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The Role of School Leadership in Singapore's Future-Ready School Reform

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Abstract

In this paper, we propose that successful education needs to fulfil three purposes while being cognisant of time and context: (1) learning, (2) lifework and (3) well-being. An education system is successful if it can develop future-ready individuals who will continue to learn beyond graduation, take on future lifework, and thrive in a changing society and environment. The future is context-situated and context-dependent. We have chosen to examine the economic, social and environmental context of Singapore to provide insight on the values, skills and knowledge that are required of future-ready learners. We have compared the trajectories of other high-income nations with those of Singapore. Traditional teaching and learning practices no longer serve us well in the new realities that emerge. Education practices need to evolve in tandem to meet the demands of the 21st century. The roles that school leaders play include creating teaching and learning environments where these practices can be implemented. In our review of leadership practices and concepts, we have found that it is important for school leaders to question existing assumptions of teaching, learning and leadership practices in order to advance the development of 21st century skills, knowledge, values, and habits in learners.

KEYWORDS: Singapore, school leadership, economic context, social context, environmental context

1. INTRODUCTION

1.1 Purposes of education over time

School reform takes on both local and international contexts when schools strive to be relevant and globally connected. Comparative results from international tests, such as the Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA) measure certain aspects of quality in education internationally. However, education is more than just standardised testing. Although academic performance in standardised testing remains important for many countries, countries including Singapore have taken steps to incorporate 21st century skills into their curriculum (Lamb, Maire, & Doecke, 2017; Soland, Hamilton, & Stecher, 2013). We see three purposes for education, and outcomes of education, that are in line with such a broadened view of educational success. They are:

- developing learning (knowledge);
- developing lifework (vocation); and
- developing well-being (citizenry, values, and sustainability) that enable individuals to live peacefully and collegially with one another in society.

Successful schools incorporate these three purposes (Ng, 2019). In discussing effective schools and success in education, we need to bring in another dimension to the purposes of education – time. Time provides perspective and focus to the purposes of education. The perspective of time is like the physics concept of vectors. A vector has direction and magnitude. Direction in the time continuum consists of the past, present and future (Ng, 2019). Learning, therefore, will involve studying the past, meeting present standards of knowledge, and being prepared for the future. Magnitude is the extent or quantity of school activities as per point of vector (past, present, and future) in the time continuum. The extent or magnitude of learning and school activities that are set aside for learning for the past, the present, and the future, provide us with an indication of what is valued in schools. The focus is often on the present and the measures that bring immediate value to our education system. For example, high performance in assessments is immediately valuable in the form of recognition for the individual, school, system, and country. This leads to an emphasis on activities related to assessment. But we need to be keenly aware of the future. The future is no less important or valuable. Value for the future is about the readiness of our graduates to meet evolving and changing circumstances in the future.

We estimate that individuals spend three times the time working, when compared with the time spent in education. Students finish post-secondary education at the median age of 23 and work until a median age of 65. Working life is an important outcome of learning in relation to past and present outcomes of learning.

The government expenditure on education (% of GDP) across the world averages 4.5% in recent years (The World Bank, 2019a). The figure for Singapore is roughly 3%. With competing government budget allocations, countries have to do more with less funding for education. The question is, how much of spending on education is translated into value in terms of student outcomes? Given the lengthy years that school graduates spend being economically active, countries need to ensure that education prepares students adequately for their future, as well as the future of the nation. Therefore, we need to consider the future value of students' skills.

Here follows our definition of world-class education and being ready for the future: *A successful education system is able to develop future-ready individuals who will continue to learn beyond graduation, take on future lifework, and thrive in a changing society and environment.* The definition underscores the importance of developing and preparing students not only for short-term goals but also for the future. Being ready for the future implies that learning outcomes must be dynamic and aligned to new realities that emerge over time. The future is about new realities that are context-situated and context-dependent. In this paper, we review leadership concepts for Singapore and a number of other high-income countries in order to provide a definition for future readiness. We discuss teaching, learning and school leadership practices that are aligned with emerging circumstances. Figure 1 shows purposes of education, time, context and practices in a multi-dimensional framework for success in education. A significant contribution of this model is the inclusion of time as an additional dimension in defining successful education.

