paperwork. For example, the teacher collaboration module I propose below is both time consuming and professionally challenging. To improve buy-in, teachers who opt to participate in this module will be relieved of certain administrative duties for the duration.

36 The criteria are: sufficient resources; readiness of the school head and teachers; demand and support from parents; and scoring above the national average in Bahasa Melayu in public exams (Ketua Pengarah Pelajaran Malaysia, 2015).

Figure 7.1: Billboard in a Ministry of Education publicity campaign[37]

Source: my photograph, taken at the Masjid Jamek LRT station, 2 May 2016

Presentation and messaging

People's responses to incentives are also affected by how the incentives are presented. Because of this, policy planning must pay attention to how potential reforms are framed and described to the people who will implement them. Current approaches to messaging leave much to be desired. For example, although the Ministry invests in advertising campaigns (usually, on billboards in train stations and along highways), these advertisements tend to show generic, vaguely positive slogans alongside stock images; as in Figure 7.1; rather than content that is inspiring, challenging, or informative.[38] Besides this, the performance benchmark scattered twelve times throughout the *Education Blueprint 2013–2025* is "to be in the top third of countries in terms of performance in TIMSS and PISA" (Kementerian Pendidikan Malaysia, 2013c, p. E-4)—a target somewhat lacking in motivational value, as such international rankings have no bearing on the lives of the students who take these assessments and the teachers who teach them.

37 Translation: "Education is openness. Education is joy. Education is welfare. Spearheading change."

38 Psychology experiments indicate that people are much more motivated to make charitable donations when they are told a story of an individual's plight, rather than given statistics about the scale of the problem (Slovic, 2007). Perhaps the Ministry of Education could attempt to build shared vision and prompt efforts in educational improvement through stories, rather than bland sweeping statements.

In addition to strengthening motivation to implement policy reforms, careful presentation of new policies reduces the likelihood of the policies getting misinterpreted by the front-line workers who determine their success (Spillane, 2009; Weaver, 2010).

Monitoring and accountability

Alongside incentives comes accountability. As discussed in the previous chapter, accountability in primary and secondary schools is skewed towards procedural compliance rather than real improvements in student learning. This diverts teachers' energies away from their core duties and towards finicky paperwork. It also leads to a façade of policy reform, without substantial changes inside classrooms. Hence, attempts to change Malaysian education policy must incorporate accountability mechanisms that increase responsibility rather than posturing.

Alignment

For smooth implementation, new policy proposals must be aligned with existing systems. This reduces wastage and raises chances of success. The policies I propose below are closely aligned with current goals of the education system, as articulated in the *Education Blueprint 2013–2025.* As noted earlier, the Four Cs overlap with three of the six Student Aspirations in the *Blueprint*: thinking skills, leadership skills, and bilingual proficiency. Moreover, the proposed policies support seven of the eleven Shifts emphasised in the *Blueprint*:

- Shift 1: Provide equal access to quality education of an international standard
- Shift 2: Ensure every child is proficient in Bahasa Malaysia and English Language and is encouraged to learn an additional language
- Shift 4: Transform teaching into the profession of choice
- Shift 6: Empower JPNs, PPDs, and schools to customise solutions based on need
- Shift 9: Partner with parents, community, and private sector at scale
- Shift 10: Maximise student outcomes for every ringgit
- Shift 11: Increase transparency for direct public accountability (Kementerian Pendidikan Malaysia, 2013c)

Other types of alignment also matter. For example, instructional tools must cohere with current curricula, in order to successfully integrate content mastery and skills development. Moreover, different components of the policy reforms must be harmonised. To illustrate, a detailed analysis of school improvement in Chicago concluded that the most significant school improvement occurs when "five essential supports" are all in place: "school leadership, parent and community ties, professional capacity of faculty and staff, a student-centred learning climate, and an instructional guidance system" (Bryk et al., 2010, p. 197). Finally, policy approaches must be aligned with how the brain learns skills. As discussed in Chapter 3, students best cultivate skills when they practice these skills in challenging tasks involving meaningful knowledge and real-world settings, receiving feedback on how to improve.

Policy proposals for cultivating the Four Cs

Below, I propose fourteen policies for cultivating the Four Cs in Malaysian primary and secondary schools. The policies are divided into three categories:

- student assessment and instructional tools;
- school organisation; and
- the teaching profession.

These three categories loosely match the "three critical factors" identified in the dialogue sessions held in the development of the *Blueprint*: "student learning (more relevant curriculum, better language proficiency and communication)"; "school quality (learning environment: infrastructure, discipline, management)"; and "teacher quality (administrative burden, training, performance management, remuneration)" (Kementerian Pendidikan Malaysia, 2013c, p. 3-16).

Student assessment and instructional tools

If policy reforms are to cultivate student skills, the reforms must change how students think and interact during lessons. Two key mechanisms for such change are assessments and instructional tools.

In the crusade to develop students' skills, assessments are a double-edged sword. Advocates of high-stakes tests cite empirical evidence that countries with exit exams have higher student achievement (Woessmann, Lüdemann, Schütz, & West, 2007) or recount anecdotal arguments that public exams motivate students and teachers towards excellence (Ripley, 2014). However, as discussed in the previous chapter, a narrow focus on exam-style drills can compromise skills development. Education scholar Yong Zhao also argues that exams dampen creativity and entrepreneurship (Zhao, 2012).[39] The productive middle ground is using student assessments as a force for the desired changes; by broadening traditional test questions to push for high-level conceptual understanding, and introducing tasks that demand creativity and social skills (e.g. Mazur, 1997, p. 28). Exams serve as a declaration of government priorities in education; and they can re-shape the priorities of students, teachers, and parents, in turn. Below, I

39 Yong Zhao quotes a 1997 policy document by the Chinese National Education Commission, which then had begun reforming its education system to foster creativity and entrepreneurship: "'Test-oriented education' refers to the factual existence in our nation's education of the tendency to simply prepare for tests, aim for high test scores, and blindly pursue admission rates [to colleges or higher-level schools] while ignoring the real needs of the student and societal development. It pays attention to only a minority of the student population and neglects the majority; it emphasizes knowledge transmission but neglects moral, physical, aesthetic, and labor education, as well as the cultivation of applied abilities and psychological and emotional development; it relies on rote memorization and mechanical drills as the primary approach, which makes learning uninteresting, hinders students from learning actively, prevents them from taking initiatives, and heavily burdens them with [an] excessive amount of course work; it uses test scores as the primary or only criterion to evaluate students, hurting their motivation and enthusiasm, squelching their creativity, and impeding their overall development" (quoted in Zhao, 2012, pp. 139–140).

propose three policies that will broaden the existing examinations system beyond rote mastery.

Another way of changing ingrained behaviour is introducing lesson routines that inculcate new habits. Routines for facilitating students' thinking increase the efficiency of lesson planning and add structure to lesson delivery. They also promote different types of reasoning and idea generation, and give schools a language for sharing learning across classrooms and subjects. Additionally, well-designed routines can communicate messages about the process of learning; for example, that learning is open-ended, and that questioning is integral to learning (Ritchhart, Church, & Morrison, 2011, Chapter 3). In this section, I propose plans for incorporating three sets of skills-focussed and empirically proven instructional routines into Malaysian classrooms. These instructional routines are strictly opt-in; with the expectation that teachers will opt in because the routines can improve student outcomes while streamlining lesson planning.

Although the government has attempted to introduce similar tools in the past, most notably with the i-THINK thinking maps, the tools I propose differ from i-THINK in a number of ways. First, they are more flexible. i-THINK maps can greatly aid visual learning, but offer less help for verbal learning; while the tools proposed here can be drawn, discussed orally, or written down. Second, unlike i-THINK, all three proposed routines incorporate group work; hence enhancing communication and collaboration in tandem with classroom content. This aligns with a recent meta-analysis of group learning activities found that students in collaborative groups learned significantly more than peers in less interactive groups (Chi, 2009). Third, the Visible Thinking and argumentation frameworks I propose are language-rich, incorporating a range of sentence prompts, and thus scaffolding communication skills. Such language-based tools are a powerful tool for students to organise their knowledge and for teachers to structure classroom discourse (Schneider & Stern, 2010). In addition, such tools can facilitate communication in Malaysia's multilingual classrooms. Finally, the third instructional tool, Peer Instruction, will be embedded in the national syllabus. Peer Instruction has a track record of improving student mastery of content- and concept-heavy material. Thus, it can improve student performance on our traditional exam questions, while fostering complex thinking.

Student assessment

SPM group project component

While PBS showed that it is not realistic to immediately replace public exams with task-based assessments, it is very much possible to incorporate projects into high-stakes assessments. The SPM group project component would require all Form 4 students to complete a yearlong project in groups of three to five students, addressing a local, national, or global problem that affects their community. Projects would be interdisciplinary, entailing a range of skills. In addition to creating an opportunity for students to practise their skills in a challenging, goal-oriented setting, this group project requirement in the flagship public exam would clearly signal that it is crucial for students to cultivate skills alongside traditional classroom knowledge. The projects would also equip fresh school leavers with a real-world accomplishment to showcase to potential employers. Details on how to implement the SPM group projects are in Table 7.1.

The precedent for such a group project component in a major public exam is Singapore's Project

Work, which students complete in the first year of their "A" Levels (Bryer, 2006).[40] Like Singapore's Project Work, the SPM group project component would incentivise close collaboration among group members: half of each student's final mark will come from individual written and presented work, while the other half will come from elements shared across the group (Singapore Examinations and Assessment Board, 2014). However, while group presentations in Singapore's Project Work are witnessed only by assessors, I propose that the final presentations for the SPM group projects be open to the public, on a schoolwide exhibition day. As with High Tech High's emphasis on making students' work public (Wagner, 2010, Chapter 6),[41] these public presentations will exercise students' public speaking skills, strengthen accountability about the quality and grading of projects, and increase community participation in education.

Table 7.1: Implementation details for the SPM group project component

Policy aspects	**Specifics of the SPM group project component**
Overview	A new SPM component, requiring each Form 4 student to complete a yearlong group project addressing a problem relevant to their community. All projects will be presented and defended at a public exhibition day in school.
School level	Upper secondary school (Form 4)
Aims	• Give all secondary school students work on a project with real-world links prior to graduation. • Assess a wider range of student learning. • Build public favour towards non-traditional assessments.
Measures of success	• *Direct*: quality of projects, and skills demonstrated in the projects • *Indirect*: employment rates of recent graduates
Four Cs cultivation (among students)	• *Critical thinking*: use different sources of information to solve a problem • *Creativity*: generate practicable solutions to the problem • *Communication*: through group work and public presentations • *Collaboration*: through group work
Systemwide/opt-in	Systemwide: compulsory for all SPM candidates, while in Form 4.
Who does what?	• *Ministry*: set syllabus and rubrics; train teachers; moderate and verify marks • *Schools*: arrange day for public presentation of the projects • *Teachers*: assign students to groups, facilitate project development, grade final projects • *Students*: in groups: design solutions, write final report, present solutions to the public; individually: write preliminary ideas, review of literature/primary data, and reflections
Incentives	• *Teachers*: help students develop skills; help students put up a solid public exhibition • *Students*: SPM results and public affirmation

40 Singapore's Project Work is not without its critics. For example, some have questioned the validity of Project Work grades (e.g. Edward, 2012), and teachers have said that Project Work guidelines are unrealistic given school resources and student capabilities (The Online Citizen, 2011).

41 See Case Study 1 in Chapter 3 of this paper.

Resource demand	• *Initial*: curriculum development expertise; publicity to disseminate information about the group project component • *Annual*: training of teachers newly assigned to teach/grade project work; processing of marks by the Exams Syndicate • *Ongoing*: teachers and timetable space (one Form 4 class period, per class per week)
Accountability	Teachers submit marks to the Exams Syndicate after the presentations. Each school presentation day is open to the public; and observed by a district officer, who moderates grading where necessary. Results (unsatisfactory, satisfactory, excellent) are included in SPM results.
Time frame:	• *1st year*: preparation of guidelines; recruitment of volunteer schools for the pilot project; training of teachers for the pilot project • *2nd year*: pilot project in volunteer schools; modification of guidelines; selection of exemplar materials from pilot schools; training of teachers in all schools • *3rd year onwards*: included in SPM requirements

Potential challenges and mitigation steps:

- *Teachers and students may collude to plagiarise group projects, which occurs with current project-based assessments in schools*.
  The risk of faked projects will be drastically reduced by making students' final presentations open to the public. Simply copying another group's work wholesale is unlikely to escape the scrutiny of a local audience. Other forms of cheating, such as blindly copying material from the internet, will also be much riskier for would-be tricksters, who would struggle to answer probing questions from the audience.

- *People may mistrust the grading of the group projects, as in the case of PBS*.
  Rubrics and exemplars for each component of the group projects[42] will be publicly accessible, so that performance expectations are publicly known. Interested community members can then compare the project presentations at exhibition day against the benchmarking material, thus building understanding of how demanding the projects are, and gaining information for holding schools and district assessors accountable for fair grading.

- *Schools and students may pay little attention to the group projects, focussing instead on conventional subjects.*
  To establish the importance of this new SPM component, group project grades (unsatisfactory, satisfactory, excellent) will be printed on official SPM results slips.[43] In addition, these grades will be factored into admissions criteria for public university entry under the Unit Pusat Universiti.

42 For example, Singapore's Project Work includes an oral presentation, a group written report, and a few individual writing assignments (Singapore Examinations and Assessment Board, 2014).

43 The precedent for including non-exam-based assessments on public exam certificates is Penilaian Perkara Asas Fardu 'Ain (Evaluation of Basic Aspects of Islamic Obligations, PAFA). PAFA results are printed on the official results statements of Muslim candidates in public exams (Ketua Pengarah Pendidikan Malaysia, 1994).

