Chapter 4 | Education: Pedagogy and Infrastructure

Mr. KHOUN Theara

Waking up on a morning in January 2040, Ret Mayuri (English nickname "Yuri") asks TimeSmart, a low-cost, time management robot, about her schedule for the day. The device tells her there is one science class for her to attend at Sisowath School from 10am to 12pm, two self-registered online courses on creative design and material engineering for her to resume, and a pending twelve-week collaborative project for her to work on. Consisting of a team of five students, the collaborative project on adjustable chair design is in response to a recent student feedback survey showing that some students are having difficulty sitting for long hours in the current school chairs. After school, Yuri searches on the internet for ideas, samples, and videos on adjustable materials and takes relevant online classes recommended by her class facilitator. She then syncs her collaborative works on KhmerKollab, a popular cloud-based platform, and makes an initial presentation using a hologram projector from her home to her teammates. Yuri then successfully produces four different prototypes of adjustable chairs to share with her friends, using a 3D printer available at the Student Lab. Her team then invites 20 students to try out the new chairs during their class. A week later she conducts an online survey with these volunteer students to learn about their experience, using an app on their e-watches. The result shows that only two students found all four prototypes uncomfortable, implying a tenfold decrease of complaints when set against the standard design. At the end of their project, Yuri and her teammates need to write an individual reflective paper in English, including the portfolio of their data, reading materials, and

raw files. Her team then uploads their project, prototype, and relevant information to Share9, a popular skill and problem-solving platform, to share their initiative with other netizens.

I. Future Education: Pedagogy and Infrastructure: The Ideal Scenario

Education as we know it has evolved. Assessment in 2040 is holistic and individualized, tailored towards the specific interests of the students. Class facilitators normally group students in projects based on their shared interests. Compulsory education covers five broad subjects – Khmer literature, foreign languages (English compulsory, and a secondary elective of Chinese or a Southeast Asian language), math and science, philosophy and ethics, and information and computer technology (ICT), based on various types of holistic student assessments in addition to the collaborative projects which usually takes a student 12 years to complete. However, some gifted students like Yuri can finish much earlier while students with learning difficulty may take a longer time than the average. Upon graduating from her compulsory education, Mayuri plans to undertake her advanced degree in Material Engineering which largely follows the same project-based format but specifically will prepare her to be a material scientist. In this new system, six main systematic reforms are envisioned:

- the integration of digital education and technology into the classroom;
- a model of bilingualism (Khmer and English);
- the adoption of facilitation-based education;
- the feature of project-based, collaborative, and real-world learning;
- integrated sensorial learning; and,
- individualized, holistic evaluations.

The successful implementation of these reforms will support the development of the skilled workforce needed to transform Cambodia's economy from being labor-intensive to knowledge based.

[I] Integration of digital education and technology into classroom

The ideal scenario is that by 2040, Cambodia's Ministry of Education, Youth, and Sports (MoEYS) will have fully integrated digital education platforms and affordable technologies to supplement the traditional education system. For more than 150 years, society has demanded students physically go to school. With disruptive technology and the rise of digital education, this may no longer necessarily be the case in the near future (Thomas Arnett, 2016, in Jukes & Schaaf, 2019). Presently, millennial students often find it more convenient and faster to put their questions into a search engine such as Google than ask their teacher (ibid.). Other online resources have also become increasingly more sophisticated, including, for instance, electronic books, cloud-based learning, learning apps, open online courses, educational games, personalized learning playlists, blended learning, video streaming, and interactive and virtual simulations. In many parts of the world, these resources have rivaled the ability of teachers and traditional curriculums to make learning engaging, fun, and memorable, and are gradually separating education from the physical buildings known as "schools" (Thomas Arnett, 2016 in Jukes & Schaaf, 2019, p.2-3). While the concept of schooling in the physical sense will retain relevance, the availability of personal digital devices and access to a huge amount of digital learning resources will augment the learning system. Such an integration of digital learning with an offline mode of knowledge delivery through affordable technologies is known as "blended learning". This approach has been adopted as best practice in some countries. Singapore, for example, in 2004 introduced the "Teach Less, Learn More" initiative that urges teachers to give priority to the quality of learning, with the incorporation of technology/digital education into the classrooms, rather than quantity of knowledge and memory-based exams (Ketchell, 2014). Studies show this innovative teaching and learning method helps students learn better and become more engaged in the subject compared with traditional modes of instruction (Hockly, 2018). Such systematic integration will allow students like Yuri to learn from anyone, anywhere, at any time, and at any pace to improve their competency in their core subjects, as well as their own personalized subjects and skills while using just a tablet or mobile device.