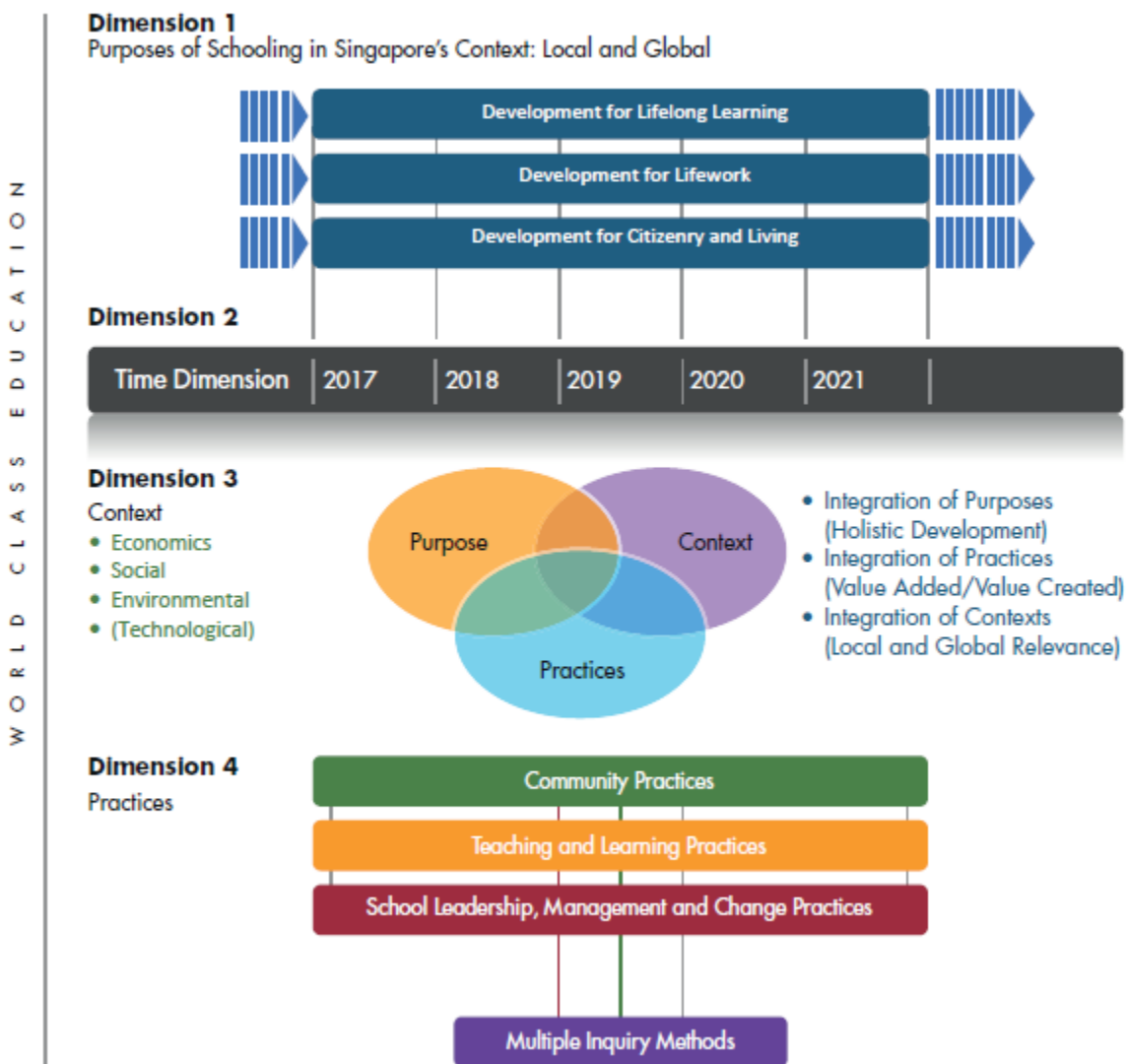


Figure 1: Multi-dimensional framework for success in education (Ng, 2019)

2 CONTEXT AND EDUCATION

Education and context share an intricate, mutually dependent relationship. Context shapes education; at the same time, education also shapes context. The outcome of education is to develop future-ready learners who co-shape and co-create the future contexts of economy, society and environment. In terms of economy, education develops human capital of the work force and raises economic productivity (Ozturk, 2001; Sahlgren, 2014). Other important factors that contribute to the economy, such as politics and domestic and foreign investments, are also influenced by the education of policy makers and investment managers (Ozturk, 2001). Education shapes society by instilling social, religious and cultural values and norms to help individuals integrate into their communities. Through socialisation, education ensures that individuals are raised appropriately as members of their society (Francois, 2015). Also, education can be used for guiding individuals' attitudes and behaviours regarding environmental resources (Fu & Liu, 2017).

Moving on from the ways in which education shapes context, we consider the ways in which context shapes education. In particular, how do the trajectories of future contexts shape education? Context provides the frame for the specifics and details that describe the purposes of education. As mentioned, successful schools are those that fulfil the three purposes of education. School leadership plays a fundamental role in leading schools to achieve success. The practices and policies implemented by school leaders are essentially shaped by the context that the school is situated in. The interpretation of the context by school leaders directs the vision, practices and criteria that school leaders set for the success of schools.

A number of scholars have emphasized the importance of examining school leadership in context (Braun, Ball, Maguire, & Hoskins, 2011; Clarke & O'Donoghue, 2017; Hallinger, 2018; Moos, Krejsler, & Kofod, 2008; O'Donoghue & Clarke, 2015). Hallinger (2018) describes six contexts that school leadership is situated in – institutional, community, national cultural, economic, political and “school improvement” contexts. The institutional context refers to the education system as a whole and its various parts on the regional level, state level and the local level. The structure of the education system influences the role definition and behaviour of principals such as their allocation and use of time (M. Lee & Hallinger, 2012). The community context, such as the socio-economic composition of the school, and whether the school is located in urban or rural communities, also shapes how principals adapt their leadership. National culture influences the socio-cultural norms and values that are upheld and practiced by school leaders. For example, whether leadership is practiced in a top-down manner or a less hierarchical manner reflects socio-cultural standards of the society that the school is situated in. The economic context greatly affects the resources and opportunities that a school has access to, which in turn influences the work of the school leaders. The political context shapes the political ideology that directs the broad policies and practices of school leaders (L. Bell & Stevenson, 2015). Last but not least, the context that Hallinger (2018) referred to as “school improvement” context is the school

improvement trajectory. At different stages of a school's improvement, school leaders will shift their focus and practices accordingly.