SPM portfolio option

Another way of broadening the skill set assessed by public exams is to offer SPM candidates the option of being assessed by a portfolio of subject-specific tasks, rather than written tests. Subject-specific tasks can be designed to challenge students' mastery of a wide range of skills and content, as in the task shown in Box 7.1, which is used for high school mathematics in the United States. In the proposed SPM portfolio option, students will be told about the option at the end of Form 3; and then briefed again after their Form 4 midyear exams, at which point they have to select either the examination route or the portfolio route for the SPM. At the end of Form 4, portfolio candidates sit for the same final exams as their peers, and also submit progress reports showing preliminary work on their selected tasks in each subject. Candidates must again submit progress reports after the first semester of Form 5. At the end of the year, they must defend each of the assessment tasks in their portfolios, in public defences monitored by SPM invigilators. Details on how to implement the SPM portfolio option are in Table 7.2.

Box 7.1: Performance-based assessment task (PBAT) from the New York Performance Standards Consortium

The math PBAT is built around problem solving and applications of higher levels of mathematics.

The student is expected to use sound mathematical procedures accurately when solving problems; justify all mathematical statements efficiently and accurately; and create appropriate models, inherent to the task, that represent the problem accurately and elegantly.

Communication is an important aspect of the mathematical task. Students are expected to use mathematical terminology and notation, communicate clearly the process and solution used, and make predictions. Students will also discuss how mathematical concepts interconnect, build on each other, and apply to real-world situations.

External evaluators assess both written and oral work using the Consortium rubric.

Sample Math PBATs:

- Texas Tech -vs- Oklahoma: A comparative statistical analysis that exhibits how data can be manipulated to convey a variety of messages. ...
- How can matrices be used to solve multivariable mathematical situations?
- How can the properties of parabolas be employed in producing solar energy?

Source: (Performance Standards Consortium, 2013, p. 10)

There are a few advantages to offering an SPM portfolio option. First, several studies indicate that, while some people perform better under stressful conditions such as exam halls, others are genetically predisposed to perform worse under pressure (Yeh, Chang, Hu, Yeh, & Lin, 2009; Bronson & Merryman, 2013). A portfolio option would allow students in the latter category to showcase their skills under fairer conditions. Second, while standardised tests graded on a curve foster competition between students, performance portfolios encourage students to focus on their own mastery of the skills entailed. Some experimental research has shown that students motivated by skills mastery perform better on tasks

than students who are motivated by competition (Bergin, 1995).

This appears to be the case in the Performance Standards Consortium, a group of public schools in which students graduate by completing a series of performance-based assessment tasks, and presenting these tasks in front of external evaluators. Students in Consortium schools have lower dropout rates and higher graduation rates, in both high school and subsequent tertiary education, than their peers from comparable backgrounds across New York and the United States (Performance Standards Consortium, 2013). Similarly, a study of 19 Deeper Learning Schools, the majority of which use performance-based assessments such as portfolios or exhibitions, found that these students did significantly better on cognitive competency tests than peers with similar background characteristics (Huberman, Bitter, Anthony, & O'Day, 2014; Zeiser, Taylor, Rickles, Garet, & Segeritz, 2014). These outcomes are receiving attention from other schools across the United States, which are starting to consider assessments based on portfolios and dissertation-style defences (Iasevoli, 2015; G. Robinson, 2016).

Table 7.2: Implementation details for the SPM portfolio option

Policy aspects	**Specifics of the SPM portfolio option**
Overview	SPM candidates can opt to be assessed not through exams, but through a portfolio of performance tasks and projects. Students assessed under this option will present and defend their portfolios at an open exhibition day at the end of the year.
School level	Upper secondary school
Aims	• Offer students the option of being assessed in a holistic, skills-based manner. • Build public favour towards non-traditional assessments.
Measures of success	• *Direct*: quality of portfolios; proportion of students opting for portfolios • *Indirect*: employment rates of SPM portfolio candidates vs. exam candidates
Four Cs cultivation (among students)	• *Critical thinking*: use multiple sources of information in completing performance tasks • *Creativity*: through challenging performance tasks with non-routine requirements • *Communication*: through written performance tasks and public portfolio defences
Systemwide/opt-in	Opt-in: all schools must offer the option, but students are free to choose.
Who does what?	• *Ministry*: set syllabus and rubrics; grade portfolios • *Trainee teachers*: create exemplar projects (voluntary) • *Schools*: arrange public portfolio defences; disseminate guidelines to portfolio candidates • *Teachers*: support portfolio candidates under their supervision • *Students*: complete performance tasks for each subject; defend portfolios in front of a public audience
Incentives	• *Trainee teachers*: gain first-hand familiarity with a challenging new policy • *Schools*: showcase student abilities • *Students*: explore and develop skills, avoid exam pressures
Resource demand	• *Initial*: curriculum development expertise; publicity to make people aware of this unconventional option • *Annual*: dissemination of information to new Form 4 students • *Ongoing:* ad hoc support of portfolio candidates by schools and teachers

Accountability	All portfolios are assessed by Examinations Syndicate assessors. Each portfolio defence is open to the public, and monitored by SPM invigilators; and is video-recorded for further reference. Portfolio candidates submit progress reports to their schools at the end of Form 4 and after the first semester of Form 5.
Time frame:	• *1st year*: preparation of guidelines; trial runs and exemplar development at teacher training institutes; briefings to all schools during the end-of-year holidays • *2nd year onwards*: incorporated into SPM options

Potential challenges and mitigation steps:

- *Students (and parents) may be reluctant to select the portfolio option, which may be regarded as less prestigious than exams. Alternatively, some may select it as an easy way out of difficult exams.*
  To show that SPM portfolios are as prestigious as the traditional exam route, the Education Ministry should ensure that top portfolio candidates are publicly recognised in the same media releases that celebrate top SPM exam candidates. Also, public university and pre-university entry standards must develop entry standards that give (at least) equal priority to SPM portfolio candidates. To reduce the likelihood of students perceiving the portfolio option as an easy route, portfolio candidates will only be eligible for SPM certificates if they perform above a minimum standard in performance tasks across all subjects—in contrast to exam candidates, who require passes in just Bahasa Melayu and History.

- *Schools may discourage students from pursuing this unconventional option.*
  Initially, schools may be reluctant to allow students to pursue this unorthodox assessment mode. To ensure that students are still aware of the portfolio option, it must be publicised in mainstream media, and all secondary schools will be required to screen a video (with subtitles in Mandarin and Tamil) about the option on PT3 results day for students finishing Form 3. Schools will also be required to brief students about the portfolio option in the middle of Form 4, after which each student will complete a form stating which SPM option they choose.

- *Students may plagiarise rather than creating original material.*
  As with the SPM group projects component, students will be required to present and defend their portfolios publicly. This will allow for public scrutiny of portfolio content and quality, while requiring students to demonstrate deep understanding of their submitted tasks.

- *Students may choose the portfolio option without adequately understanding its challenges, and then jeopardise their future education and career when they struggle with the tasks.*
  To help students understand the requirements of the portfolio option, rubrics and exemplars for each subject's task will be easily accessible online. (Ideally, the exemplars should cover each performance level in the rubric; and include "drafts" of tasks that improved with revision, showing students the potential for performance gains over time.) Students who select the portfolio option will submit progress reports at the end of Form 4 and halfway through Form 5,

and discuss these reports with subject teachers. This will help students to determine if they should switch to the exam option; a change will be permitted any time before the second semester of Form 5. After SPM results are released, portfolio candidates will have one opportunity to re-submit failed assessment tasks, which will be defended in front of state-level invigilators.

Public collection of HOTS test questions

In the initial plans for promoting higher-order thinking skills (HOTS) in schools, the Ministry included the production of HOTS Item Exemplar Books as one of its four strategies for implementing HOTS assessments (Bahagian Pembangunan Kurikulum, 2013, p. 13). However, the material available publicly thus far (e.g. Lembaga Peperiksaan, 2013b; Bahagian Pembangunan Kurikulum, 2014b) is neither accessible nor systematic enough, and has not been publicised enough, to forestall confusion and anxiety about HOTS exam questions, as described in the previous chapter. Instead, the Ministry should develop a question bank containing examples of each question type for each subject and each school year. Every question in the bank should be accompanied by (a) one sample zero-credit answer and one partial-credit answer, to show how HOTS marking works; and (b) several full-credit answers, to demonstrate that HOTS questions go beyond single, black-and-white answers. To facilitate the development of the question bank, there is a wealth of accumulated expertise on how to design high-quality HOTS assessments, whether guidebooks (e.g. Brookhart, 2010); or well-recognised assessments such as PISA or the College and Work Readiness Assessment (Wagner, 2010, pp. 115–121).[44]

The question bank should be freely accessible online. Also, question booklets for each year and subject should also be sold in bookshops, for a nominal cost. Details on how to implement the HOTS question bank are in Table 7.3.[45]

Table 7.3: Implementation details for the public collection of HOTS test questions

Policy aspects	**Specifics of the public collection of HOTS test questions**
Overview	A publicly accessible (online and print) question bank for test items focussing on thinking skills, across all subjects and levels. Each test item will have multiple exemplar answers, to illustrate the breadth of possible answers.
School level	Primary and secondary school

44 For a sample of this challenging performance assessment, which requires considerable competence in critical thinking and written communication, see http://cae.org/education-professionals/k12-faculty-or-administrator/cwra-sample-instrument/.

45 The term "HOTS" implies a false hierarchy of thinking processes (Ritchhart, Church, & Morrison, 2011, Chapter 1)—when thinking processes do not actually occur in a set sequence, and "lower-order" processes such as understanding may demand very complex thought. Still, I use the term here because it has become familiar to Malaysians as a catch-all for cognitively challenging tasks.

Aims	• Develop public understanding of HOTS test questions, why they matter, and how they work. • Develop teachers' and students' notions of thinking skills through shared benchmarks and independent practice
Measures of success	• *Direct*: student performance on HOTS test questions in public exams; volume of traffic on the online question bank • *Indirect*: diminishing public anxiety about HOTS questions, as reported in the media after public exams
Four Cs cultivation (among students)	• *Critical thinking*: through practising and reflecting on test items in the bank • *Creativity*: through practising and reflecting on test items in the bank
Systemwide/opt-in	Systemwide: available to all, and HOTS questions will be faced by all exam candidates; though no mandated action.
Who does what?	• *Ministry*: develop the question bank, host it online, and distribute inexpensive print copies to bookshops • *Schools:* ensure that all teachers, students, and parents are aware of the question bank
Incentives	• *Ministry*: develop students' thinking skills; minimise public dissatisfaction with unexpected HOTS questions in exams; increase validity of tests and grading by improving teachers' understanding of thinking skills assessment • *Teachers and students*: improve performance in public exams through greater familiarity with the testing of thinking skills
Resource demand	• *Initial*: curricular expertise to refine guidelines for thinking skills questions; pool of teachers to develop question and answer sets; publicity to build awareness about the question bank • *Periodic*: updates to the question bank when necessary
Accountability	Feedback form in the online question bank (and telephone feedback system) for proposed amendments to questions or answers.
Time frame:	• *1st year*: preparation of guidelines; then development of test items and exemplar answers; then construction of the database • *2nd year onwards*: accessible to the public

Potential challenges and mitigation steps:

- *Students, parents, and teachers may treat the sample answers as content to be memorised and parroted.* This inclination to memorise the One Correct Answer, which is deeply ingrained in many high-achieving schools, will be flummoxed by the diverse exemplar answers to each question in the HOTS question bank. The range of answers will communicate the message that HOTS questions are open-ended and require active, independent thought.

Instructional tools

Visible Thinking routines in primary schools

The first skills-based instructional tool that I propose for widespread adoption in Malaysian schools is Visible Thinking, a set of classroom routines developed by researchers at the Harvard Graduate School of Education's Project Zero.[46] The 21 Visible Thinking routines can be used in any subject, and are grouped into three categories for structuring lesson content: Introducing and Exploring; Synthesizing and Organizing, and Digging Deeper (Ritchhart et al., 2011, Chapter 3). Box 7.2 shows a routine in the Synthesizing and Organizing category, which guides students through key moves for synthesizing new information with existing knowledge. In this Connect-Extend-Challenge routine, students first encounter new information—whether by reading a passage, watching a video, looking at a picture, or another mode—and then work through the questions to push their understanding; before finally sharing their thinking with classmates. Details on how to introduce the Visible Thinking routines are in Table 7.4.

Box 7.2: Instructions to students for the Connect-Extend-Challenge Visible Thinking routine

Connect-Extend-Challenge

Consider what you have just read, seen, or heard, then ask yourself:

- How are the ideas and information presented *connected* to what you already knew?
- What new ideas did you get that *extended* or broadened your thinking in new directions?
- What *challenges* or puzzles have come up in your mind from the ideas and information presented?

Source: (Ritchhart et al., 2011, p. 132)

One of the most powerful aspects of Visible Thinking routines is that they give teachers and students a shared framework for talking about thought processes that usually take place within mental black boxes. This is important because much learning takes place through observation and imitation, as in Alan Collins, John Seely Brown, and Ann Holum's influential description of schooling as a sort of cognitive apprenticeship:

> ... in traditional apprenticeship, the process of carrying out a task to be learned is usually easily observable. In cognitive apprenticeship, one needs to deliberately bring the thinking to the surface, to make it visible, whether it's in reading, writing, problem solving. (Collins, Brown, & Holum, 1991)

Once thoughts have been made visible, others in the classroom can critique and extend their peers' thoughts. Furthermore, the Visible Thinking routines help teachers to focus their lessons on the development of students' thinking, alongside curricular content (Ritchhart, 2015, Chapters 2, 7). These

46 For a brief introduction, see http://www.pz.harvard.edu/projects/visible-thinking. For examples of schools using the Visible Thinking routines, see (Ritchhart et al., 2011).

routines also help students to conceptualise learning in productive ways (Ritchhart et al., 2011, Chapter 8). For example, the "What makes you say that?" routine shows students that statements should be based on evidence; but also that questioning is part of learning, and that learning is built on contributions from many people (Ritchhart et al., 2011, Chapter 7). Such messages about learning, when internalised during the formative primary school years, can help students to become self-directed learners; rather than learners fixated on black-and-white, achievement-oriented memorisation.