[II] Bilingualism

The 2040 ideal scenario is that Cambodia's compulsory education will cover four broad subjects: Khmer language, literature, and culture (for identity and sense of belonging), math and science (for their role in all scientific innovations), philosophy and ethics (for responding to skills demands including, for instance, ethics, critical thinking, interpersonal skills, and leadership), and ICT (for efficiency in work and communication). Only Khmer literature and culture will be taught in Khmer, with all the other subjects delivered in English. Bilingualism -- Khmer- and English-based education -- is essential for two main reasons. First, mastering a high level of English proficiency will give students access to a vast body of knowledge. As stated earlier, there are a huge amount of learning materials, including electronic books, apps, multimedia content and digital education platforms, available online across disciplinary subjects, but they are largely in English (Dao, 2018). In the early 2000s, a quarter of the world's population, or 1.5 billion people, were fluent or competent in English, followed by Chinese with 1.1 billion, and the trend is growing (Cristal, 2003, p.12). There is no incentive to translate all these resources into Khmer given Cambodia's small population. The second argument is that proficiency in English will prepare Cambodian students for the future of work, with seamless integration into the global production network, where English will likely remain the *lingua franca* for professional communication, thus opening up greater business opportunities.

[III] Facilitation-based education

In many education systems, teachers usually dictate the way they teach and generally avoid extended discussions, making the process a one-way communication (Ketchell, 2014). Evidence suggests that the teacher-centered education system makes students passive and lacking in self-confidence (Emaliana, 2017). In Cambodia in 2040, the concept of the teacher as it is understood today will be obsolete, with educators instead taking on the new role of "class facilitator". The two main functions of a class facilitator will be to rouse the curiosity of students and to improve their engagement, proactivity, creativity, and ability to absorb new knowledge. First, as the name suggests, a class facilitator is a mentor or facilitator who is willing to invest quality time in guiding students through their learning journeys. They will also take on other roles beyond the learning

environment, including supplying pastoral care and emotional support (Bateman, 2012, p.17). Second, a class facilitator should be an "expert generalist", not a specialist (Jukes, McCain, & Crockett, 2010, pp.79-88). Coined by Orit Gadiesh, an expert generalist is someone who has the ability and curiosity to draw on diverse knowledge and skills to recognize patterns, "connect the dots," and manage situations (Roberta, 2018). An educator will be required to have these qualities as they respond to students with diverse interests and talents and capitalize on their strengths and curiosity to unlock their full potential in solving real-world problems. For such an arrangement to be manageable will usually require small class sizes (Emaliana, 2017).

[IV] Project-based, collaborative, real-world learning

By 2040, project-based and collaborative learning will be integral to the Cambodian education system and act as the core assessment of a student's learning outcomes. Jukes and Schaaf (2019) contend that in the age of "InfoWhelm", in which information has become increasingly accessible, limitless, and overwhelming, memory-based facts and knowledge can be easily outsourced to electronic devices, and thus students can put greater focus on creation and application through project-based learning rather than the pure retention of factual knowledge. Given the complexity of global problems such as water pollution and poverty, having one specialized discipline will not be enough to tackle them (Jukes & Schaaf, 2019, p. 1). This poses one significant implication for the approach to education in that these complex issues usually require interdisciplinary solutions, whereby they cannot be solved alone but rather require a team effort in which different skill sets and roles are utilized.

[V] Integrated sensorial education

The approach to learning in 2040 will see students optimize the use of their five senses -- vision, hearing, smell, taste, and touch. In this regard, digital education and technology will require a supporting physical environment to operate within. Therefore, other tools will have been integrated into the new learning environment in Cambodia by 2040. These include play-to-learn tools including learning games and playgrounds; exposure to local communities and the natural environment through field trips and site visits; and the availability of the

Student Laboratories to undertake collaborative exercises. These sensorial tools combined will enhance students' learning by incorporating all five senses and translating this new knowledge and wisdom into the creation of applications to solve real-world problems. A recent study shows that this type of active learning helps students learn more and perform better in tests compared with passive lectures (Deslauriersa et al., 2019). Sensorial education has been integral in various education models, particularly the Montessori approach. Developed by Maria Montessori, it is a child-centered educational method based on scientific observations of children that has been widely used for more than 100 years in many parts of the world (American Montessori Society, 2019). Numerous studies have found that when implemented holistically, Montessori students generally outperform students from other types of schools not only in academic skills such as mathematics and science, but also in social skills deemed crucial in later stages of life (Dohrmann et al., 2007; Borman et al., 2003).