National policies are part of the macro-context at the national level while "school improvement" context relates to the specific school. Contexts overlap and are interdependent. Overlapping and ambiguous as they might be, it is important for school leaders to take contexts seriously to achieve success for their schools. In our paper, we have selected economic, social and environmental contexts to describe the purposes of education over time. These are macro-contexts at the national level and relate to the three purposes of education identified above: learning, lifework and well-being. Technological aspects are interwoven into all the three primary contexts. Next, we examine the contexts in which Singapore is situated and compare with other high-income countries.

3 FUTURE TRAJECTORIES FOR SINGAPORE AND OTHER HIGH-INCOME COUNTRIES

3.1 Economic Context

Singapore's GDP grew by 0.7% in 2019 amid global uncertainties such as Brexit and trade tensions between US and China (Ministry of Trade and Industry, 2020). The global economic landscape is getting more competitive and it is necessary for Singapore to increase the value of the products and services that it delivers. Singapore cannot sustain a competitive edge simply by producing what the rest of the world is producing (U.-W. Lee, 2015). This calls for radical adoption of technology and innovation. These two themes of technology adoption and innovation have been reiterated many times in various forms in the government's budget statement in recent years (Heng, 2016, 2017, 2018, 2019).

Across the globe, new technologies are reshaping the economies of nations, business models of enterprises and jobs of individuals. For example, the global trajectory towards high value in manufacturing requires that manufacturing companies move up the value chain (Livesey, 2006), which can be assisted by deploying suitable new technologies such as automation and robotics. High value manufacturing is important for Singapore as manufacturing is a significant contributor to the nation's economy. When we speak of high value manufacturing, we consider the financial, strategic and social aspects of value (Livesey, 2006). For example, for the financial aspect, automation can reduce manpower and thus make production more cost-effective. The Singapore government has launched a automation support package for firms to adopt large-scale automation, including Internet of Things (IoT) and robotics (Heng, 2016). Another programme, the National Robotics Programme, aims to drive industry-level transformation via deploying new technologies to solve problems that are relevant for the entire industry, as well as to create high value jobs. (Heng, 2016, 2018)

Digitalisation is inherent to the development of industry; it has the power to transform large and small companies in line with the Industry 4.0 agenda (EDB Singapore, 2017). The Singapore government has introduced a plan to help small and medium enterprises to build digital capabilities (Heng, 2017).

A large scale port development in Tuas is an example of how Singapore aims to adopt new technologies to ensure that Singapore retains a competitive edge as a maritime nation (Abdullah, 2019). The development of the mega-port will take over two decades and cost billions of dollars. When fully developed, the Tuas mega-port will be the single largest terminal in the world that is fully automated (Paulo & Heng, 2018). Automation will help the port achieve predictable and consistent performance, which is important for the fast turnaround of vessels. Local businesses will also benefit. For example, the digitalisation of the port provides local firms with business opportunities to develop virtual reality and artificial intelligence for the port. Individual workers will also benefit from the creation of high value jobs. It is important to note that the overwhelming majority of the jobs for the maritime industry are in the service businesses (Singapore Maritime Foundation, 2017). Service jobs likewise will need to adopt new technologies.

Innovation is enabled by technology but is not limited to that. Innovation is about coming up with new solutions and ways of doing things that create value in the economy. The Singapore government has committed billions to encourage research, innovation and enterprise, as well as to support start-ups and in new and existing industries. The Jurong Innovation District in the western part of Singapore will be launched to foster innovation for enterprises and learning (Heng, 2016). Innovation is a prevalent theme in Singapore's efforts to tap into overseas resources. The Global Innovation Alliance was announced in 2017 to enable Singaporeans to network and collaborate with their overseas partners (Heng, 2017).

Moving forward, it is clear that Singapore's economic trajectory requires workers who are able to learn and apply technology quickly to keep up with the speed of change in the age of Industry 4.0. Paper qualifications are no longer sufficient for employers. Increasingly, employers are looking for workers who can adapt quickly and provide creative solutions to problems. Lifelong learning becomes the norm. Those who cannot catch up will face great challenges in the future economic landscape of high-value manufacturing and high-value service jobs. An education system can be successful only if it is able to develop value for the future and prepare individuals to take on jobs and to thrive in jobs in the future. For example, education must make innovation an ingrained mindset in students to prepare them for future jobs. Developing an innovative mindset will require consistent teaching and learning environments that will foster such a mindset. Rote learning and efficient learning will no longer be enough in the new economic reality (Ng, 2019).