Table 7.4: Implementation details for the Visible Thinking routines in primary schools

Policy aspects	**Specifics of the Visible Thinking routines in primary schools**
Overview	A set of research-based protocols for helping students to be articulate and extend their thinking processes; through shared exploration of lesson content.
School level	Primary school
Aims	• Develop students' understanding and skills. • Raise awareness, among both students and teachers, that learning is incremental, active, and open-ended; not a process of generating test scores.
Measures of success	• *Indirect*: achievement growth of students whose teachers use Visible Thinking routines vs. those who don't; perceptions about the UPSR vs. PBS, as observed by Ministry officials in school visits and as reported in the media
Four Cs cultivation (among students)	• *Critical thinking*: through the thought processes prompted by the routines • *Creativity*: through elaboration and synthesis prompted by the routines • *Communication*: language cues in the routines aid clear expression • *Collaboration*: the routines frame learning as a social effort towards understanding
Systemwide/opt-in	Opt-in: training is open to all interested primary school teachers, and materials are freely available online.
Who does what?	• *Ministry*: develop Malaysia-specific training material; deliver two-day training courses during school holidays • *Teachers*: attend courses; incorporate VT routines into lessons
Incentives	• *Ministry*: develop student skills and understanding; alter perceptions of learning to align with the National Education Philosophy • *Teachers*: improve student skills and mastery of content; structure teaching in a consistent, research-based way; strengthen classroom community; fulfil two days of the annual in-service training requirement
Resource demand	• *Initial*: pedagogical expertise to adapt VT materials and create training modules • *Annual*: training sessions nationwide for teachers
Accountability	Teachers who attend the courses (a) give anonymous feedback on the training and materials immediately after the course and (b) write reflective reports, six and twelve months after the course, on how the VT routines have changed their classes.
Time frame:	• *1st year*: preparation of resources and training modules • *end of 1st year onwards*: VT resources available online; training courses conducted annually

Potential challenges and mitigation steps:

- *There may be little buy-in for the Visible Thinking routines, given that teachers feel overworked and the training course is opt-in.*
  To build buy-in among school leaders, each district will be required to screen a video explaining the routines and their benefits during one of its regular meetings for headmasters/mistresses. The benefits emphasised in the video will include the fact that a schoolwide framework for learning can stoke a shared passion for cognitive challenge and improvement. To encourage teachers to attend the two-day training course during the end-of-year holidays, the course will count towards the required seven days of in-service training annually; and child care will be provided on-site.

Peer Instruction in secondary school science and mathematics

While the generalised Visible Thinking tools facilitate strong foundations in thinking and communication for primary school students, other supports should be introduced for secondary school students who are beginning to develop specialised knowledge in academic disciplines. The second instructional tool, Peer Instruction, targets sophisticated understanding of the concepts and formulas in science and mathematics that students often struggle with (Mazur, 1997; Vickrey, Rosploch, Rahmanian, Pilarz, & Stains, 2015). Under Peer Instruction, each key point in the curriculum is covered in this way:

1. Teacher explains the concept or formula in question.
2. Teacher poses a ConcepTest, i.e. a multiple-choice question focussed on a single concept, which cannot be solved by mechanically relying on equations, and which is neither too hard nor too easy for the class. See Box 7.3 for an example of a ConcepTest.
3. Students think about the ConcepTest for a minute.
4. Students show the teacher their answers. (optional)
5. Students discuss the ConcepTest with their neighbours, trying to convince their neighbours of the answer.
6. Students show the teacher their revised answers.
7. Teacher explains the correct answer.

Thus, Peer Instruction makes students think through the concept in question, promotes collaborative learning, and gives students and teachers real-time feedback on student understanding of the concept (Mazur, 1997, pp. 10, 26). Students can indicate their answers by raising hands, holding up different coloured pieces of paper, using Plickers cards,[47] or any other appropriate and efficient method. Ideally,

47 Plickers are a set of square "bar codes" printed on cards, with different card orientations indicating different answers. To answer multiple-choice questions during class discussions, each student hold up their Plickers card, in the orientation indicating their desired answer. The Plickers codes look like random collections of pixels, and each student has a different code, so students can answer without fearing judgement from classmates who answered differently. The teacher uses a smart phone app to read and tally the bar code answers. For details and to download a set of cards, see https://plickers.com/.

35–70 percent of students should answer the ConcepTest correctly prior to discussing it with their neighbours. If fewer than 35 percent of students answer correctly, the classwide grasp of the concept may be too weak for fruitful peer discussions. If greater than 70 percent answer correctly, there is not much to gain from peer discussion (Crouch & Mazur, 2001).

Box 7.3: Sample ConcepTest for introductory physics

A person standing at the edge of a cliff throws one ball straight up and another ball straight down at the same initial speed.
Neglecting air resistance, the ball to hit the ground below the cliff with the greater speed is the one initially thrown

1. upward.
2. downward.
3. neither—they both hit at the same speed.

Answer: 3. Upon its descent, the velocity of an object thrown straight up with an initial velocity of v is exactly –v when it passes the point at which it was first released.

Source: (Mazur, 1997, pp. 107–108)

A bank of ConcepTests matched to the national syllabus would give teachers a pedagogically effective and labour-reducing way of including both skills and content mastery in their lessons; while allowing flexibility in how they introduce subject material and build students' understanding. To incorporate Peer Instruction into secondary school science and mathematics lessons, the Ministry should develop a one-day training course for interested teachers, alongside an online bank of ConcepTests,[48] to which teachers can also contribute their own ConcepTests. Details on how to introduce the ConcepTests are in Table 7.5.

Peer Instruction and ConcepTests were developed in the 1990s by Harvard physicist Eric Mazur, who was shocked by how superficially his undergraduate students understood his lecture-style classes (Mazur, 1997). Since then, Peer Instruction has been shown to deepen secondary and tertiary students' conceptual mastery and problem-solving skills in a range of settings and countries (Crouch & Mazur, 2001; Fagen, Crouch, & Mazur, 2002; Mazur, 1997; Vickrey et al., 2015). For example, Peer Instruction is the centrepiece of India's low-cost Avanti Learning Centres; where students have a 40-percent success rate in the gruelling Indian Institute of Technology entrance exam, compared to a 1-percent success rate nationally (Avanti Learning Centres, n.d.; Wagner & Dintersmith, 2015, Chapter 6). The success of Peer Instruction is probably due to a range of factors: its flexibility; its embedding of skills in content knowledge, which is key to skills development (Rotherham & Willingham, 2009); its emphasis on formative (mid-learning) assessment, which can enhance learning substantially (Black & Wiliam, 1998). Peer Instruction also emphasises wait time, i.e. time given to students to independently mull over

48 Mazur and his collaborators host an online collection of ConcepTests at http://galileo.harvard.edu/. However, having a separate ConcepTests bank would allow the Ministry to compile ConcepTests written in Bahasa Melayu, and to organise the questions according to national curricular specifications.

problems, which has been shown to raise students' confidence, exploration of ideas, and performance on complex cognitive tasks (Rowe, 1986). Additionally, Peer Instruction resembles the high-impact maths lessons of Japan, in which students grapple with a new maths problem and compare each other's methods for solving the problem, before finally practising a particular solution method that the teacher highlights (Stigler & Hiebert, 1997).

Table 7.5: Implementation details for Peer Instruction in secondary school science and mathematics

Policy aspects	**Specifics of Peer Instruction in secondary school**
Overview	A collection of curriculum-based puzzles (ConcepTests), coupled with an evidence-based lesson protocol, for deepening students' understanding through discussion of key concepts.
School level	Secondary school
Aims	• Facilitate students' mastery and retention of challenging concepts in the sciences and mathematics. • Develop students' communication and collaboration skills through cooperative learning.
Measures of success	• *Indirect*: achievement growth of students whose teachers use Peer Instruction vs. those who don't; anecdotal reports from employers of improved soft skills among school leavers
Four Cs cultivation (among students)	• *Critical thinking*: solve the non-routine questions in ConcepTests • *Communication*: through discussing ConcepTests with partners • *Collaboration*: discussion routines aimed at correct answers to the ConcepTests
Systemwide/opt-in	Opt-in: training is open to all interested secondary school teachers of relevant subjects, and materials are freely available online.
Who does what?	• *Ministry*: establish and maintain an online platform for sharing ConcepTests; deliver one-day training courses during school holidays • *Trainee teachers in relevant subjects*: develop the initial bank of ConcepTests, based on the national curriculum • *Teachers*: attend courses; incorporate Peer Instruction into lessons; review ConcepTests used in class; contribute to the bank of ConcepTests
Incentives	• *Ministry*: improve student mastery of economically important subjects; develop student skills • *Trainee teachers*: gain experience in, and feedback on, their understanding of concepts that students frequently misunderstand • *Teachers*: improve student achievement in concept-heavy subjects; plan lessons efficiently by drawing on the ConcepTests bank; get reliable, immediate feedback on student understanding during lessons; strengthen classroom community; fulfil one day of the annual in-service training requirement

Resource demand	• *Initial*: technical capacity to create a sub-portal on the existing Frog VLE platform, and a simple smart phone app; curricular expertise to create the initial ConcepTests bank; pedagogical expertise to create training modules • *Annual*: training sessions nationwide for teachers
Accountability	Teachers who attend the courses (a) give anonymous feedback on the training and materials immediately after the course and (b) write reflective reports, six and twelve months after the course, on how Peer Instruction has changed their classes.
Time frame:	• *1st year*: preparation of resources, training modules, online portal, and initial bank of ConcepTests • *end of 1st year onwards*: ConcepTests resources available online; training courses conducted annually

Potential challenges and mitigation steps:

- *There may be little buy-in for the ConcepTests training course, given that teachers feel overworked and the course is opt-in.*
  Refer to the corresponding point in "Visible Thinking routines in primary schools".

- *It will take a lot of resources to create curriculum-specific ConcepTests that are both conceptually clear and challenging enough to engage students.*
  I propose that the initial collection of ConcepTests be derived from (a) translations of existing ConcepTests used in other countries, translated to Bahasa Melayu and adjusted to appropriate difficulty; and (b) ConcepTests designed by trainee teachers studying the target subjects in teacher training institutes. Trainee teachers are themselves recent graduates from secondary school, so they are likely to understand common conceptual errors made in these subjects. Moreover, this will develop their familiarity with this effective instructional tool.

Teaching argumentation in secondary school languages and humanities

Argumentation—the ability to take a position on an issue, and defend that position using reasoning and evidence—not only demands critical thinking, but also is a crucial part of the communication skills that are in high demand today (e.g. Wagner, 2010). In addition to deepening students' understanding and preparing them for jobs, argumentation also contributes to the improvement of collective welfare (Kuhn, 2005, Chapter 6)—as in democratic parliaments arguing for the best legislation for the country. Hence, I propose that the Ministry of Education develop a framework for teaching argumentation in secondary schools. Teachers of language and humanities subjects should be particularly encouraged to teach argumentation clearly, as sophisticated engagement with such subjects requires competence in argumentation.[49]

49 Recently, science lessons centred on dilemmas and argumentation have been growing in popularity (Erduran & Jiménez-Aleixandre, 2007; Kuhn, 1993; Zohar & Nemet, 2002). However, shifting to this style of science lessons in Malaysian secondary schools would require prohibitively large changes in curriculum and pedagogy.

Box 7.4: Deanna Kuhn's 10 activities for teaching argumentation

- *Generating reasons*
  Goals: Reasons underlie opinions; different reasons may underlie the same opinion.
- *Elaborating reasons*
  Goal: Good reasons support opinions.
- *Supporting reasons with evidence*
  Goal: Evidence can strengthen reasons.
- *Evaluating reasons*
  Goal: Some reasons are better than others.
- *Developing reasons into an argument*
  Goal: Reasons connect to one another and are building blocks of argument.
- *Examining and evaluating opposing side's reasons*
  Goal: Opponents have reasons too.
- *Generating counterarguments to others' reasons*
  Goal: Opposing reasons can be countered. "We can fight this."
- *Generating rebuttals to others' counterarguments*
  Goal: Counters to reasons can be rebutted. "We have a comeback."
- *Contemplating mixed evidence*
  Goal: Evidence can be used to support different claims.
- *Conducting and evaluating two-sided arguments*
  Goal: Some arguments are stronger than others.

Source: (Kuhn, 2005, pp. 153–154)

One possible framework for teaching argumentation in a systematic but interdisciplinary way was presented by education psychologist Deanna Kuhn in her book *Education for thinking* (2005), which argues that the goal of education is to develop students' thinking, especially in inquiry and argument.[50] In the book, Kuhn describes a module for teaching argumentation, which divides good argumentation into ten manageable activities, listed in Box 7.4. In Kuhn's study, this series of activities helped a group of low-achieving middle-school students to produce increasingly sophisticated arguments. The students also showed increasing motivation as the module progressed (Kuhn, 2005, Chapter 8). Besides Kuhn's ten activities, another tool for teaching argumentation is the Boston Debate League's Evidence-Based Argumentation, which follows a sequence of five argumentation skills; and which has a track record of improving students' written arguments and claims (Boston Debate League, 2011, 2012; National Speech & Debate Association, n.d.). Details on how to introduce the argumentation framework are in Table 7.6.

50 Some materials from Kuhn's Education for Thinking research project are available at http://www.educationforthinking.org/.

Table 7.6: Implementation details for teaching argumentation in secondary school languages and humanities

Policy aspects	**Specifics of the argumentation programme**
Overview	A framework for teaching the different components of effective argumentation in SPM group projects, as well as other language and humanities subjects.
School level	Secondary school
Aims	• Develop students' skills in thinking and effective communication. • Deepen students' engagement with curriculum content.
Measures of success	• *Indirect*: quality of SPM group projects; achievement growth, especially in open-ended test questions, of students whose teachers use the argumentation framework vs. those who don't; anecdotal reports from employers of improved soft skills among school leavers
Four Cs cultivation (among students)	• *Critical thinking*: through practising the different components of strong argumentation (e.g. weighing evidence, anticipating counterarguments) • *Creativity*: through formulating ideas in argumentation • *Communication*: through practising elegant, systematic argumentation
Systemwide/opt-in	Opt-in: training open to all interested secondary school teachers, and materials freely available online.
Who does what?	• *Ministry*: develop Malaysia-specific training material; align the argumentation framework with the SPM group projects rubrics and the cocurricular projects guidelines; deliver one-day training courses during school holidays • *Teachers*: attend courses; incorporate the argumentation framework into lessons
Incentives	• *Ministry*: develop student skills and understanding • *Teachers*: improve student skills and mastery of content; raise the quality of SPM group projects; structure teaching around a coherent set of skills; fulfil one day of the annual in-service training requirement
Resource demand	• *Initial*: pedagogical expertise to create resource materials and training modules • *Annual*: training sessions nationwide for teachers
Accountability	Teachers who attend the courses (a) give anonymous feedback on the training and materials immediately after the course and (b) write reflective reports, six and twelve months after the course, on how the argumentation framework has changed their classes.
Time frame:	• *1st year*: preparation of resources and training modules • *end of 1st year onwards*: argumentation resources available online; training courses conducted annually

Potential challenges and mitigation steps:

- *There may be little buy-in for the argumentation frameworks training course, given that teachers feel overworked and the course is opt-in.*
  Refer to the corresponding point in "Visible Thinking routines in primary schools". Also, the chosen argumentation framework should correspond closely to the SPM group projects rubric, to maximise gains in teachers' and students' understanding.