[VI] Individualized, holistic evaluations

When it comes to student assessment, age-based education and memory-based testing will be outdated across all levels of Cambodia's education system by 2040. Whether a student should move on to a higher level of education will be based on a variety of sophisticated competency yardsticks. Thus, talented students will be able to graduate earlier than the average student, while students who struggle will spend more time in compulsory education. The school curriculum has been traditionally organized along a one-size-fits-all mentality, operating on the assumption that students learn from the same materials, in the same way, and in the same timeframe. However, in reality, students neither have the same capacity nor do they share the same interests (Stein, 2019; Jukes & Schaaf, 2019). In this sense, curriculum and student assessments will be holistically designed, and tailored towards equipping learners with the skills of the future, both soft and hard. Evaluation tools will also broaden the perspective of the curriculum, allowing students to connect the dots, for example, as to how mathematics is related to music, art, material design, and social science. This will in turn make education more interesting, engaging, and relevant to the real world.

II. Scenario Space and Key Factors for Industrialization

Education provision in the future will largely depend on three main factors:

i. Supply and the substance and way in which education is delivered (teaching pedagogy and curriculum);
ii. Demand and the structure of the economy, which dictates the skills demanded in the future (future skills);
iii. Resources through which such an education delivery mode is made possible (education infrastructure and digital technology); and,
iv. Digital technologies and their widespread adoption across society.

According to the WEF's Human Capital Report 2017, Cambodia scored the lowest in ASEAN in educating and training its citizens into becoming a productive and competitive labor force. Cambodia ranked 92nd out of 130 countries in the human capital development index (WEF, 2017). Similarly, Cambodia ranked 146 among 189 countries in the UNDP's Human Development Index 2019, the lowest in Southeast Asia after Myanmar, whereas Singapore and Sweden remain consistently in the top 10 (UNDP, 2019). In a recent survey of 605 employers in Cambodia across industries, one-third of interviewees reported having encountered a skills gap, including a lack of foreign-language skills, technical skills, and communication skills, as well as collaboration and problem-solving skills (National Employment Agency, 2018). The findings regarding skills demand in Cambodia are generally consistent with global trends (see WEF, 2016; Florida, 2014). This can be seen as partly emanating from the kingdom's dropout rates. At primary level the dropout rate in Cambodia has increased from 7.2% in 2016 to 9.4% in 2017 (the World Bank, 2018). At lower-secondary school the rate is higher still with a rate of 19.2% in 2014-15 (MoEYS, 2016).

Supply: Teaching pedagogy and curriculum

While as a global trend, facilitation-based, student-centered learning has been embraced by many countries, the mode of delivery in public schools in Cambodia is presently largely one-way, teacher-centered instruction wherein teachers take on two main roles. First, they lead the classroom based on the core curriculum as designated by MoEYS. Second, teachers are generally experts in their

subject. For instance, a math teacher is trained only in math, and the same is true of teachers of Khmer literature; however, they may not be expert generalists who have the ability to help students understand the big picture or to connect the dots through facilitation-based learning.