3.2 Social context

For decades, Singapore has enjoyed peace and harmony on the whole. However, forces that threaten peace and harmony remain with increasing diversity within the nation brought about by factors such as religion, race and immigration. These forces are intensified by the liberal expression of views on these matters online.

A study conducted in late 2018 found that the level of religiosity of Singaporeans is high, with three out of four Singaporeans saying that they follow a religion (Mathew, Lim, & Selvarajan, 2019). Though the study found that 97% of the respondents think that it is "unacceptable or very unacceptable for religious leaders to incite violence or hatred against other religions", almost a quarter of respondents would "allow religious extremists the freedom to post their views online". This is a case for concern because there is only a fine line between freedom of speech and the

instigation of harm towards other religions. With the proliferation of social media, addressing radical online content will be a fight for the hearts and minds of the population. False information online, also known as “fake news”, tear at Singapore’s interfaith unity and has the potential to undermine Singapore from within (Chua, 2018). Against the global backdrop of increasing religiosity and digital connectivity, the people in Singapore will become more and more exposed to pressures that potentially undermine interfaith unity.

The influx of foreigners into Singapore brings about another dimension of diversity. For decades, the Chinese-Malay-Indian-others (CMIO) framework has been used for categorising the population in Singapore. Because of immigration, the category “others” has increased by proportion the most for the last decade (Cheng & Chua, 2017). Within the Chinese ethnic group and the Indian ethnic group, intra-group diversity grows, with immigration of people from China and India. These new immigrants have different habits, mannerisms and speech compared with locals despite sharing the same ethnicity. There are concerns that receiving many foreigners will dilute the national identity of Singaporeans (Nasir & Turner, 2014). Social tensions brought about by immigration are intensified by foreigners and locals expressing hate speech online.

Increasingly, the people of Singapore will be studying, working and living with people who do not share the same ethnicity, country of birth, or religion. Tolerance and inclusivity are required for the people of Singapore to come together as a united nation. Education must play the role of inculcating the right values in the people of Singapore for maintaining a harmonious co-existence.

The aging population is another social challenge for Singapore. Within a short period of 53 years from the nation’s independence in 1965, the median age of its resident population has more than doubled. From a resident median age of 17.8 years in 1965, its resident median age has increased to 40.8 years in 2018 (Department of Statistics, 2019). A rapidly aging population implies a rapidly aging workforce. Recognising these trends, there have been efforts by the Singapore government to improve the employability of older workers and encourage those previously outside the workforce to return to employment. As the average person is now expected to work longer, lifelong learning for lifelong employability is now crucial.

3.3. Environmental context

There are more than seven billion people in the world today. More than 50% of the world’s population now live in urban areas (Steffen, Broadgate, Deutsch, Gaffney, & Ludwig, 2015). The rapid pace of urbanisation places strains on the environment, with ever-increasing demand for energy and resources. The period following 1950 has been termed the Great Acceleration, where global socio-economic trends such as real GDP, urban population, transportation and use of water rose sharply in comparison to the period before 1950 (Steffen et al., 2015; Steffen, Crutzen, & McNeill, 2007; Steffen et al., 2011). This sharp increase parallels the rise in the emission of greenhouse gases, ozone depletion and other global-scale changes in the earth system, strongly indicating the coupling of environmental deterioration with increases in urban populations, GDP growth and material consumption. The dire consequences of these changes in the earth system include global warming, climate change, rising sea levels and declining biodiversity.

Global temperatures have risen by about 1 degree Celsius since the industrial age began. Thermal expansion from warmer ocean waters and melting of ice-caps lead to rising sea levels, causing widespread devastation to coastal habitats. (Nunez, 2019) Weather patterns around the world are becoming more erratic, with increasing frequency and intensity of extreme weather events. Human activities and global climate change threaten the extinction of species – 1 million species face extinction unless massive action is taken to reduce the drivers of the decline in biodiversity (IPBES, 2019; McGrath, 2019). The loss in biodiversity has severe implications for global food security, as the resilience of agro-ecosystems is being undermined (IPBES, 2019).

Singapore is not spared from these global threats. As part of earth's delicate ecosystem, Singapore's challenges for energy, water and food are intricately linked to the state of the global ecosystem. Despite being a small nation, Singapore has to play a role in sustainability and environmental conservation. As described in the following, Singapore has a number of measures in place to address environmental challenges.

Improving energy efficiency is a key strategy for reducing carbon emissions. Mandatory practices have been implemented to address the energy efficiency of Singapore's industry sector. The government is also studying policy options for facilitating the adoption of cleaner fuels in industry. (National Climate Change Secretariat, 2016). Singapore is also increasingly turning to "green" buildings – buildings that reduce the negative impact on the environment by virtue of their design and operation. Singapore is also increasing the use of renewable energy sources. Solar energy is the most promising renewable energy option for Singapore (National Climate Change Secretariat, 2016).

Moving forward, innovation and the adoption of technology are crucial for addressing Singapore's energy needs, while ensuring that the impact on the environment is minimised. The Energy National Innovation Challenge was launched in 2011 to harness research and development capabilities to increase energy efficiency, reduce carbon emissions and increase energy options within 20 years. Singapore has a number of research groups and research centres working on energy research. For example, the Energy Research Institute at Nanyang Technological University focuses on energy solutions for megacities and the tropical environment (ERI@N, 2019).