School organisation

Classrooms do not exist in vacuums. Instead, the surrounding school environment and wider atmosphere can strongly condition how teachers teach and how students learn. The previous chapter discussed several entrenched patterns in the Malaysian education system that hamper the development of student skills. However, the school setting can also influence positive change in classrooms. For example, Ron Ritchhart describes ways in which eight "forces"—expectations, language, time, modelling, opportunities, routines, interactions, and physical environment—can be harnessed to build "Cultures of Thinking" in schools (2015). Other scholars argue that organisational routines can be a pivotal mechanism for changing classroom instruction to match government policy (Spillane, Parise, & Sherer, 2011). For example, the Ministry could introduce a new instructional tool, along with an organisational routine that prompts school leaders to monitor the incorporation of the tool into teaching and learning. In this section, I propose four policy approaches that counter systemic weaknesses and support skills cultivation in Malaysian schools. The approaches comprise a new structure for cocurricular activities; self-contained classrooms in primary schools; a policy experiment in eliminating exam-based streaming; and revamped school evaluations.

Cocurricular public projects

Cocurricular activities have been enshrined in the Malaysian education system since at least the 1979 *Report of the Cabinet Committee to Review Education Policy Implementation*, which stipulated that each student join at least one club or society, and strongly encouraged students to join at least one sport and uniformed group (e.g. Scouts or the Red Crescent Society). Stated goals included building esprit de corps, confidence, and skills (Mahathir, 1979, pp. 91–96). A later directive made it compulsory for each student to join three cocurricular activities: one club or society, one uniformed group, and one sport; with a stipulated number of meetings each year (Bahagian Sekolah-Sekolah, 1985, pt. 5.1). In 2006, cocurricular achievement became part of the admissions formula for public universities (Kementerian Pelajaran Malaysia, 2006, p. 20). However, as I shall explain below, many schools do not run cocurricular activities in ways that give students meaningful opportunities to develop skills such as the Four Cs. Consequently, I propose changing the corurricular requirement from a membership quota to a requirement that each student contributes significantly to one public project per year.

Using cocurricular projects as an avenue for skills cultivation is not an outlandish idea. For example, Ministry documents for the HOTS initiative describe 1Murid 1Projek, a scheme requiring each student to complete a cocurricular project following a seven-step problem solving process (Bahagian Pembangunan Kurikulum, 2013, pp. 15–17, 2014a). The *Education Blueprint 2013 annual report* explains that 1Murid 1Projek would require students to "solve an issue facing their school or community", and that the projects would build bonds with the community and private sector (Kementerian Pendidikan Malaysia, 2014,a p. 52). The subsequent *Blueprint* annual report describes a project innovation competition "building upon the 1Student 1Project programme" (Kementerian Pendidikan Malaysia, 2015b, p. 20). However, a Google search for various permutations of "1Murid 1Project" on the Ministry of Education website yields no hits besides a PDF copies of the documents cited mentioned above; as well as a directive on a Perak district education office website instructing school principals to fill in reports

stating that all students had completed innovation projects under the 1Murid 1Projek initiative[51] (Pegawai Pendidikan Daerah Kinta Utara, 2015).[52]

That said, this failure to implement planned cocurricular initiatives is the least of the shortcomings of the cocurricular programme in Malaysian schools. In an informal survey I conducted among government school teachers of my acquaintance,[53] 21 out of 30 respondents said that students in their school do not get any choice about which club, sport, and uniformed group they join. According to one respondent, students are assigned to cocurricular groups based on their class, because teachers say it would be inconvenient to give students free choice. Sixteen respondents also stated that student committee members for these cocurricular groups are selected by teachers rather than nominated by peers; and 18 stated that students, whether committee members or otherwise, have no say in the types of programmes conducted. Consequently, one teacher stated that "there is no student leadership in the [cocurricular] activities". In addition, cocurricular reporting is subject to the same on-paper inflation as the academic initiatives described in the previous chapter. Twenty-two respondents said that some of their colleagues falsify records for the cocurricular groups under their supervision. Eighteen said that teachers in their school tell students to inflate their individual cocurricular attendance records. (One common tactic is listing irrelevant events—such as extra classes, exam preparation workshops, or schoolwide Hari Raya celebrations—under the annual quota of cocurricular meetings.) According to one respondent, teachers were "told to fake the attendance of students even when the students [had] never attended a meeting in their life just so that [their] school's koko [cocurricular] performance is on par". Another said that they had "strict orders" from the school to give all students "at least a 60%" score in cocurricular activities so that they pass a benchmark that will help school leaders to raise the school evaluation ranking; which I will discuss further under *Revamped school evaluations* below.

We need to shift the focus from breadth to depth, from burdensome procedures to real opportunities for students to practice skills. Requiring each student to join three cocurricular groups results in very large clubs and sports teams with insufficient teacher support and facilities. These constraints underlie the fact that 14 out of the 30 survey respondents stated that cocurricular groups in their school don't usually have activities specific to the group (such as no science-related activities for the Science and Mathematics Society), apart from preparing selected students for inter-school competitions. One way to maximise real-world opportunities given limited resources is, instead, stipulating that each student play a significant role in one public project per year, and that each project must have some sort of public audience.[54] Correspondingly, each teacher must be responsible for one such project each year—

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51 I conducted several such searches throughout July and August, most recently on 16 August 2016. The relevant text on the district education office website was in a letter to headmistresses and principals: "Bagi pelaporan penglibatan pelajar 1MURID 1 PROJEK, 1M1P yang dimuatkan dalam BORANG DATA KEHADIRAN KOKURIKULUM, hanya untuk tahun 2015, Unit Kokurikulum Jabatan Pendidikan Negeri Perak memberi arahan agar semua pelajar di sekolah diberi markah "1". Hal ini bermaksud semua pelajar memiliki Projek Inovasi masing-masing (Pegawai Pendidikan Daerah Kinta Utara, 2015)."

52 Also, I did not hear any mention of the 1Murid 1Projek programme during my time as a secondary school teacher in 2014–2015.

53 The survey was conducted using Google Forms, from 20 July to 5 August 2016.

54 Under the project-based system, uniformed groups could function in parallel with the cocurricular public projects, similar to the prefects' and librarians' boards. This would be especially appropriate for service-based

whether a competition, a performance, a service-based project, a community gathering, or a problem-solving initiative as in the abortive 1Murid 1Projek plans. Before the start of each school year, each teacher will propose a project for which they have expertise and interest. Students will be assigned to projects based on their stated preferences. Rather than receiving a single numeric score for the year's cocurricular participation, as in the current system, each student will write a reflective report on their involvement in the public project; which will then be verified by the supervising teacher and uploaded to the online cocurricular records.

A cocurricular system based on projects with a public audience would give students far more opportunities for practising the Four Cs in authentic, goal-driven settings, than the current system does. In addition, it would increase teachers' ownership over cocurricular activities: instead of being obligated to supervise three disparate groups, teachers would concentrate on one project of their choosing. Also, there will be far less parental resistance to a project-based route in cocurricular activities than in academics. As with the SPM group projects component, cocurricular public projects can be a way of shifting public perception in favour of skills cultivation through projects, without replacing exams with performance tasks wholesale. Details on how to implement the cocurricular public projects are in Table 7.7.

Table 7.7: Implementation details for the cocurricular public projects

Policy aspects	**Specifics of the cocurricular public projects**
Overview	Every year, each student must contribute significantly to one teacher-sponsored public project (e.g. a performance, competition, school event, or community service initiative). This will replace the current requirement to join one society, one uniformed group, and one sport.
School level	Primary and secondary school
Aims	• Give all students the experience of collaborating for a common goal. • Change the existing, flawed cocurricular system to emphasise productive and enjoyable skills development.
Measures of success	• *Direct*: quality of projects, and skills demonstrated in the projects • *Indirect*: employment rates of recent graduates
Four Cs cultivation (in school culture)	• *Critical thinking*: address different needs and constraints in the project • *Creativity*: develop ways to meet needs and overcome constraints • *Communication*: through group work and public interactions • *Collaboration*: through group work
Systemwide/opt-in	Systemwide: compulsory in all schools.

uniformed groups such as the Red Crescent Society and St John's Ambulance, which provide first aid for students at school Sports Days and other events.

Who does what?	• *Ministry*: develop templates for planning, reflection, and reporting on different types of projects; monitor project completion through the cocurricular database • *Schools*: sequence all teacher-proposed projects before the school year opens; assign students to projects according to stated preferences • *Teachers*: initiate, and guide students through, projects (each teacher is responsible for at least one project annually); report on the completed project • *Students*: actively contribute to the planning and execution of the project; complete a document describing and reflecting on individual participation
Incentives	• *Schools*: increase interactions between the school and the community, showcase student capabilities • *Teachers*: supervise one self-contained project of interest annually (rather than supervising a cocurricular group year-round) • *Students*: practice skills; enjoy more varied cocurricular options; receive public recognition of cocurricular involvement
Resource demand	• *Initial:* development of guidelines and templates • *Annual*: school-level coordination of projects among teachers • *Ongoing*: teacher supervision of projects
Accountability	School submits a master list of planned projects (with student and teacher participants) to the Ministry. Teachers record all project activities and submit a report after project completion. Students submit individual reports after they complete their projects.
Time frame:	• *1st year*: preparation of guidelines and templates; modification of cocurricular database to accommodate projects • *2nd year onwards:* public projects replace existing cocucrricular system

Potential challenges and mitigation steps:

- *Shifting from numeric scores to reflective write-ups might not change the long-established tendency to inflate cocurricular reporting in order to make students and the school look good.*
  The requirement that each project have some kind of public audience—such as parents, the local community, or judges at a competition—reduces the potential for such inflation. Also, with more flexibility and choice in their cocurricular activities, both teachers and students are more likely to feel ownership over the activities; thus raising their motivation to work together to produce good work rather than merely churning out pretty reports.

Self-contained classrooms in primary schools

In Malaysia, the typical primary (and secondary) classroom is departmentalised: each subject is taught by a different teacher, with teachers specialising in particular subjects. In many other countries, however, primary school classrooms are self-contained, with a single, generalist teacher for most subjects. Self-contained classrooms are also the main configuration for primary school in Malaysia's trust schools.[55]

55 Trust schools are government schools that receive extensive support from Yayasan Amir and LeapEd Education

Reasons given for adopting self-contained classrooms in trusts schools include: greater opportunities for interdisciplinary learning; more flexible scheduling; consistent rules and routines in the learning environment (rather than different rules from teaacher to teacher); and deeper relationships leading to more personalised approaches to students' learning needs and emotional well-being (LeapEd Services, 2015; Yayasan Amir, 2013). Self-contained classrooms were also implicitly mentioned in the *Pelan Strategik Interim Kementerian Pelajaran Malaysia 2011–2020*, which laid out plans to study whether primary school teachers should receive generalist or specialist training (Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, 2012b, p. 40). Although nothing seems to have emerged from that study, I propose a shift to self-contained classrooms in primary school, with students having the same teacher for each three-year Level (Tahap) of primary school.[56] In the first several years of the programme, schools will have the choice of opting-in for self-contained classrooms. Later, self-contained classrooms will be implemented systemwide. Details on how to introduce the self-contained classrooms are in Table 7.8.

The empirical research literature on the efficacy of self-contained vs. departmentalised classrooms is scanty.[57] One analysis found no causal studies on the topic in five major research databases, including JStor, Google Scholar, and the Education Research Information Center (ERIC) (REL Southeast, 2015). Among the few empirical (but non-causal) studies, the evidence is mixed, with some arguing for self-contained classrooms (e.g. Culyer, 1984) and others favouring departmentalised classrooms (e.g. Strohl, Schmertzing, Schmertzing, & Hsiao, 2014). However, self-contained primary school classrooms are the norm Finland's acclaimed education system, in which students sometimes have the same teacher for up to six years (kellyj1111, 2015; Sahlberg, 2012, Chapter 3). One commentator credits these long-term, self-contained classrooms with a large contribution to Finland's success; because this setup helps teachers to meet individual students' learning needs, and promotes both professional autonomy and teacher ownership over students' development (kellyj1111, 2015). Students in Estonia, which has also been a very strong performer in international assessments, also study in self-contained classrooms in primary school, with the same teacher for three years; leading to deep student-teacher relationships (Butrymowicz, 2016; Eurydice National Unit, 2010).

Services under a public-private partnership for school improvement. For details, see http://www.yayasanamir.org.my/?page_id=77 and http://www.leapedservices.com/our-projects/yayasan-amir-trust-school/.

56 The national curriculum has different subjects, time allocations, and skills emphases for Level 1 (Years 1 to 3) and Level 2 (Years 4 to 6) of primary school. Thus, the shift from one level to another offers a natural break.

57 The lack of research here may be because most education systems have either self-contained or departmentalised classrooms, and few within the system question the default configuration. In TIMSS 2011, most of the 50 countries that participated in the 4th grade assessments appear to have either (a) nearly all teachers as generalists teaching all three subjects, presumably in self-contained classrooms; or (b) nearly all teachers as specialists who teach only mathematics or both maths and science (or, for Chinese Taipei, both maths and language), presumably in departmentalised classrooms (IEA, 2012b). (Only five out of 50 participating countries—Georgia, Germany, Singapore, Tunisia, and Thailand—had between 25 and 75 percent of maths teachers also teaching science and/or reading, suggesting that schools in these countries have a mix of self-contained and departmentalised classrooms.) This apparent lack of within-country variation in self-contained and departmental classroom configurations perhaps accounts for the lack of studies on the subject, given that cross-country studies would face too much background variation for solid conclusions.