This is, however, practical for two main reasons. First, with the current large class sizes, with an average 44:1 student-teacher ratio (MoEYS, 2017), student-centered learning is, in theory, not feasible (Emaliana, 2017). Second, the large number of low-quality teachers, especially in rural areas, also poses a legitimate constraint on modernizing teaching pedagogy. At slightly more than $200 a month in 2017, the pay is low, with teachers earning 60% less than other professions that require similar levels of education. Many teachers are forced to take additional, often low-paid, employment to support themselves, resulting in the quality of their teaching being compromised (MoEYS, 2015a; Sokhean, Sineat, & Amaro, 2017). As a consequence of poor remuneration, the profession often fails to attract high-performing students, with most trainee teachers attaining C, D, or E scores in their Grade 12 final exams, while private tutoring is still widespread (Tandon & Fukao, 2015). In the Teacher Policy Action Plan 2015, MoEYS has committed to increasing the salaries and other benefits for teachers based on performance to attract talent. The qualification needed for teaching is being increased to the minimum of a Bachelor's degree, while a fast-track program is being provided for existing teachers (MoEYS, 2015a). With respect to the curriculum, in its recently adopted Curriculum Framework for General Education 2015, MoEYS laid out a new vision in transforming the public school curriculum in response to global trends and changes in workforce demand, moving from memory-based, summative knowledge to higher levels of competencies and skills in application, analysis, and evaluation (MoEYS, 2015b). The curriculum framework is a key document for all stakeholders in developing important documents such as student textbooks, learning aids, guidelines for teaching and learning methods, and indicators of student learning outcomes (ibid.). Three significant changes to the old curriculum framework are the incorporation of international languages (English or French) from Grade 1 to 6 as core subjects, the integration of ICT classes from Grade 4 to 12, and the incorporation of life skills

from Grade 4 to 9. Additionally, curriculums will need to be developed around eight core competencies:

1. Literacy and numeracy
2. Foreign languages
3. Information and communications technology (ICT)
4. Communication and teamwork
5. Analysis and creativity
6. Applying knowledge and skills
7. Personal, family, and societal development
8. Entrepreneurship and leadership (MoEYS, 2015b).

However, a recent study by Khieng et al. (2016) found that such curriculum reforms usually get bogged down by under-qualified staff and vested interests. There was a plan, for example, to solve a problem with science textbooks by adapting Oxford University Press books at no additional cost; however, the proposal was shelved in favor of creating a large committee to handle the task. Another example is that of a small, competent team tasked with revising the chemistry curriculum that was quickly expanded to become a large committee of 50 people, many of whom had neither knowledge in chemistry nor of teaching pedagogy (ibid.). These cases illustrate the challenges to be faced when modernizing the school curriculum. In assessing the competency of students, MoEYS has committed to improving the system through regular classroom tests, national examination system reforms, preparing students for international tests such as PISA and Olympiad, and improvements to the school quality assurance system (MoEYS, 2014).

Resources: Education infrastructure and digital technology

In terms of education infrastructure, as a global trend, more digital platforms and technologies have become accessible, with more to become available in the future. Apart from these digital resources, there are a wide array of other disruptive and emerging technologies that have significantly changed the way students learn and will continue to do so. Below are four examples of technologies that will provide pioneering new teaching methods moving forward:

- Holographic, virtual reality (VR), and augmented reality (AR) learning experiences: These technological breakthroughs are a splendid add-on for online and physical learning in that they can give learners an immersive learning experience without the need for travel. Learners can wear VR headgear to immerse themselves in the Milky Way, for example, while medical students can follow complicated operations (Jobanputra, 2018).
- Games: Scenario-based games now have been integrated into various universities in the US and elsewhere as part of the training for nurses and engineers, and in the teaching of history and other subjects (TeachThought, 2015).
- 3D printing: Students can print basic prototypes, structures, and materials as part of the application of training to address real-world problems (TeachThought, 2015).
- Artificial intelligence (AI) integrated software: Such software can be used to improve language proficiency and detect plagiarism. It has even begun to grade students' essays with teacher-like accuracy (Jukes & Schaaf, 2019).

Looking at trends that will likely affect Cambodia, while very few people in Cambodia had a mobile phone in the 1990s given the high price, almost everyone could afford one as of 2016 (MPTC, 2016). Cambodian mobile phone subscription has already reached saturation, with 20.5 million subscribers in a population of only 15 million people (ibid.). As of 2016, internet subscription in the kingdom accounted for 7.16 million people, or approximately half the population, a sevenfold increase from 2011 (ibid.). With the highest internet coverage growth rate in the Asia-Pacific region, the Royal Government of Cambodia (RGC) expects 100% coverage of high-speed and affordable internet in urban areas and 80% in rural areas by 2020 (Xinhua, 2018). This promising trend will provide a feasible foundation for blended and other forms of digital learning through the integration of education technologies/platforms in the classroom.