Water resources are another environmental challenge for Singapore. Singapore is a water-scarce country that is not self-sufficient in water. To supplement its water supply, Singapore turns to recycling used water (NEWater) and desalination (E. T. Lee, 2016). Both require adoption of advanced technologies and technological expertise.

Singapore imports food from many different countries, employing a diversification strategy. Locally produced food makes up less than 10% of total food supply. Nonetheless, locally produced food acts as a buffer against supply disruptions (Singapore Food Agency, 2019). Efficient use of land in innovative and high-tech farming are promoted as Singapore is a land-scarce country (Ministry of National Development, 2018).

The future development of Singapore is intricately linked to environmental factors. Greater consumption of energy and resources will inevitably follow as the country continues to develop as a modern and sophisticated city-state. There is an urgent and compelling need for Singapore to

formulate sound policies, implement concrete actions, and apply great ingenuity to come up with novel and innovative solutions for environmental issues. Without a sustainable and habitable environment, there will be no place to support future economic development or to live harmoniously. All the above imply that learners will have to fulfil roles that require ingenuity, innovation and entrepreneurial skills now and in the future.

3.4 Comparison of high-income country contexts

It is instructive to compare the contexts of a few high-income countries with Singapore. Each country may define the specifics of future livelihoods and changes in the environment differently because of inherent differences in history, culture, and geopolitical influences. Nevertheless, these countries share many similar challenges for the labour force and environment. A description of the skills, knowledge and values required for preparing students for the future is provided in the following; similarities among countries in terms of economic and environmental contexts are noted.

Service production has an increasingly prominent role in economic growth; over the past two decades, this has been seen both in terms of value added and GDP. In 2015, value added from services accounted for 74 percent of the GDP in high-income countries, up from 69 percent in 1997. The World Bank noted a trend of added value to GDP, from service production, for high-income countries such as the United States, Canada, Australia and Germany (The World Bank, 2019b).

The following drivers contribute to high value manufacturing and services:

- High cost of production and services
- Sophistication of products and services
- Higher application of specialised knowledge
- Low employment (fewer workers due to adoption of technology and high specialization of expertise)

In summary, high-income countries are not likely to regress in sophistication of manufacturing and services. The following table summarizes the trajectories of high-income countries' economic, environmental and – to some extent – social contexts. The skills, knowledge and values required of individuals for these trajectories are also identified. Table 1 illustrates that high-income nations share commonalities in terms of their economic and environmental trajectories. These trajectories require the adoption of technologies, innovation, creative thinking and sustainable lifestyles.

In Singapore, as in other high-income countries, the economic challenges require workers who are able to learn and apply technology swiftly to keep up with the next generation of industrial production. Employers will look for skills and qualities in workers such as adaptability, creativity and lifelong learning; a specific academic degree is no longer enough. In high-value manufacturing

and high-value service jobs in Singapore as well as other high-income countries, individuals who cannot keep up with changes will face redundancy.

Table 1: Trajectories of high-income countries' economic, environmental (and to some aspects, social) contexts and the skills, knowledge and values required of individuals for these trajectories

Country/Territory	Trajectory		
	Economic	Environmental	Skills, knowledge and values required
Singapore	• High value manufacturing. • New and novel services (High- tech services requiring IoT, blockchain etc.). • Commercialisation of innovative solutions. • Competitive advantage through purposeful and radical adoption of technology and digitalization in services and manufacturing. • Lopsided population pyramid may result in social unrest in the future.	• Increased urbanisation: increased consumption of energy and resources. • Global environmental problems: the need for reducing carbon footprint. • Renewable energy and energy efficiency through green and innovative solutions. • High-tech water solutions for meeting the increasing water needs. • High-tech and green farms for increasing local food produce.	• Mastery of learning • Lifelong, life-wide and life-deep learning • Innovation • Value creation • Technology adoption • Digitalisation • Creative thinking • Sustainable lifestyle
United States	• Slowdown and uncertainty in economic outlook due to trade war. • Decline in manufacturing and shift to services-based economy.	• Global climate change causing more natural disasters in the US (hurricanes, floods etc.). • Climate change projected to cause US economy to lose hundreds of billions, more	• Adaptability to change • Mastery of learning • Lifelong, life-wide and life-deep learning • Innovation • Value creation