For Malaysian primary schools, one particular benefit of such long-term, self-contained classrooms would be reduced pressure to finish the syllabus, as teachers can focus on establishing students' foundational skills, secure in the knowledge that they can catch up on content the subsequent year. This may lessen the nationwide preoccupation with covering content and drilling for exams. Also, class teachers will have greater flexibility in managing lesson time, as they will no longer be bound to a regimented rotation of teachers in and out of different classes. This will facilitate interclass collaborations between teachers, who will be able to plan joint lesson activities without upsetting the timetables of other teachers. Resource-wise, self-contained classrooms will streamline teacher allocations at Sekolah Kurang Murid (under-enrolled schools), which constitute 34 percent of primary schools but just 7 percent of total primary school enrolment. Currently, these under-enrolled schools have teacher: student ratios of 1:6, compared to the national average of 1:13; and much higher per-student maintenance expenditures (Kementerian Pendidikan Malaysia, 2013c, pp. 4-18, 4-19). Shifting from departmentalised to self-contained classrooms with generalist teachers would reduce the number of teachers required at each under-enrolled school.

Table 7.8: Implementation details for self-contained classrooms in primary schools

Policy aspects	**Specifics of the self-contained classrooms in primary schools**
Overview	A gradual move from having different teachers for different subjects to self-contained classrooms, in which each class has a single teacher throughout each level (three-year block) of primary school.
School level	Primary school
Aims	• Facilitate holistic, personalised and interdisciplinary learning though extended contact time between students and teachers. • Reduce the pressure to finish each year's syllabus at the expense of cultivating student skills and understanding.
Measures of success	• *Direct*: student-teacher perceptions, as reported in feedback surveys, of self-contained classrooms vs. other classrooms • *Indirect*: achievement growth of students in self-contained classrooms vs. those in other classrooms
Four Cs cultivation (in school culture)	• *Creativity*: teachers and school administrators develop new solutions to challenges faced during the transition • *Communication*: more frequent and meaningful practice in communication through extensive contact and familiarity between students and with teacher • *Collaboration*: more opportunities for students and teacher to work together on extended, interdisciplinary projects
Systemwide/opt-in	Initially opt-in, and later systemwide.

Who does what?	• *Ministry*: develop guidelines for transition; develop self-study modules for teachers preparing to teach a wider range of subjects; provide support for early adopter schools; prepare incoming teachers for self-contained classrooms; monitor and review implementation • *Schools*: reallocate teachers, schedules, and classrooms; administer assessments to teachers who will be teaching new subjects; facilitate collaborations between teachers for support in different subjects • *Teachers*: build mastery of content and pedagogy for new subjects; outline new schedules and activity plans
Incentives	• *Ministry*: strengthen learning communities and holistic student growth • *Schools*: strengthen school community; raise exam achievement through deeper student development • *Teachers*: build deeper relationships with a smaller group of students; gain autonomy and flexibility in structuring teaching
Resource demand	• *Initial*: curricular and pedagogical expertise for guidelines, self-study modules, and revised primary school teacher training curriculum; intensive preparation by schools and teachers • *Throughout the pilot*: ongoing adaptation in schools; Ministry support in early adopter schools
Accountability	Schools report to the Ministry every quarter about challenges and mitigation steps.
Time frame:	• *1st year*: development of guidelines and self-study modules for schools and teachers opting for self-contained classrooms • *2nd year*: early adopter schools plan schedules, staffing, and room allocation for self-contained classrooms, with the help of Ministry officials; early adopter teachers complete self-study modules and sit for assessments in their new subjects; all incoming primary school teacher trainees are taught to be generalists • *3rd year*: launch of self-contained Year 1 classes in early adopter schools • *4th–9th years*: self-contained classrooms cycle through school years in early adopter schools; other schools can opt in to the programme at the beginning of any year • *9th year*: major review of self-contained classrooms progress, including a comparative analysis of UPSR results, in preparation for national roll-out • *10th year onwards*: all Year 1 classes nationwide are self-contained (reaching all Year 6 classes in the 15th year)

Potential challenges and mitigation steps:

- *The current stock of primary school teachers are trained to be subject specialists, not interdisciplinary generalists. They may struggle to teach the full breadth of subjects.*
  Two features of the proposed policy will mitigate this. First, early adopter schools will introduce self-contained classrooms only in Year 1 initially, before cycling the self-contained classrooms through the system. This will give time for teachers to build up their subject knowledge; both by completing the required modules and assessments on their new subjects, and by collaborating with teachers who have other specialities. Self-contained classrooms will only become compulsory

for all Year 1 classes in the 10th year of policy implementation, and for Year 6 classes in the 15th year; by which time a significant number of new teachers will have undergone generalist pre-service training in teacher training institutes. In addition, each school will have the option of allocating up to half the subjects to specialist teachers who will move from class to class, thus streamlining the portfolios of generalist class teachers.[58] For example, a school may choose to designate English as a specialist subject to reduce the pressure on generalist teachers who are less fluent in English.

- *Students who are assigned to the same under-performing teacher for three consecutive years will have severe, accumulated shortcomings in their cognitive development.*
  This real and terrible risk is addressed in part by the opt-in nature of the policy: presumably, headmasters who lack confidence in some of their Year 1 teachers will not sign up as early adopters of self-contained classrooms. By the time the programme becomes compulsory across all schools, enough time would have passed for the revamped teacher appraisals and school evaluations (described below) to address many issues in teacher quality.

Policy experiment: eliminating streaming

Besides introducing self-contained classrooms, another way to restructure how students are organised in schools is to eliminate streaming. Most schools in Malaysia stream students into different classes (homerooms) based on their end-of-year exam results. Although this does help teachers to differentiate instruction by student ability, such hierarchical sorting of students reinforces the exam-orientedness that, as we saw in the previous chapter, hinders skills cultivation. To ascertain whether the main effects of streaming are positive or negative, the government should attempt an opt-in policy experiment. The experiment could be structured in one of two ways, or a mix of the two: (a) in each school, a cohort of students is randomly divided into a streamed group and an unstreamed group, and student outcomes are compared across the streamed and unstreamed groups; or (b) in each experimental school, the whole cohort is unstreamed, and student outcomes are compared with streamed schools of similar socioeconomic and academic circumstances.[59] One advantage of this experiment is that it would require very little in resource investment beyond administrative work in tracking outcomes. No additional classrooms, teachers, or teacher training would be required. Details on how to carry out the no-streaming experiment are in Table 7.9.

As with self-contained and departmentalised classrooms, the empirical research on streaming does not reach a clear consensus. One review found that streaming by exam results tends to improve outcomes for high-performing students, but to worsen outcomes for low-performing students (Education Endowment Foundation, n.d.). An analysis of the PISA 2003 data found that inequality of opportunity tends to be higher in systems that begin ability grouping from a young age (Schütz, West, & Woessmann,

58 The KSSR identifies eight subjects (Malay, English, Mandarin/Tamil, maths, science, Islamic/moral studies, physical and health education, and art) for Level 1 of primary school, with an additional two subjects (history, and design and technology) for Level 2 (Bahagian Pembangunan Kurikulum, 2016a).

59 Of course, this would not be sufficiently controlled and randomised to be an experiment by scientific standards, but it would provide very informative data for policymaking.

2007). However, an experiment in Kenya found that streaming improved student achievement gains across all ability levels; and that teachers were more motivated and more able to target their lessons to student needs in streamed classes (Duflo, Dupas, & Kremer, 2009). This ambiguity suggests that the effects of streaming on student outcomes may depend on broader circumstances in the school system—hence the proposed experiment. Given the low cost of this experiment, it is worth seeing if eliminating streaming can change mindsets about exam achievement, and reduce students' and teachers' stress surrounding exams, without worsening student learning gains.

Table 7.9: Implementation details for the experiment in eliminating streaming

Policy aspects	**Specifics of the policy experiment in eliminating streaming**
Overview	A policy experiment to determine if eliminating streaming (a) improves student learning and/or (b) weakens the focus on exams.
School level	Primary and lower secondary school
Aims	• Ascertain whether schools that do not sort classes according to test scores improve student outcomes and school climate. • Enrich evidence-based policymaking in Malaysia with a low-cost policy experiment.
Measures of success	• *Direct*: national exam results of unstreamed students vs. streamed students • *Indirect*: comparisons between unstreamed and streamed students of: higher education admission rates; student and teacher satisfaction, as reported in feedback surveys; the quality of lessons, as reported in classroom observations (see "Revamped teacher appraisals" below)
Four Cs cultivation (in school culture)	• *Critical thinking*: through engagement between Ministry, schools, and teachers to ascertain the strengths and weaknesses of each mode • *Collaboration*: more opportunities for collaboration between teachers of similarly homogeneous classes and students of different abilities
Systemwide/opt-in	Opt-in: schools volunteer for the policy experiment for a set number of years.
Who does what?	• *Ministry*: develop material explaining the experiment; publicise the experiment and recruit schools • *Schools*: assign students to classes that are as heterogeneous as possible (especially in test scores and socioeconomic background); ensure that parents and students understand the rationale behind the experiment
Incentives	• *Ministry*: good data about a policy that may improve student outcomes • *Schools*: potential academic gains, especially for students who would otherwise be assigned to weaker classes; healthier school community less geared toward exams
Resource demand	• *Initial*: develop material to inform schools and the public about the experiment • *Ongoing*: analyse data comparing the experimental schools against otherwise similar schools
Accountability	Schools report to the Ministry every quarter about challenges and mitigation steps.

Time frame:	• *1st year*: development of guidelines for transition; recruitment of experiment schools • *2nd–7th years*: policy experiment runs through one cycle in volunteer schools • *8th year*: analysis and public presentation of experiment data; Ministry decision about whether to extend the policy systemwide

Potential challenges and mitigation steps:

- *When students approach exam years, experimental schools may be strongly inclined to re-introduce streaming so that teachers can tailor exam drills to student performance.*
  For cohorts of students /in exam years (Year 6 in primary school and Form 3 in secondary school), experimental schools should be encouraged to group students by ability during extra classes or enrichment workshops that specifically deal with the exam format, rather than reverting to streaming in all lessons. However, if schools do insist on dropping out of the experiment when exams loom, this should be treated as a data point in the research project—an indication that other steps need to be taken to reduce the obsession with exam results.

Revamped school evaluations

Malaysian schools are evaluated annually, receiving a composite score that translates to a school grade or "band", with Band 1 for schools judged to be highest quality, and Band 7 at the lowest end of the spectrum. In the 2013 and 2014 annual reports for the *Education Blueprint*, the Ministry proudly reports that the number of schools in in the lower bands has been decreasing drastically. For example, the number of Band 6 schools has decreased from 528 in 2009 to 86 in 2014, concurrent with a decrease in the number of Band 7 schools (Kementerian Pendidikan Malaysia, 2014a, pp. 46–47, 2015b, pp. 35–36). However, 30 percent of each school's composite score is based on a school self-evaluation, for which no hard evidence is required (Kementerian Pendidikan Malaysia, 2015e); and Band 6 spans just 10 percentage points in the composite score (40–49 points for primary schools, and 35–44 points for secondary schools) (Kementerian Pendidikan Malaysia, 2015e). In this light, the Ministry's self-congratulations are likely to be premature, especially when the *Blueprint* reports massive inflation in school-level appraisals of teachers; with 63 percent of schools saying that they had "good or excellent" teaching and learning practices, while the Ministry's Inspectorate put only 13 percent of schools in this category (Kementerian Pendidikan Malaysia, 2013c, p. 5-2).

The research literature highlights a few considerations in improving the impact of school evaluations as tools for school improvement. First, school evaluation should focus on the improvement of student learning, as this is the central mission of the school. Second, those responsible for school evaluation must be trained in understanding the interacting factors that facilitate student learning (Nevo, 1994; OECD, 2013). Next, it is crucial to balance the developmental function (feedback for improvement) and the accountability function (benchmarking for sanctions or rewards) of school evaluation (OECD, 2013; Santiago, Benavides, Danielson, Goe, & Nusche, 2013). It is also important to strike a balance between internal and external school evaluation—which can be tricky as the ideal mix varies from school to school (Kyriakides & Campbell, 2004; MacBeath, 1999; OECD, 2013, pp. 388–389). To illustrate, an

overemphasis on the accountability function can lead to inflation of internal school evaluations, as we have seen. Conversely, neglecting the accountability function entirely would be unconscionable given the stakes: vast amounts of public funds, and all of the nation's future citizenry. Furthermore, while self-evaluation is central to progress in professional learning communities, external evaluators can challenge schoolwide assumptions and address matters that school leaders had deemed off-limits (Blok, Sleegers, & Karsten, 2008; OECD, 2013).

In light of this, I propose a number of changes to school evaluation. First, we must eliminate school composite scores. Reducing school quality to a single number comprising arbitrary weightings of very different types of data serves little purpose beyond assigning bands and ranks to school. Some may argue that this enhances school accountability, by giving titles such as Sekolah Berprestasi Tinggi to high-scoring schools and heaping shame on their low-scoring counterparts. However, accountability-by-composite-scores heightens competition between schools, as 70 percent of the composite score comes from public exam results, which are graded on a curve. Such a horse race is incompatible with the goal of holistic development for all Malaysian children; not least in at atmosphere already suffused with cynicism and blame. Moreover, a composite score or a school band does not give schools any useful information about how to improve student learning. Instead, each category in the school evaluation rubric (e.g. leadership, classroom instruction, student outcomes) should be discussed qualitatively, based on relevant data sources.