Taking advantage of these technological advances, MoEYS has piloted two innovative programs, the New Generation Schools (NGS) model[2] and the E2STEM school as groundwork toward modernizing the Cambodian education system. Operational in 2015, NGSs are autonomous public schools with a mandate to innovate and improve educational quality, especially in the STEM subjects -- science, technology, engineering, and mathematics -- through access to high level of investment (MoEYS, 2016). After a competitive selection process, students in NGSs have access to a modern STEM curriculum, and cutting-edge textbooks and educational technologies, such as electronic lesson plans, science labs, and e-learning. They are also provided life skills education and interactive learning modules, including project work and subject clubs to provide them with the skills needed for the 21st century (MoEYS, 2016).

Demand: Future skills

Regarding future skills demand, this chapter will examine this from both the global and national perspectives. As a global trend, in the 2016 WEF report *The Future of Jobs*, more than one-third of skills (35%) that are considered important in 2020 will be replaceable by advanced robotics, self-driving transportation, AI, and machine learning in the Fourth Industrial Revolution. This requires everyone, including employees, employers, governments, and educators, to be proactive in up-skilling, unlearning, and retraining themselves and others. According to the report, the 10 most fundamental skills necessary in the future will be complex problem solving, critical thinking, creativity, people management, coordination, emotional intelligence, judgment and decision-making, service orientation, the ability to negotiate, and cognitive flexibility (WEF, 2016). In his seminal book *The Rise of the Creative Class,* Florida (2014) examines and classifies the modern workforce of a nation into four groups: agriculture, working, service, and creative. Creative class jobs are those professions that require "headware skills" in addition to hardware skills. Headware skills are abilities such as leadership, critical thinking, problem-solving, adaptability, productivity, accountability,

[2] Discussed thoroughly in Rath's (2020) chapter in this volume.

communication, information management, creativity, innovation, global citizenship, and collaboration. These are lifelong skills, not short-life ones that traditionally require the memorization of specific content knowledge as practiced in high-stake standardized tests and benchmark exams. Florida (2014) believes that short-life skills will quickly become irrelevant in the age of disruptive innovation and hyper-information.

In Cambodia, though such a global trend has yet to drastically materialize, the share of the labor force in agriculture has continued to shrink steadily from 60% in 2009 to less than 40% in 2017, whereas the share in industry increased from 17% to nearly 30% over the same period (National Institute of Statistics, 2018). The decline of the labor force in agriculture is the result of moves to larger-scale commercial farming and mechanization, as well as diversification to other economic sectors (ODC, 2015). Meanwhile, although an increase of the labor force in industry is plausible, it is predominantly in low-skilled industries such as manufacturing. In Cambodia, automation in the manufacturing industry will likely see the loss of thousands of jobs to machines in the coming years (Chea, 2019). Potential job losses to automation and machinery in agriculture and labor-intensive industries will be exacerbated by a projected population growth, and especially an aging population.

III. Policy Initiatives to Achieve the Ideal Scenario

To make the best-case scenario a reality, the following action plans are proposed at policy and implementation levels. During the initial phase, it is recommended that MoEYS establishes a governing council whose tasks are to harmonize and address the gap in existing policy frameworks and create action plans moving toward the best-case scenario. Under the council, it is advisable to have six subordinate committees to reform each of the features outlined in the best-case scenario. While they are independent, the committees should work closely and collaboratively under the governing council to design a new, holistic education system. This can be done by revising and capitalizing on the existing NGS policy based on clear, progressive indicators, feasibility studies, cost-benefit analysis, and monitoring and evaluation frameworks. The following proposals may assist the council with the direction of the reform agenda:

Feasibility of extensive digitalization of classroom

- Identify low-cost technology, digital learning tools, personalized learning apps and games, and online materials that can be used as supplementary aids for teachers and students. These resources should then be broken down into different sets for different levels of class. It could be argued that as a developing country, such digital education platforms and technologies are out of Cambodia's reach. However, there is cause for optimism for two reasons. First, most such electronic learning platforms, like Khan Academy, Coursera, and EdX, as well as collaborative platforms such as Google Suite, are generally available free or with low subscription fees. Second, while even technologies such as 3D printing are somewhat expensive for the time being, technological diffusion and transfer should make them affordable in the coming years.
- Provide flexibility for students in bringing their laptops, tablets, smartphones, or other mobile devices into the classroom. This will help public schools and the Cambodian government save day-to-day operational expenses and simultaneously improve students' learning outcomes and productivity as they use their personal devices (Jukes & Schaaf, 2019).