	• High value manufacturing and services using 3D printing, Internet of Things and artificial intelligence etc. • Computer and information technology jobs grow faster than the average of all occupations, due to increasing demand for cloud computing, big data and information security. • The fastest growing category of new jobs is gig work - contract, part-time, temp, self-employed and freelance.	than 10% of GDP, by the end of the century. • Extreme weather conditions affecting agricultural yields: the need for innovations in animal and crop genetics, chemicals, equipment, and farming. Innovations contributed to growth in US farm output despite decreases in labour and land. • Energy shortages: the need to strengthen resilience and reliability of electrical grids.	• Technology adoption • Digitalization • Creative thinking • Sustainable lifestyle
United Kingdom	• Slowdown in the UK economy and depreciation of the British pound due to Brexit. • Decline in manufacturing and shift to services-based economy. • High value manufacturing and services using 3D	• Warmer winters, hotter summers and higher rainfall in the UK due to global climate change. • The need for greener energy: switch from coal to gas and renewable energy sources. Support schemes in place to encourage technology development for green energy.	• Mastery of learning • Lifelong, life-wide and life-deep learning • Innovation • Value creation • Technology adoption • Digitalisation • Creative thinking • Sustainable lifestyle

	printing, robotics and artificial intelligence etc. Jobs in high demand in the UK: Jobs needed for building IT infrastructures, mobile developers, jobs requiring advanced manufacturing skills.	Food production challenged by climate change, declining soil quality and agricultural land availability. New agricultural technologies are being developed to aid production such as robots, drones, satellites and sensors.	
Canada	- Highly dependent on US economy due to comprehensive bilateral trade and investment relationships. - Reliant on oil and gas reserves and production. - Major supplier of energy to the US. - Tariffs on Canadian exports in America. - Growing service sector comprises a range of activities such as high-tech and knowledge intensive jobs. - Toronto start-up scene is more vibrant and has added more tech jobs in 2018 than New York and San Francisco Bay Area combined.	- Acid rain from air pollution severely affecting lakes and damaging forests. - Metal smelting, coal-burning and vehicle emissions impacting agricultural and forest productivity. - Increasing cyclones at the east coast of Canada. - Since 1948, Canada has seen an increase in the annual average temperature over land by 1.7 degrees with warming higher in the northern parts of the country. - Coastal flooding is expected to increase due to rising sea levels. - High level of carbon emission per capita.	- Mastery of learning - Lifelong, life-wide and life-deep learning - Innovation - Value creation - Technology adoption - Digitalisation - Creative thinking - Sustainable lifestyle

Australia	• A significant exporter of natural resources, energy (natural gas and coal) and food. • Exports primarily to East and South Asian region. Slowdown in China has affected Australian economy. • Expanding high value manufacturing exports. However, low value manufacturing still remains. • A growing service sector of Education, Tourism and Finance. • Diversity and disparity of employment ranges from high-pay, high-skill, full-time employment to low pay part time employment. • Gap in economic growth between cities and regional Australia.	• Driest inhabited continent making it particularly vulnerable to the challenges of climate change. • Floods, droughts and bushfires. • Australia has become hotter and drier. • Annual temperatures since the beginning of the 20th century have risen by one degree and rainfall has become heavier and more infrequent. • Carbon tax introduced in 2011 has reduced Australia's carbon emission by 11%. • More tropical cyclones. • High level of carbon emission per capita.	• Mastery of learning • Lifelong, life-wide and life-deep learning • Innovation • Value creation • Technology adoption • Digitalization • Creative thinking • Sustainable lifestyle
New Zealand	• Transformed from British market to industrialized free market that can compete globally. • Economic growth has stabilized.	• Native plants, animals and ecosystems are under threat. • Urban growth is reducing versatile land and native biodiversity.	• Mastery of learning • Functioning in socially heterogeneous groups • Acting autonomously • Critical thinking • Technology adoption

	• Water and climate change are key challenges for future well-being. • Immigrations' contribution to wellbeing should be enhanced. • Auckland has developed specialist manufacturing industries and a talented, globally-focused service sector with advanced industries, tradeable industries and enabling industries.	• Changes to the vegetation on land are degrading the soil and water. • Environment is polluted in urban areas. • Waterways are polluted in farming areas. • The way people fish is affecting the health of ocean environment. • Taking water changes flows which affects freshwater ecosystems. • NZ has high greenhouse gas emissions per person.	• Innovation for sustainability • Bicultural and multicultural awareness • Enterprise and creativity • Value creation • Sustainable lifestyle
Hong Kong	• Hong Kong's free market economy is highly dependent on international trade and finance. • Four key industries: Financial services, trading and logistics, tourism, and professional and producer services. • Push for upgrading of manufacturing industry with technology, robotic manufacturing and innovation. • Companies are intensifying use of big data technologies and	• Extreme weather conditions such as typhoons and hailstones in Hong Kong brought on by global climate change. • Hong Kong imports more than 90% of its food supply, a large portion from mainland China, which is one of the countries most affected by climate change. • Government aims to reduce carbon footprint by 26 per cent to 36 per cent over the next ten years. Efforts include using cleaner fuel, renewable energy, and increasing sustainability and	• Mastery of learning • Lifelong, life-wide and life-deep learning • Innovation • Value creation • Technology adoption • Digitalisation • Creative thinking • Sustainable lifestyle

	infrastructures. Technical specialist jobs in data, cloud computing and finance are in high demand.	efficiency in urban areas and transport.	
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Source: Table constructed by Authors. Table references: EDB Singapore (2017), CFE (2017), Population SG (2019), NEA (2019), Ministry of National Development (2018), United States Department of Labor (2019), CIA (2020), Office for National Statistics (2019), PWC (2016), Canadian Visa (2019), Australian Department of Foreign Affairs and Trade (2019), OECD (2019a), MFE (2019), Census and Statistics Department (2018)

4 ADAPTING TEACHING AND LEARNING FOR CHANGING CONTEXTS

If the broader measure of successful education includes being prepared for the future, then the logical question to pursue is: “Which teaching and learning approaches prepare students for the future?” As new realities emerge in Singapore and in other countries, there is a need to re-examine learning outcomes beyond assessment and standards. Practices such as those pertaining to teaching and learning must also evolve with new demands and challenges. Assumptions, beliefs and theories that underlie these practices must not and cannot remain unchallenged paradigms when we talk about developing future-ready learners in Singapore and elsewhere. As Puncreobutr (2016) put it, the next generation of education practices “Education 4.0” must address the demands of the society in an era of innovation. The management of learning must respond to societal and economic environments to address the need for human capital.