Second, school evaluation should emphasise a few new data sources. In the existing school evaluation system, the 70-percent weighting of exam results counters numerous Ministry affirmations of well-balanced student development. I propose the addition of: feedback surveys from both students and teachers, and video-recorded classroom observations. Students and teachers surveys offer valuable feedback from the main players in the school's mission of enhancing learning (OECD, 2013). That said, such surveys should be used solely for the developmental function, rather than affecting accountability, because biases abound in survey data, even in low-stakes settings. While classroom observations already factor into the existing school evaluation system, they receive the same self-interested behaviour (whether inflation by worried administrators or fabrication by overworked or lackadaisical ones) as the other components of internal school evaluation. Requiring classroom observations to be video-recorded takes advantage of a familiar and inexpensive form of technology—many Malaysian teachers have smart phones with adequate video capabilities—not only to hold internal observers accountable for the appraised lessons, but also to improve the quality of teaching, as lesson videos can be important professional learning tools, as I shall discuss in *Revamped teacher appraisals*.

Third, we need mechanisms for emphasising the oft-neglected developmental function, and for reducing opportunities to "game the system" under the accountability function. On the developmental side, schools should conduct two annual internal evaluation meetings with all staff: one at the end of the school year to formulate an improvement plan for the next year, based on exam results, student and teacher surveys, and classroom observation data; and another in the middle of the year to discuss progress on the improvement plan and adjust operations accordingly. These meetings will be strictly internal, without observation from any external Ministry officials. However, reports from both meetings must be submitted to the school's SIPartner+ at the district office.[60] On the accountability side, each school will

60 School Improvement Partners (SIPartners+) are full-time coaches for school principals. Each SIPartner+ is

be required to hold an externally moderated town hall meeting at the beginning of each year to present the year's improvement plan to parents and to solicit their input, thus including a crucial set of stakeholders in the school evaluation process.[61] To further safeguard the quality of evaluations, the Jemaah Nazir dan Jaminan Quality (Inspectorate) will visit each school at least one every three years to assess the soundness of its improvement plan, data use, and progress.[62] Details on how to implement the revamp of school evaluations are in Table 7.10.

Table 7.10: Implementation details for the revamped school evaluations

Policy aspects	**Specifics of the revamped school evaluations**
Overview	A phased transition to a new school evaluation system focussed on the improvement of teaching and learning, rather than on comparisons between schools.
School level	Primary and secondary school
Aims	• Maximise student learning and improve school quality through an evaluation framework that focuses on teaching, learning, and growth. • Hold schools accountable to high standards of excellence. • Strengthen relationships between the school and the community.
Measures of success	• *Direct*: school performance across the various evaluation measures • *Indirect*: student outcomes, whether on test scores, cocurricular achievement, or post-secondary trajectories
Four Cs cultivation (in school culture)	• *Critical thinking*: analyse a range of data sources and develop improvement plans for the school • *Communication*: through public discussion of the school standards and improvements at annual town hall meetings • *Collaboration*: through teamwork across the school community to improve school quality
Systemwide/opt-in	Systemwide, in phases (see *Time frame*).

based at a district office, and is assigned to several principals within the district (Kementerian Pendidikan Malaysia, 2013, p. 6-8).

61 There are similarities between, on one hand, the internal evaluation meetings and town hall meetings that I am proposing and, on the other, the school performance dialogues that were introduced under the *Education Blueprint 2013–2025* (Kementerian Pendidikan Malaysia, 2013, p. 4-27), in that both use empirical school data to inform improvement plans. However, performance dialogues tend to focus narrowly on improving exam results. In my experience of performance dialogues as a teacher in 2014–2015, the presence of district officials at performance dialogues blunted the developmental goal because school leaders were anxious about saving face.

62 This target frequency for school inspections tallies available Ministry resources. When the *Education Blueprint 2013–2025* was written, the Inspectorate visited 2,500 schools—a quarter of all government schools—each year. The *Blueprint* set a target of visiting each school at least once every three years, which I adopt here. (Kementerian Pendidikan Malaysia, 2013, p. 6-9).

Who does what?	• *Ministry*: modify evaluation frameworks and reporting systems; develop student and teacher surveys; train SIP+ officers and school heads to facilitate school evaluations; deploy SIP+ officers to participate in town hall meetings at schools • *Schools*: conduct teacher surveys, student surveys, and classroom observations; hold end-of-year evaluation meetings; work towards improvement plans developed at evaluation meetings; organise midyear town hall meetings
Incentives	• *Ministry*: improve the quality of student learning • *Schools*: improve the quality of student learning, develop relationships with the wider community
Resource demand	• *Initial*: development of the new frameworks and surveys; training of SIP+ officers and school heads • *Annual*: coordination of school-level evaluation meetings; facilitation of the town hall meetings • *Ongoing*: schools work towards improvement plans and data collection
Accountability	Schools submit student and teacher survey data to the Ministry twice a year; along with improvement plans at the end of every year. SIP+ officers monitor schools' progress: after the year-end meeting, after the town hall meeting, and midyear.
Time frame:	• *1st year*: ◦ removal of composite scores (and league tables) in school evaluations ◦ revision of evaluation standards to focus on improving teaching, learning, and student outcomes; listing evidence required for each category ◦ development of teacher and student feedback surveys, with translations ◦ teacher surveys administered at the end of the year ◦ train SIP+ officers and school heads in facilitating school evaluations • *2nd year*: ◦ teacher surveys administered at the end of each semester ◦ year-end staff-wide evaluation meeting, based on the revised standards and incorporating student outcomes, student and teacher surveys, and teacher observation data (see *Revamped teacher appraisals* below); resultant improvement plan submitted to the district office • *3rd year*: ◦ midyear staff-wide meeting with the SIP+ officer to discuss progress on the improvement plan ◦ surveys and year-end staff-wide evaluation meeting, as before ◦ JNJK begins to visit schools to evaluate improvement plans, covering 20% of schools annually; or each school at least once in every five years • *4th year onwards*: ◦ beginning-of-year town hall meeting to discuss the improvement plan with parents (school head chooses the meeting facilitator: either the SIP+ officer or another school head) ◦ surveys, and midyear and year-end meetings as before

Potential challenges and mitigation steps:

- *The blame-and-shame pattern in the education system may turn school evaluation mechanisms into battlegrounds, worsening relationships rather than improving school quality*.
  A number of measures can mitigate this very real risk. First, student and teacher feedback surveys must not be used in high-stakes ways. That is, these surveys will not be considered valid evidence for sanctioning or rewarding schools or teachers (e.g. imposing additional observations from district officers; or promoting a teacher to an administrative role). This will minimise both (a) the consequences from maliciously negative survey responses, and (b) the incentive to "bribe" respondents towards favourable feedback. Second, schoolwide evaluation meetings, whether internal or town-hall sessions, will only use aggregated data rather than teacher-level data; so that no individual teacher becomes a target for public blame. (Such aggregation can easily be conducted using computer-based data management systems, in which the Ministry has already invested.) Third, each school head will be entitled to choose the moderator for their annual town hall meeting, whether an official in the district office or a principal of a neighbouring school. Thus, school leaders can select moderators who are locally respected, and who have a suitable facilitation style for the school community; reducing the likelihood that the town hall meeting will turn ugly and counterproductive.

The teaching profession

Psychologist Lev Vygotsky wrote that "Children grow into the intellectual life around them" (quoted in Ritchhart et al., 2011, p. 28). This encapsulates a crucial aspect of Four Cs cultivation: for students to develop skills, their teachers have to exercise those skills too. The need to raise teacher quality is a frequent refrain in discussions of Malaysian education. For example, the 2007–08 Teaching and Learning International Survey (TALIS) found that 45.9 percent of Malaysian teachers were in schools in which the principal said that a shortage of qualified teachers hindered instruction "a lot" or "to some extent" (OECD, 2009a, p. 43). One World Bank report recommended that one of two key policy moves for boosting the performance of the Malaysian education system is "transforming the teaching profession to significantly upgrade the quality of teaching" (World Bank, 2013). The Ministry's responses have included raising the entry bar for teacher training institutes (Institut Pendidikan Guru, IPG): from 2014, only the top 30 percent of an SPM cohort, or those with a minimum of 5"A"s, are eligible for IPG entry (Kementerian Pendidikan Malaysia, 2015b, p. 26). This is a commendable move, especially for raising the prestige accorded to teaching in an exam-obsessed system. However, exam results are hardly the only element of teacher quality that matters in developing students' skills.

One high-leverage variable in teacher quality is the strength of the school's professional learning community. There is reliable statistical evidence that teacher learning communities improve student achievement (McLaughlin & Talbert, 2006, Chapter 1).[63] Nonetheless, teacher learning communities are rare. Often, they lack support from education authorities; who may desire quick fixes rather than the slow germination of a learning community; or who may not trust teachers, who themselves are "part of

63 Beyond the field of education, there is also a well-established literature on the role of "communities of practice" in organisational learning and growth (Wenger, 1998; Wenger, McDermott, & Snyder, 2002).

the problem", with primary responsibility for reform. The gradualism in these communities also runs counter to the purported urgency of raising test scores. Moreover, teacher learning communities require considerable resources, whether time, or funding to recruit professional coaches (McLaughlin & Talbert, 2006, Chapter 7). But when a school does invest in a professional learning community, its effects are manifold. Such learning communities help teachers to iteratively improve their teaching practice, aided by peer feedback and pedagogical research. Teacher learning communities also play a less tangible but pivotal role in school improvement: professional learning communities can crystallise shared vision for substantially changing student learning (e.g. Benitez et al., 2009). For example, James Spillane found that teachers who consistently discussed new education standards with their colleagues were much more likely to understand the new standards comprehensively, and to implement them in class successfully (2009). These shared understandings may seem "fluffy" next to, say, sanctions for schools that underperform in standardised tests. However, teacher beliefs can be more powerful than sanctions in effecting real change in longstanding but ineffective instructional practices (Firestone, Mayrowetz, & Fairman, 1998).

In this section, I propose four policies that would gradually build both community and learning among teachers; thus growing their capacities for exercising the Four Cs in their professional practice, and for cultivating such skills in their students. The policies are: revamped teacher appraisals, in parallel to the revamped school evaluations; an opt-in module for building collaboration among teachers; an online platform for teachers across the country to share classroom stories with each other; and a series of public discussions about key questions in education.

Revamped teacher appraisals

On paper, teacher appraisal in Malaysia looks great. Among the 22 participating countries in the 2007–08 Teaching and Learning International Survey (TALIS), Malaysia had the second lowest proportion of teachers (2.3 percent) reporting that they had never received feedback on their work (whether from the principal, other teachers, or external inspectors). Also, Malaysia had the highest proportion of teachers reporting that the appraisal or feedback they received led to a moderate or large change in work responsibilities, the likelihood of career advancement, and opportunities for professional development activities. Similarly, 81.6 percent of Malaysian teachers—again, a larger proportion than any other participating country—reported that appraisal and feedback on their teaching led to a moderate or large change in a development or training plan for improving their teaching (OECDa, 2009). All of this suggests that teachers are appraised regularly, and that appraisal data are used to create substantial incentives and professional growth.

In addition to these favourable survey results, the Ministry of Education recently released a unified instrument for teacher appraisal: the Penilaian Bersepadu Pegawai Perkhidmatan Pendidikan (PBPPP). In 2015, the PBPPP officially replaced several appraisal instruments with disparate purposes (e.g. reviewing annual performance, determining eligibility for promotion, and calculating the school's aggregate teacher quality) (Kementerian Pendidikan Malaysia, 2014a, 2016a). The PBPPP is clearer than its precursors in specifying expected competencies, appraisal procedures, and career pathways. However, it remains a complicated, procedure-heavy appraisal, completed internally by the school, but with high

stakes attached. The reduction of minutiae into a single score through seemingly arbitrary weightings[64] means that the PBPPP is unlikely to guide teachers to concrete, sequenced actions for improving student learning. The accountability stakes attached to the internal appraisal mean that teachers are likely to give themselves and their colleagues higher scores than they deserve, and to conceal weaknesses (Santiago et al., 2013)—thus blunting both the accountability and developmental functions.

To counter these tendencies, I propose a revamped system of teacher appraisal. This appraisal system will work in tandem with the revamped school evaluations described above. Individual classroom observation reports will inform one-to-one discussions between teachers and their designated appraisers (typically, the head of department); while classroom observation data aggregated to the school level will inform schoolwide improvement meetings. Similarly, teachers will receive student survey data anonymously aggregated for each class they teach; while the schoolwide improvement meetings will use student survey data anonymously aggregated at the school level. Another commonality between the revamped school evaluations and teacher appraisals is the elimination of numeric scores. Instead, appraisers and teachers will qualitatively discuss the teacher's performance across a set of categories, all of which have explicit connections to the quality of student learning and skills development.

Second, multiple sources of data on teacher performance will be used to improve the rigour of the teacher appraisals (OECD, 2013, Chapter 5). Currently, teacher feedback sessions focus too much on exam results: in TALIS 2007–08, 91.5 percent of Malaysian teachers reported that appraisals and feedback they received led to moderate or large changes in the emphasis they placed on improving student test scores (OECD, 2009a). This was the highest among the 22 participating countries, and especially troubling as the teachers surveyed taught lower secondary classes, rather than classes preparing for the higher-stakes SPM. Moreover, a large empirical survey in the United States found that the teachers who were most effective at raising students' scores on standardised tests were not always the same teachers who improved students' social-emotional skills or their performance on more cognitively challenging open-ended tasks (Kraft & Grace, 2016). Thus, to broaden the focus in student learning to include non-routine thinking skills and soft skills, such as the Four Cs, teacher appraisal must use a wider range of measures. As noted above, one such measure is a rubric for classroom observations, with rubric categories corresponding to teaching practices that have been shown empirically to cultivate students' skills. Additionally, the revamped teacher appraisals should include student feedback surveys. The large-scale Measures of Effective Teaching research project argues that student perception surveys are a low-cost way of gathering data on teachers' strengths and areas of improvement; and that student surveys are reliable data sources that predict student outcomes (MET Project, 2012).[65] This is supported by the OECD Review on Evaluation and Assessment Frameworks for Improving School Outcomes; with the caveat that student feedback surveys should be used for teacher development, but not for high-stakes appraisal, because students are schools' main clients, but not experts in pedagogy (OECD, 2013).

Third, we must emphasise the need for teacher appraisals to develop teachers' competencies,

64 The PBPPP awards each teacher a single score; of which 10 percent comes from achievement ("keberhasilan") and 90 percent from assessment of competencies (teaching skills, 60 percent; professionalism, 20 percent; involvement, 10 percent; and additional duties, 10 percent).