Financial sustainability

- Charge parents a modest school fee. Parents in the low-income threshold should be subsidized or have fees waived. In Cambodia, parents who can tend to send their children to private schools over public schools, perceiving a difference in quality. If public schools were to provide better quality education, a lot of parents would reconsider sending their children to private schools.
- Identify resources at public schools that could be monetized from various revenue sources, including, for example, parking fees, renting out the canteen, or possibly after-school classroom rental for private lessons. The revenues would need to be managed with transparency, accountability, and efficiency so they could be used to improve learning facilities and supplement teachers' basic pay.

Improvement of teaching competency

- Implement a vigorous approach to human resource management, retiring corrupt and unqualified staff through an effective education management system, as well as put an end to "shadow" education, in which educators teach private lessons. The problem with shadow education is that this often leads teachers to not put much effort into their school lessons so that they can provide private tutoring to their students instead. This is a corrupt and inefficient practice that needs to be addressed.
- Increase basic salary for teachers and provide performance incentives based on a list of indicators, including student assessment and teaching performance, to attract more talent to the teaching profession.
- Put significantly more effort into teacher recruitment. Having competent people on board would in itself greatly reduce weaknesses in education. The role of the new intakes and existing teachers should be framed as "class facilitator".
- Provide existing teachers and new intakes with intensive training in student-centered, facilitation-based instruction methods, digital education and the related tools, and supplementary English training. With regard incentives, salary supplements and other benefits should be contingent on their competencies in these digital tools, their English proficiency, and their ability to apply the new teaching pedagogy in the classroom.

Feasibility of curriculum and assessment restructuring

- The curriculum and student assessments should be holistically designed and tailored towards equipping learners with the skills of the future, including complex problem solving, critical thinking, creativity, people management, coordination, emotional intelligence, judgment and decision-making, service orientation, negotiation, and cognitive flexibility.
- Reduce the number of compulsory subjects to only five: Khmer literature, English language, mathematics, science, and ethics/philosophy, and increase the variability of elective courses to meet the different interests, needs, and talents of students.

- Adopt the Singaporean model in which English is the medium of instruction. Compulsory classes except Khmer literature should be given in English. Also, high-quality textbooks, such as Oxford Science Textbooks, should be consulted and contextualized into the new curriculum design.
- Integrate project-based learning into the classroom. Using Yuri's scenario, the learning outcomes of each student can be assessed from each collaborative project via a variety of methods: the acquiring of soft skills, such as the ability to work collaboratively as a team and presentation skills; obtaining hard skills, such as the quality of the project's content, and its feasibility and applicability, and evidence-based project outcomes; critical writing (through personal reflection); and general skills (portfolio filing). In this sense, students become more empowered, curious, and passionate throughout the learning process. Emphasizing the collaborative project also suggests that the core subjects in the curriculum should be limited to just those that are the most relevant for real-world applications.
- Incorporate a wide range of activities such as group work, student presentations, prototyping, and project implementation in addition to standardized tests to assess students' competency and their eligibility to graduate to a higher level. Holistic, individualized assessment also means a competency-based education can replace the traditional age-based division. The implication is that students who perform better can progress faster.
- Invest more in learning facilities, especially the learning lab, so that students can better understand the importance of various subjects, how they relate to one another, and how they can be applied in real life.
- Include periodic fieldwork and study trips as part of the curriculum.

Collaboration with non-state actors

- Maintain close and healthy collaborations with all stakeholders, especially local and international EdTech non-governmental organizations and startups, to provide greater efficiency in integrating digital education tools and recruiting qualified teachers. Teach for Cambodia, for

example, has recruited numerous potential teaching fellows to teach in rural areas, so this type of setup should continue to be embraced and leveraged.

IV. Education: Pedagogy and Infrastructure Under the Baseline Scenario: Business as Usual in 2040

The baseline scenario is the business-as-usual trend analysis, taking into account current and future trends collected from available data and resources. As a general trend, the Cambodian government has been committed to improving the quality of education. In 2019, MoEYS received the highest share of total national expenditure at 11.7% ($915 million), an 11% increase from the year before (MEF, 2018). Along this line, there is also an explicitly high level of political commitment to gradually reforming the education system. In the Rectangular Strategy Phase IV in particular, while education and human resources development stand as the first pillar of the rectangular strategy, the government boldly acknowledges that "the quality of higher education does not meet market demand and regional standards, as well as [there being] limited efficiency in the management and governance of higher education institutions." (RGC, 2018, p.21). The government estimated that only 42% of students finished Grade 9 in 2016 (PPP, 2018). As discussed in Section 2, failings have been acknowledged, and the determination to address them has been manifested by the adoption of numerous progressive policies in recent years, such as the Policy on Higher Education 2030, Teacher Policy Action Plan, New Generation School Policy, Curriculum Framework for General Education, Policy on Technical Education, and Education Strategic Plan. Following an analysis of these policies and extrapolating major trends, the quality of Cambodia's education will be substantially improved, but it is unlikely to be as competitive as that of Singapore's and other developed countries as of 2040.