We have outlined how to fulfil the purposes of education whilst recognising that context and time are essential for the success of education. For the future of Singapore, learners need to have an innovative mindset that enables them to rise to the challenges of the new economic and environmental realities. The starting point for innovation is generating and developing ideas. The next step would be to test the ideas and bring them into fruition. If the final outcome is to develop a useful product, the final stage of entrepreneurship involves convincing others to use the new product. Translating these phases into teaching and learning practices in schools will necessitate a shift in educational practices (Ng, 2019). This is because current practices focus on knowledge acquisition and there is little room for students to generate and test out ideas that are not in the curriculum. Paradigms of teaching and learning such as constructivism, connectivism, student agency and being engaged in “communities of practice” might be more aligned to changing contexts.

The core tenet of constructivism is that people construct meaning from their experiences (Bada, 2015). By making sense of their world, people learn (Wilson, 2012). Constructivism consists of teaching methods focused on active student learning (Krahenbuhl, 2016), which is in contrast to the more passive role of the students in the traditional classroom. For example, some characteristics of constructivism include teachers helping students to test their ideas and teachers modifying teaching strategies in the process of teaching according to students’ experiences or interest (Kim, 2005).

Connectivism is a learning theory for the digital age (Siemens, 2005). In connectivism, learning occurs through the construction and traversing of networks; participation in networks result in the creation, removal or adjustment in the strength of the connections (Goldie, 2016). The emphasis on learning and knowledge that rests on a diversity of opinions facilitated by networks is more in line with today’s era of social media and digital connectivity. F. Bell (2009) describes some practices that teachers can take to incorporate connectivism in teaching. For example, following cutting-edge education technology blogs and encouraging students to be critical and selective in assessing online resources are some of the ways of doing this.

Student agency is “the capacity to set a goal, reflect and act responsibly to effect change. It is about acting rather than being acted upon; shaping rather than being shaped; and making responsible decisions and choices rather than accepting those determined by others.” (OECD

(2019b), p. 2) Future-ready students need to exercise agency in school and out of school, to make an impact in their own lives as well as the world around them. When students exercise agency, they actively decide what and how they will learn. They also display greater motivation to learn, as well as learn how to learn, which will benefit them for their entire lives (OECD, 2019b). To help enable agency, teachers should also recognise and acknowledge the relationships that exist between students and their peers, teachers and parents. Such “co-agency” is a joint enterprise in which learners progress toward their goals.

In a “community of practice”, there is mutual engagement between members, joint enterprise and a shared repertoire (Wenger, 1998). Students learn from one another, mutually engaging one another in the learning process. They also share a common domain of interest and repertoire of resources for generating ideas. Importantly, members of different backgrounds build and sustain relationships with one another, negotiating meaning and mutual understanding within the community.

5 ROLES OF SCHOOL LEADERS IN MEETING THE DEMANDS FOR FUTURE-READINESS

School leaders are responsible for creating environments where teaching and learning practices prepare students for the future. As noted above, constructivism might be one relevant paradigm that can address changing circumstances. Constructivist school leadership involves reciprocal relationships between participants that are trusting and respectful – this forms the bedrock for teaching and leading. Constructivist leaders possess an understanding of constructivism and engage in conversations that surface assumptions and beliefs, inquire into practice, make sense of what has been found and frame new or improved action (Lambert, 2009). Lambert (2009) describes the four dimensions of constructivist leadership as follows:

- Reciprocal: Being committed to and responsible for learning of others while expecting others to assume similar responsibility for the leaders’ learning
- Purpose: Sharing vision, beliefs and goals about schooling and student learning
- Learning: Constructing meaning and knowledge together through dialogue, reflection, inquiry and action
- Community: Being part of a group of people who share common goals and aspirations for the future and who care about one another

Constructivist leadership is in this perspective embedded in the patterns of relationships that permeate through the entire organisation. It is a meaning making process for both leaders and teachers alike.

Connectivism is a paradigm in digital learning for the 21st century, as described in the previous section. In connectivism, the role of school leaders requires knowledge of how students learn online and having the necessary competencies to manage and lead effectively in an e-learning environment (Makina, 2016). Leaders in e-learning construct spaces that guide learners to relevant resources and learning opportunities online (Makina, 2016). School leaders need to develop the

mindsets and skillsets of colleagues who might be less technologically inclined, by providing opportunities to engage with relevant new technologies. Leaders play an important role in the implementation of policies and practices for developing learners to be critical when assessing online information. This requires awareness of risks associated with societally harmful propaganda, the spread of false information and extreme opinions.