65 For other MET Project resources, see http://k12education.gatesfoundation.org/teacher-supports/teacher-development/measuring-effective-teaching/why-met-additional-resources/. For a critique of the MET Project's research methodology, see (Rothstein & Mathis, 2013).

while minimising tension between this developmental function and the accountability function. As recommended by the OECD Review on Evaluation and Assessment Frameworks for Improving School Outcomes, appraisals for promotions, in which accountability is the key concern, will be conducted by external evaluators from the Competency Development and Evaluation Department (Bahagian Pembangunan dan Penilaian Kompetensi, BPPK), in order to maintain high standards of professionalism. On the other hand, internal teacher appraisals for development will take place through low-stakes feedback discussions between teachers and their heads of department (ketua bidang) every semester. These discussions will focus on improving classroom practice (OECD, 2013, Chapter 5). The teacher appraisal system will further emphasise professional development by incorporating training in identifying effective instructional practices, which will increase teachers' pedagogical knowledge, as well as the usefulness of classroom observation reports. Another possibility for enhancing the development function here would be giving teachers the option to release their classroom observation videos for training other teachers and for research on pedagogy (with whatever redactions necessary for maintaining students' privacy). This could create a rich database for educational research, similar to the oft-cited TIMSS video studies (Stigler & Hiebert, 1997; TIMSS Video, n.d.). Details on how to implement the revamp of teacher appraisals are in Table 7.11.

Table 7.11: Implementation details for the revamped teacher appraisals

Policy aspects	**Specifics of the revamped teacher appraisals**
Overview	A phased transition to a new teacher appraisal system focussed on the improvement of teaching and learning, incorporating classroom observation data and student feedback.
School level	Primary and secondary school
Aims	• Maximise student learning and develop teachers' skills through classroom observation and professional development rubrics that incorporate improvement steps. • Build a shared understanding of high-quality teaching. • Strengthen incentives for teachers to improve their classroom practice.
Measures of success	• *Direct*: teacher performance across the various appraisal measures • *Indirect*: student outcomes, whether on test scores, cocurricular achievement, or post-secondary trajectories
Four Cs cultivation (among teachers)	• *Critical thinking*: incorporate a range of knowledge and resources to improve teaching practice • *Collaboration*: school-level appraisers are strongly encouraged to facilitate collaborations among the teachers under their supervision
Systemwide/opt-in	Systemwide, in phases (see *Time frame*).

Who does what?	• *Ministry*: develop classroom observation rubric and training module, as well as the student survey; roll out the classroom observation module to all schools; monitor completion and quality of the appraisals; analyse student survey data • *Schools*: ensure that all teachers complete the classroom observation module; assign senior staff to appraise teachers and ensure that regular observations and appraisal discussions are held • *Teachers (appraisers)*: observe colleagues' lessons; appraise and discuss colleagues' professional development • *Teachers (all)*: discuss professional development with appraiser; work towards improved practice based on classroom observations, student feedback, and appraisal discussions
Incentives	• *Ministry*: improve the quality of teaching and learning • *Schools and teachers*: improve classroom practice and student outcomes
Resource demand	• *Initial*: development of the classroom observation materials and student survey; training of teachers in classroom observation • *Ongoing*: classroom observations, student surveys, and appraisal discussions • *Ad hoc*: screening of teachers applying for promotions
Accountability	Appraisers enter appraisal data into the online monitoring system, as in the current system. Observed lessons are videotaped for benchmarking and moderation by the BPPK. BPPK also screens all applicants for promotions.
Time frame:	• *1st year*: ◦ removal of numeric scores from PBPPP evaluations—but teachers must still meet with their designated appraisers twice a year to discuss performance on the PBPPP rubric ◦ development of classroom observation materials: a simplified rubric, and a training module (with sample videos) ◦ development of student feedback surveys, with translations • 2nd year: ◦ classroom observation module for all teachers, at the school level; and for all students in teacher training programmes ◦ all DG41 teachers observed once following the new rubric; observed lessons are videotaped and randomly selected for benchmarking by the BPPK ◦ student surveys administered one month before lessons end ◦ discussions with designated appraisers twice a year to work through the PBPPP rubric and aggregated student survey data • *3rd year onwards*: ◦ 20-minute refresher module (via video) on classroom observation screened at the beginning-of-year staff meeting ◦ student surveys administered one month after school opens and one month before lessons end ◦ videotaped classroom observations twice a year for every teacher ◦ discussions with designated appraisers twice a year, focussing on classroom observation rubric and aggregated student survey data ◦ teachers applying for promotions or special positions submit PBPPP evidence to BPPK, who will interview each applicant

Potential challenges and mitigation steps:

- *Teachers may treat the new appraisal system like yet another formality to complete as quickly as possible, or just another form of reporting to inflate in one's favour.*
  The separation of formal appraisals for promotions from the regular feedback sessions should somewhat reduce the inclination to exaggerate performance and conceal weakness (Santiago et al., 2013). Furthermore, student surveys are harder to inflate, especially when the surveys are conducted without the presence of the teachers in question, and when students know that teachers will only receive aggregated data, rather than their individual answers. While teachers are naturally inclined to put on a good show when lessons are observed, making these classroom observations into a semesterly routine with a familiar line manager will hopefully help teachers to drop their guards and work towards real improvement. However, schools will be required to keep video recordings of the year's classroom observations, to hold appraisers accountable for actually conducting the observations rather than filing observation reports without stepping into the classrooms. Finally, as I will discuss further in the conclusion, there is a pressing need to reduce other needless administrative work in order to free up teachers' time for activities like appraisal, which feed directly into the core business of educating students.

Teacher collaboration module

As discussed above, teachers must practice and learn about the Four Cs—not only to serve as models for students' skills cultivation, but also to constantly improve their professional practice (Willingham, 2010, Chapter 9). In a highly cited article, Deborah Loewenberg Ball and David Cohen argue that many expensive forms of teacher professional development—"one-shot workshops with advice and tips of things to try, catalogues filled with blackline-master activities for the latest educational ideas (cooperative learning, problem solving, literary analysis, or something else), six-step plans for a host of teaching challenges, and much more"—do not actually change classrooms in lasting ways (1999, p. 4). Instead, teacher professional development should involve sustained inquiry about improving student learning, rooted in the school community and in classroom practice (Ball & Cohen, 1999). Unfortunately, although over 90 percent of Malaysian teachers report that they spend roughly 10 days on professional development each year, only 16 percent of those professional development activities are school-based activities, such as peer observations and lesson planning (Kementerian Pendidikan Malaysia, 2013c, p. 5-6). We urgently need a shift to more collaborative, learning-focussed professional development—which has been shown, again and again, not only to improve teachers' instructional competencies, but also to change school culture towards collective growth (Benitez et al., 2009, pp. 159–160; McLaughlin & Talbert, 2006; Resnick, Spillane, Goldman, & Rangel, 2010; Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009).

To kick-start such collaborative professional learning, I propose that teachers be given the option to complete a year-long collaboration module in schools. The module will be structured both to develop teachers' pedagogical knowledge, and to inculcate collaboration. Groups of two or more teachers teaching

the same subject in the same school can sign up for the module. Each group will have to conduct eight professional development activities together; or roughly one activity per month, excluding months dominated by exams or school breaks. At the beginning of the year, each group will choose eight activities from a list provided by the Ministry. Activities may include, for example, learning walks, lesson studies, discussing sample videos of exemplar lessons, discussing videos of each other's lessons, examining student work, or working through curricular materials (Ball & Cohen, 1999; Resnick et al., 2010). For each activity, the Ministry will provide a range of support material, including reflection questions that teachers will be required to answer online within one week of each activity; both for accountability and because reflection improves classroom practice (Bolton, 2010). In each session, teachers will: discuss the impact of the previous session's learning on their classrooms; conduct the day's activity according to previously determined improvement goals; summarise the lessons from the day's session; watch a short video describing activity chosen for the next session; and set improvement goals for the next session. At the staffwide end-of-year meeting, the teachers will make a presentation on the main insights they gained from the collaboration module, and how these insights changed their classroom practice. These presentations will give participating teachers an opportunity to practise professional communication, while also sharing their learning with the wider community of teachers. Details on how to implement the teacher collaboration module are in Table 7.12.

Table 7.12: Implementation details for the teacher collaboration module

Policy aspects	**Specifics of the teacher collaboration module**
Overview	A year-long series of learning activities for groups of teachers teaching the same subject. The activities aim to foster long-term collaboration routines, and culminate in a presentation delivered by the teachers to all school staff.
School level	Primary and secondary school
Aims	• Foster a culture of collaboration among teachers. • Improve the quality of classroom lessons.
Measures of success (among teachers)	• *Direct*: number/proportion of teachers opting in; observed changes in teachers' classroom practice • *Indirect*: improvements in teaching practice, as measured in the teacher evaluations before and after the module; achievement growth of students whose teachers use the collaboration module vs. those who don't
Four Cs cultivation	• *Critical thinking*: examine strengths and weaknesses in teaching practice, based on multiple data sources • *Creativity*: brainstorm new applications of best practices in classes • *Communication*: articulate and discuss one's teaching practice; by presenting aspects of learning to all school staff • *Collaboration*: work together to improve the quality of teaching
Systemwide/opt-in	Opt-in: groups of at least two teachers teaching the same subject can choose to participate.

Who does what?	• *Ministry*: develop the module; monitor teachers' progress in the module; SISC+ officers participate in at least two meetings of each collaboration group • *Teachers*: form groups; set module schedule; complete collaboration activities; submit detailed reflections online after each activity
Incentives	• *Ministry*: improve teaching quality, school culture, and teacher professionalism • *Schools*: improve student outcomes and performance in school evaluation • *Teachers*: improve teaching practice and student outcomes; receive exemption from the teacher appraisal exercise that year; fulfil the in-service training requirement for the whole year
Resource demand	• *Initial*: pedagogical expertise to create training modules • *Annual*: training sessions nationwide for teachers
Accountability	At the beginning of the year, each collaboration group submits a schedule of activities to the district office. Teachers submit detailed, guided reflections after each session. SISC+ officers join two group sessions to observe depth of professional development; and remotely monitor completion of activities throughout the year. Teachers present their learning to all school staff at the end-of-year meeting.
Time frame:	• *1st year*: preparation of training modules; training of SISC+ officers • *2nd year onwards*: available to all teachers, who must commit for a full year

Potential challenges and mitigation steps:

- *Few teachers may participate in the collaboration module, given that many are overburdened.*
  To lighten the administrative workload, all teachers participating in the collaboration module will be exempted from the teacher appraisal process that year.

- *Teachers may sign up for the collaboration module in order to avoid appraisal, with plans to falsify all the required reflections without actually completing the module's professional development activities.*
  To minimise the incentive to do this, each collaboration group will be required to submit a schedule of professional development activities to School Improvement Specialist Coaches (SISC+) at the district education office. An SISC+ will then observe two of the eight sessions, at different points in the year. Moreover, while teachers may be able to fabricate their reflection reports, it will be much harder for them to falsify information during the year-end presentation they make in front of their colleagues.

Online platform for sharing classroom stories

In addition to the collaboration module, I propose another channel for teachers to collaborate for the improvement of student learning: through a nationwide social-media-style platform for sharing stories about lessons techniques, activities, or student conversations that successfully achieved particular goals.[66]

66 Elements of this platform overlap with a school improvement network that Finland used in the late 1990s, called the Aquarium Project. The Aquarium Project was "a national school improvement initiative enabling all

This would complement the Ministry's e-Guru library, a carefully selected set of lesson plans and videos of Guru Cemerlang (Excellent Teachers) in different subjects (Kementerian Pendidikan Malaysia, 2013c, p. 5-11).

The platform I propose will be available both in internet browsers and on a low-bandwidth text-based app, with a format similar to familiar Facebook posts. Anyone whose teacher status has been verified will be able to post, view, and "like" classroom stories; thus increasing engagement across the teaching community. Content will be created voluntarily by teachers, thus incurring little cost to the Ministry. Each story will be tagged by subject and school level (primary/lower secondary/upper secondary), for efficient access. In addition to sharing best practices, this platform will also share motivation, through stories of small, daily victories in student learning. Details on how to establish the online platform for sharing classroom stories are in Table 7.13.

Table 7.13: Implementation details for the online platform for sharing classroom stories

Policy aspects	**Specifics of the online platform for sharing classroom stories**
Overview	A platform for teachers to share stories of successful moments in school—lesson techniques that worked, relationships that got through to demotivated students, activities that addressed a problem in school. One selected story to be highlighted and circulated publicly each week.
School level	Primary and secondary school
Aims	• Help teachers to improve their classroom practice through sharing of exemplars. • Build motivation through stories of real change. • Facilitate teachers' learning from one another.
Measures of success	• *Direct*: number of stories contributed, read, and "liked" • *Indirect*: aggregate improvements in teaching practice, as measured in the teacher evaluations
Four Cs cultivation (among teachers)	• *Critical thinking*: make connections and find applications from other teachers' experiences to one's school • *Communication*: narrative stories for a wide audience of colleagues
Systemwide/opt-in	Opt-in: platform available to all teachers, but strictly voluntary.
Who does what?	• *Ministry*: establish and maintain platform; select stories to be highlighted; moderate stories to remove vulgar/bigoted content • *Teachers*: contribute stories as desired; read shared stories and apply learning to classrooms

Finnish schools, principals, and teachers to network with each other. The aim of the Aquarium Project was to transform schools into active learning communities. ... The Aquarium Project offered schools a new context for improvement—something that combined traditional community work and modern Facebook-type social networking" (Sahlberg, 2012, p. 128).