First, there will be a moderate adoption of technology into the classroom setting. MoEYS has been gradually embracing low-cost technology and digital platforms, for instance, by adopting an electronic attendance system, equipping computers and basic electronic devices across public schools, integrating basic ICT classes into the curriculum, and creating online portals such as the Krou website. These

portals provide supplementary teaching resources, videos, images, and games for teachers at all levels and disciplines to assist with their offline teaching (KTD, 2019). However, the rate of such adoption and technology diffusion is still relatively slow, especially as regards ICT infrastructure, such as LCD projectors, smart boards, suitable computers, high-speed internet bandwidth, and other low-cost technologies essential for blended learning.

Similarly, there still will not have been any guidelines put in place for students and teachers to adopt blended learning or consult with freely accessible online platforms and digital textbooks, such as Khan Academy and Coursera, to supplement mandatory classes, especially in math, science, and English. In other words, while there are emerging trends regarding education modernization and digitalization, they appear not to have been fully utilized to an optimal efficiency. Therefore, based on this trend, modern education models such as NGS will be difficult to scale up nationwide by 2040 without additional, credible interventions.

Second, the teaching pedagogy will be largely teacher-centered. Based on various policy reviews, especially the General Curriculum Framework 2015, there appears to be no policy or action plan in place to transform teaching pedagogy from teacher-centered to student-centered, and this trend may hold until 2040. As discussed earlier, teacher-centered pedagogy, by design, generally cannot provide students with the soft and hard skills required for the 21st century workforce as effectively as the student-centered approach.

Third, in terms of curriculum development, based on the General Curriculum Framework, Cambodian education in the coming years will continue to be driven by an inflexible, one-size-fits-all curriculum, while there is a slight chance of project-based learning pedagogy to be adopted nationwide. While there are justifications for a rigid curriculum structure, the pitfalls are that it cannot be tailored toward individualized students' interests and talents.

Fourth, as specified in the framework, there is a plan outlined to bring forward the teaching of foreign languages—English and French—into compulsory primary school education, from them currently only being taught from Grades 7 to 12. However, this approach could be dubbed the "soft integration of

bilingualism" in that all other subjects, except for languages, are still taught in Khmer. This could result in students facing challenges when doing individualized online learning or engaging in a professional working environment at a later stage if they do not possess strong enough competency in English.

Fifth, with the current rate of investment and as a matter of projection based on the available data and government policies, most public schools will be able to access a moderate use of experiential and sensorial learning tools and infrastructure by 2040. In informal interviews, several high school students said they generally learned STEM subjects such as math, chemistry, and physics by rote, but generally had no idea of the applicability and usefulness of what they had memorized. As a result, they quickly lost interest in STEM, tending to choose social science majors at university instead.

Experiential and sensorial learning through the availability of the required laboratory tools and field trips to communities and the natural environment on a periodic basis would enable students to connect the dots to make sense of the world and help them conceive and devise appropriate ideas and solutions to address the problems facing the modern era.

Sixth, a wide array of standardized, one-size-fits-all tests will still be used as the primary instrument to assess student performance and their suitability to move to a higher grade. There are two major setbacks with standardized testing. First, it operates on the assumption that students learn at the same pace, while this has been proven not to be the case. Instead, as discussed earlier, age-based, standardized testing can demotivate gifted students, with them quickly lose interest and passion. Second, it cannot be used to evaluate the skills needed for the 21st century, such as collaboration skills and leadership, and students' real competencies, for instance, their ability to apply the knowledge gained.