Innovation, creativity, technology adoption and other key competencies required for future-readiness are supported when learners exercise agency. School leaders should encourage students to pursue projects that matter to them, provide the technology needed to create meaningful and important work, and support the “voice and choice” of students (Richardson, 2019). School leaders need to articulate their expectations about effective pedagogical practices for supporting learner agency (ERO, 2016). For example, a school can articulate how they aim to create a supportive learning environment, encourage reflective thought and action, and work on the relevance of learning – the desired outcomes of which are increased learner agency and motivation. (ERO, 2016) The task of articulating such goals and the means to achieve them are the responsibility of school leaders.

Effective leadership in the “community of practice” approach requires school leaders to foster a leadership culture of consultation and collaboration (Hammersley-Fletcher & Kirkham, 2007). This is similar to the constructivist approach to leadership. As noted by Spillane (2005), p. 143, “[...] school principals, or any other leader for that matter, do not single-handedly lead schools to greatness; leadership involves an array of individuals with various tools and structures.” Leadership involves multiple persons, some with and some without leadership titles. As and when the situation arises, leadership can be extended to teachers who play the role of “middle leaders” (Hammersley-Fletcher & Kirkham, 2007). Developing a community of practice culture involves seeing leadership as an outcome of actions taken by a group rather than an individual, developing trust and openness, entrusting others with responsibility, and extending the boundaries of leadership (Bennett, Wise, Woods, and Harvey (2003), cited in Hammersley-Fletcher and Kirkham (2007)).

6 REFRAMING EDUCATION LEADERSHIP TO MEET COMPLEX CHALLENGES

A shift is emerging in the literature on leadership in education. There is a move away from a centrally controlled authority. The new goal is distributed school leadership (Hopkins, Stringfield, Harris, Stoll, & Mackay, 2014; Murphy, 2015). Murphy (2015) examined the evolution of education in the US, from the industrial era (1890-1920) to the post-industrial era that started in the 1980s. He concluded that responsibilities, relationships and roles in school organisations in the post-industrial era have changed. The distinction between administrators and teachers has blurred; roles have become more general and flexibility is appreciated; specialisation is less sought after than what it was during the industrial era. Traditional hierarchical organisational structures are giving way to structures that are flatter.

This shift in roles, relationships, and responsibilities has also contributed to the increasing complexity of schools. There is direct and indirect involvement between and among a growing

circle of stakeholders within schools and government. Employers and communities clearly support the view that schooling is no longer a closed system. Education is both a closed and open system (Darling-Hammond, 2010; Day & Leithwood, 2007; Hargreaves & Shirley, 2009). Day and Leithwood (2007) have reviewed leadership studies from eight different countries and state that “Schools are dynamic organizations, and change in ways that cannot always be predicted” (Day and Leithwood (2007), p. 184). Open systems are a system in exchange of a matter with its environment (Bertalanffy, 1968). Schools are in this understanding not independent entities but parts of larger networks. The systems-approach calls for reframing leadership in education. There is no consensus yet on the kind of educational leaders that will be able to address these challenges. Fundamental questions are:

What kind of environment, society and economy do education leaders want for the future?

How can education leaders, staff, and learners co-create and shape that future together?

How do leaders in education work with system boundaries to prepare learners for future learning, lifework and well-being?

These fundamental questions imply that education leaders will need to have both systems and individual capabilities to prepare learners for the future. System capabilities include the ability to work beyond limitations of system boundaries (use of resources, human capital, learning modalities, and locus of learning) and create learning environments that effectively support these goals.

7 CONCLUSION

Successful education fulfils three purposes that depend on time and context: learning, lifework and well-being. An education system can be successful only if it is able to prepare students for the future – individuals who will work, continue to learn beyond graduation, and thrive in a changing society and environment. Macro-contexts such as the economic, social and environmental contexts of a nation largely determines the strategic directions for education. Accordingly, school leaders need to adopt visions, missions and practices that are aligned with the economic, social and environmental trajectories of the nation.

Our comparison of the concept of school leadership in the context of Singapore and other high-income nations points at some commonalities in terms of economic, environmental and social contexts. A shared feature is the desire for specific values, skills and knowledge for the future: skills mastery; life-long, life-wide and life-deep learning; innovation; the adoption of new technologies; digitalisation; mutual tolerance as well as sustainable lifestyles. To develop these values, skills and knowledge, school leaders should question existing assumptions of teaching, learning and leadership practices. Traditional paradigms no longer serve us well in the 21st century. Teaching, learning and leadership practices need to evolve in tandem with new circumstances. Lived experiences in schools that practice new paradigms of teaching, learning and school leadership allow students to be truly “educated”, rather than merely “schooled” in the 21st century. Although there are skills and values that evolve with changing circumstances, some purposes and

goals of education remain the same over time. These form a core of education. Mastery of content remains a foundation for all ages. Dynamic learning outcomes refer to innovation in how advanced mastery of content knowledge is used for addressing changing economic, environmental and social contexts.

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