Incentives	• *Ministry*: less resource-intensive than e-Guru, since teachers create and contribute their own content • *Teachers*: gain ideas and encouragement from other teachers' stories; gain affirmation from showcasing one's own stories, especially if highlighted
Resource demand	• *Initial*: creation of a sub-portal on the existing Frog VLE platform, and a simple smart phone app to ease sharing of stories • *Ongoing*: moderation of stories; selection of weekly highlights
Accountability	N/A
Time frame:	• *1st year*: develop and test the portal; publicise the portal • *2nd year onwards*: portal is accessible to all teachers; and one story per week is chosen for mass publication

Potential challenges and mitigation steps:

- *Few teachers may use the platform, since it is entirely voluntary.*
  Making the platform for classroom stories into a smartphone app is likely to facilitate take-up. As it is, Malaysian teachers exchange a dizzying volume of information across classes, schools, and states using social media platforms such as WhatsApp, Telegram, and Facebook (bahejabella, 2016; Online, n.d.). For example, the prolific Facebook group Kami Guru Malaysia (We are Malaysian Teachers) had 68,165 members as of 26 August 2016 (Facebook, 2016). The proposed online platform will simply focus some of this social media communication on high-quality classroom practice. Furthermore, the emphasis on stories will encourage far greater, informal participation than a portal collecting immaculate lesson plans or videos of perfectly executed lessons.

- *There is potential for malicious abuse of the platform, which would inhibit teacher motivation rather than strengthening it.*
  To reduce room for negative comments (and to minimise app bandwidth), teachers can only respond to posted stories with "likes" and private follow-up messages. There will be no "dislikes", nor any public free-response comments. Also, there will be a button to flag any posts that are not classroom stories, and flagged posts will disappear from public view until vetted by moderators.

- *The classroom stories may compromise the privacy of students.*
  The platform will have strict guidelines for preserving students' privacy. Readers can flag any stories that appear to violate these guidelines, and flagged stories will disappear from public view until the identifying details are redacted. Moreover, teachers can only register for accounts on the platform through the Ministry's official Single Sign-On system. Authors of posts will be identified only by pseudonym, subject, and school level.

Public discussions on questions in education

Changing mindsets, building consensus, engaging the public in the policy process, and replacing cynicism with hope may all sound fluffy and disconnected from policy nitty gritty—but, as we have seen, the absence of such fluff can be paralysing. One way to create such impactful fluff is by circulating information and facilitating discussions on fundamental questions in education. For example, when Finland was rethinking the foundations of its schooling system in the 1980s and 1990s, the government published reader-friendly materials with titles such as "Conception of Learning" and "About possibilities for school change", and conducted in-service teacher training on similar topics (Sahlberg, 2012, p. 124).

Malaysia would benefit tremendously from similar discussions. Unlike the classroom stories platform, which should be restricted to teachers in the interests of student safety and teacher camaraderie, these discussions should be public, in order to get a wide range of input through mass and social media, and to build unified support for school transformation. Such socially constructed understandings of new policies are even more important when the policies aim to change fundamental aspects of the education system (Spillane, 2009). For example, the skills-focussed policy reforms I propose here would not be communicated adequately through a sterile list of objectives and procedures. Instead, we need to discuss the big issues at hand. For example, one discussion topic could be whether intelligence is malleable. To facilitate this discussion, the Ministry could circulate bite-sized accounts of students who believed that hard work can improve their performance and did, in fact, improve greatly (as demonstrated in social-pschological experiments, e.g. Blackwell, Trzesniewski, & Dweck, 2007; Wilson & Linville, 1982; Yeager & Walton, 2011). This could combat public cynicism about schools' and teachers' seeming inability to help students learn, as well as teacher cynicism about students being "memang macam tu" ("just like that"; unable to change) (e.g. as stated by fictitious teachers in local novels, Anis, 2014, Chapter 27; Zaifuzaman, 2006, p. 151). Details on how to run the public discussions are in Table 7.14.

Table 7.14: Implementation details for the public discussions on questions in education

Policy aspects	**Specifics of the public discussions on questions in education**
Overview	Periodic public discussions, whether about potential policy changes (e.g. "Should we eliminate streaming?") or ideas in education (e.g. "Is intelligence fixed, or can it grow?"). The Ministry drives the discussions by circulating material about the topic, and organising channels for discussion.
School level	Primary and secondary school, and the general public
Aims	• Build shared vision for education in Malaysia. • Refine education policy through ongoing engagement with different perspectives.
Measures of success	• *Direct*: participation rates in discussions at various levels and events • *Indirect*: levels of support for new policies that have been publicly discussed vs. those not discussed prior to roll-out
Four Cs cultivation	• *Critical thinking*: engage with different sources and perspectives on the question • *Creativity*: contemplate different solutions for the questions at hand • *Communication*: through engaged, open, and respectful public discussion • *Collaboration*: through joint discussion to reach conclusions or solutions

Systemwide/opt-in	Opt-in: materials and channels available to all, but participation is strictly voluntary. (District offices and schools can also choose to create reading/discussion groups around these topics.)
Who does what?	• *Ministry*: choose discussion questions; prepare and circulate discussion prompts and reference material; create response channels (e.g. web forms, social media, town hall meetings); circulate selected responses to further the discussion • *Teachers (and members of the public)*: contribute to the discussion as desired
Incentives	• *Ministry*: strengthen policies through early feedback; build support for policies through early consensus; develop teachers' and students' use of thinking skills • *Teachers*: include their views in policy discussions; receive more information about the education system; improve their teaching practice through new ideas
Resource demand	• *Ongoing*: preparing materials and organising discussion channels for each question
Accountability	If those who contribute dissenting perspectives find their voices ignored in the official channels, they can leverage alternative media to broaden the conversation.
Time frame:	• All discussions must be preceded by preparation of conversation prompts and reference material.

Potential challenges and mitigation steps:

- *There may not be lively participation in these discussions.*
  This is not a large risk, judging by the volume of commentary about education in both traditional and new media. That said, a number of actions could further minimise that risk. First, the information related to the discussions must be substantive and research-based, but also accessible. Second, prominent leaders, such as the Minister and Director-General of Education, must also participate in the discussions, with thoughtfulness and as much frankness as possible. Finally, people must be allowed to contribute to the discussions anonymously, and with immunity from the disciplinary actions that often prevent civil servants from voicing their views.

How the policies fit together

The fourteen policies that I propose in this chapter fit together as a coherent package; with several compulsory policies supported by a range of opt-in policies for highly motivated schools, teachers, and students. Different policies target Four Cs skills, as defined in Chapter 1; whether among students, teachers, or within school culture. The interaction of these policies is shown in Table 7.15.

Table 7.15: Effect of each policy on Four Cs cultivation, and whether policies are opt-in

Policy	**Critical thinking**	**Creativity**	**Communication**	**Collaboration**	**Systemwide or opt-in? (party that chooses)**
Student assessment	*Among students*				
SPM group project component	✓	✓	✓	✓	Systemwide
SPM portfolio option	✓	✓	✓		Opt-in (students)
Public collection of HOTS test questions	✓	✓			Systemwide
Instructional tools					
Visible Thinking routines	✓	✓	✓	✓	Opt-in (teachers)
Peer Instruction	✓		✓	✓	Opt-in (teachers)
Argumentation frameworks	✓	✓	✓		Opt-in (teachers)
School organisation	*In school culture*				
Cocurricular public projects	✓	✓	✓	✓	Systemwide
Self-contained classrooms in primary school		✓	✓	✓	Initially opt-in (schools), later systemwide
Policy experiment: eliminating streaming	✓			✓	Opt-in (schools)
Revamped school evaluations	✓		✓	✓	Systemwide, phased
The teaching profession	*Among teachers*				
Revamped teacher appraisals	✓			✓	Systemwide, phased
Collaboration module	✓	✓	✓	✓	Opt-in (teachers)
Online platform for sharing classroom stories	✓		✓		Opt-in (teachers)
Public discussions on questions in education	✓	✓	✓	✓	Opt-in (teachers)

The policies are spread out across different divisions in the Ministry of Education, as shown in Table 7.16. In addition to limiting the burden placed on any one agency for Four Cs cultivation,

distributing responsibility for the policies will also spread the vision for reform and skills development throughout the Ministry. This distribution also makes use of in-house expertise across the Ministry's functions, thus optimising the use of existing resources, and minimising demands on funds.

Table 7.16: Distribution of responsibility for the Four Cs policies across the Education Ministry

Policy	**Education Ministry agency charged to develop the policy**
Student assessment	
SPM group project component	Lembaga Peperiksaan
SPM portfolio option	Lembaga Peperiksaan
Public collection of HOTS test questions	Lembaga Peperiksaan
Instructional tools	
Visible Thinking routines	Bahagian Pembangunan Kurikulum
Peer Instruction	Bahagian Pembangunan Kurikulum
Argumentation frameworks	Bahagian Pembangunan Kurikulum
School organisation	
Cocurricular public projects	Bahagian Kokurikulum dan Kesenian
Self-contained classrooms in primary school	Bahagian Pengurusan Sekolah Harian
Policy experiment: eliminating streaming	Bahagian Perancangan dan Penyelidikan Dasar Pendidikan
Revamped school evaluations	Jemaah Nazir dan Jaminan Kualiti
The teaching profession	
Revamped teacher appraisals	Bahagian Pembangunan dan Penilaian Kompetensi
Collaboration module	Bahagian Pendidikan Guru
Online platform for sharing classroom stories	Bahagian Teknologi Pendidikan
Public discussions on questions in education	Pejabat Ketua Pengarah Pelajaran Malaysia

Another important way in which the policies interlock is that they collectively address the entrenched patterns in the education system that have hindered skills development for the last few decades. Each policy is designed to achieve results despite the skewed incentives and behavioural patterns established by the inordinate focus on exam results, the overload of Ministry directives and paperwork, and the pervasive cynicism and blame in the education system. Furthermore, as shown in detail in the policy descriptions above, each policy also aims to uproot these longstanding characteristics; working in various ways to establish a balanced understanding of student assessment, a purposeful focus on student learning in teachers' work, and hope and trust across education stakeholders. The effects of each Four Cs policy on these systemic characteristics is summarised in Table 7.17.

Table 7.17: Effect of each policy on systemic patterns that hinder Four Cs cultivation

Policy	How this policy overcomes:		
	Exam-orientedness	*Paperwork overload*	*Cynicism & blame*
Student assessment			
SPM group project component	Broadens range of assessments	(Increases workload, but with clear goals)	Builds trust in new assessment modes
SPM portfolio option	Broadens range of assessments		Gives students choice in learning
Public collection of HOTS test questions	Broadens range of assessments		
Instructional tools			
Visible Thinking routines	Builds skills alongside content	Aids lesson planning	Builds student-teacher relationships
Peer Instruction	Builds skills alongside content	Aids lesson planning	Builds student-teacher relationships
Argumentation frameworks	Builds skills alongside content	Aids lesson planning	Builds student-teacher relationships
School organisation			
Cocurricular public projects		Streamlines cocurricular work	Builds community relationships
Self-contained classrooms in primary school			Builds student-teacher relationships
Policy experiment: eliminating streaming	Lessens exam-based student hierarchy		
Revamped school evaluations	Reduces weight of exam results	Gives clear purpose to evaluation work	Emphasises growth, builds relationships
The teaching profession			
Revamped teacher appraisals	Reduces weight of exam results	Gives clear purpose to appraisal work	Builds professional relationships
Collaboration module			Builds professional relationships
Online platform for classroom stories			Builds nationwide teacher camaraderie
Public discussions on questions in education			Builds nationwide optimism re. schools

How likely is real change towards Four Cs cultivation in our schools?

Against a backdrop of failed policy attempts to shift our education system away from rote memorisation towards holistic skills development, it may be difficult to believe that real change is possible. In this paper, I have tried to show that such change is, in fact, within reach; if our policy approaches work within systemic constraints while also working to overcome these constraints. Besides the skills-focussed policies proposed above, successful reform in Malaysian schools requires the removal of some broader constraints.

First, one constraint that needs urgent attention is the administrative burden imposed on teachers. The government has, again and again, acknowledged that this is a problem (e.g. Kementerian Pendidikan Malaysia, 2013c, p. 5-6; Sektor Operasi Pendidikan, 2012). Education policy reform has a much higher chance of success if the front-line implementers, i.e. teachers, are not overwhelmed with work that has little apparent connection with the work of educating students. Straightforward ways of lessening the workload include streamlining routine tasks for class teachers; such as shifting the collection of school fees to the finance clerk (IDEAS Malaysia, 2016); and taking student attendance through a secure electronic portal (unlike the current setup, which requires teachers to record attendance in both a frequently unstable electronic portal and a tediously handwritten register) (Bahagian Pengurusan Sekolah Harian, 2013; SMK Muadzam Jaya, 2016; SMK TTJ Unit Hem, 2013). Also, the Ministry should ban activities that both increase administrative work and reduce instructional time, such as unnecessary school events and frequent school-level tests. Instead, teachers should be encouraged to design their own formative assessments, and to administer these throughout the semester, besides the midyear and end-of-year/trial exams that aid benchmarking. Also, responsibility for planning district-level competitions should be shifted from schools to the district education office. Lastly, the Ministry should establish a gate-keeping office responsible for rejecting or approving directives that would impose additional duties on teachers, and for ensuring that approved directives are unambiguous and have clear links to student learning.

Another constraint on the cultivation of the Four Cs in schools is the stricture on discussing "sensitive topics" in school. As civil servants, teachers are required to give undivided loyalty to the Agong, country, and government; and are prohibited from (a) doing anything to tarnish the name of the civil service, (b) making or circulating public statements that could damage the government in any way, and (c) participating actively in politics (Kerajaan Seri Paduka Baginda, 1992). The breadth of these prohibitions, and the looming threat of disciplinary actions, keeps issues such as race, language, religion, and the economy out of classroom discussions. This deprives students of a wide swathe of fertile, familiar material on which to practice critical thinking. Similar questions about the necessity of freedom of speech in creativity and intellectual development have been raised in Singapore (e.g. Overland, 2007). In Malaysia, silencing such discussions in schools not only communicates the message that critical thinking and creativity are dangerous; but also prevents conversations about identity issues that needlessly hamper collaboration and communication.

Finally, as noted at the beginning of this chapter, the presentation and framing of a policy influences its success. For these skills development policies to work, leaders in the education system—whether the Education Minister and the Director-General, or the leaders of the various state education departments and district offices—must show that they themselves value the Four Cs and practice them in

their work and lives. As discussed above, such role modelling is not an optional extra. Rather, it is crucial for developing shared responsibility for improving student learning, and for sustaining the hope that such a vision can be achieved. Given the stakes—our national economic future, and the well-being of a generation—our leaders cannot afford to do otherwise.

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