If the baseline trends were to be followed, Cambodia's education system and human capital would be improved to some extent, but they would still lag behind those of neighboring Thailand and Vietnam. As discussed earlier, there are a host of reasons why this would be the case. For example, with a limited use of affordable technologies and digital education, together with Khmer-based instruction, students would continue to struggle with independent learning and

access to the world of knowledge. Equally important, with a teacher-led classroom setting and standardized assessment, students would not be able to master the skills demanded by the 21st century, including critical thinking, leadership, and collaboration.

With many jobs likely to be replaced by machines and AI, it is critical that these essential skills are provided to ensure the smooth integration of the Cambodian labor force into the future of work and to inspire life-long learning. While there are some efforts being undertaken by education startups and non-state actors such as Future Forum, Edemy, Teach for Cambodia, and Liger Leadership Academy to bridge the gap, the reforms needed cannot go far without a holistic revision of the education system.

References

American Montessori Society. (2019). Why choose Montessori education? Retrieved from American Montessori Society: https://amshq.org/Families/Why-Choose-Montessori

Bateman, D. (2012). Transforming teachers' temporalities: Futures in an Australian classroom. Futures, 14-23.

Bateman, D. (2015). Ethical dilemmas: Teaching futures in schools. Futures, 71, 122-131.

Borman, G. D., Hewes, G. M., Overman, L. T., & Brown, S. (2003). Comprehensive School Reform and Achievement: A Meta-Analysis. Review of Educational Research, 73(2), 125-230.

Chea, V. (2019, June 20). Manufacturing sector prepares for Industry 4.0. Retrieved from Khmer Times: https://www.khmertimeskh.com/50615769/manufacturing-sector-prepares-for-industry-4-0/

Cristal, D. (2003). English as a Global Language (2nd edition). Cambridge: Cambridge University Press.

Dao, K. (2018, August 14). 4 reasons why learning English is important for our students. Retrieved from Kwah Dao: http://kwahdao.org/4-reasons-why-learning-english-is-important-for-our-students/

David, S. (2018, November 20). New Generation Schools discussed at parliament meeting. Retrieved from Khmer Times: https://www.khmertimeskh.com/552520/new-generation-schools-discussed-at-parliament-meeting/

Deslauriersa, L., McCartya, L. S., Millerc, K., Callaghana, K., & Kestin, G. (2019). Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. Cambridge: Havard University.

Dohrmann, K., Nishida, J., Gartner, A., Lipsky, D., & Grimm, K. (2007). High school outcomes for students previously in a public Montessori program. Journal of Research in Childhood Education, 22(2), 205-2017.

Emaliana, I. (2017). Teacher-centered or Student-centered Learning Approach to Promote Learning? Jurnal Sosial Humaniora, 10(2), 59-70.

Factmaps. (2019). PISA Worldwide Ranking – average score of math, science and reading. Retrieved from Fact Maps: http://factsmaps.com/pisa-worldwide-ranking-average-score-of-math-science-reading/

Florida, R. (2014). The Rise of the Creative Class: Revisited. New York: Basic Books.

Hockly, N. (2018). Blended Learning. ELT Journal, 72(1), 97-101.

Jobanputra, K. (2018, May 30). Top 6 Educational Technology Trends Right Now. Retrieved from eLearning Industry: https://elearningindustry.com/educational-technology-trends-top-right-now

Jukes, I., & Schaaf, R. (2019). A Brief History of the Future of Education: Learning in the Age of Disruption. California: Corwin.

Jukes, I., McCain, T., & Crockett, L. (2010). Understanding the Digital Generation: Teaching and Learning in the New Digital Landscape. Kelowna: Corwin.

KAPE. (2019). Annual Report 2018. Phnom Penh: KAPE.

Kelsall, T., Khieng, S., Chantha, C., & Muy, T. T. (2016). The political economy of primary education reform in Cambodia. ESID Working Paper No. 58.

Ketchell, M. (2014, 02 12). Why is Singapore's school system so successful, and is it a model for the West? . Retrieved from The Conversation: http://theconversation.com/why-is-singapores-school-system-so-successful-and-is-it-a-model-for-the-west-22917

KTD, see Kampuchea Thmei Daily

KTD. (2019, March 30). Ministry of Education introduces the first electronic attendance system [Unofficial translation]. Retrieved from http://kampucheathmey.com/2016/archives/1042478?fbclid=IwAR3aZKdcbnOnI1rhqct6Y6C22erO0xpp3Avblyzmc0QaJR3iOeYG1p4U5ig

Martin, E. (2015, February 2). Education in Cambodia. Retrieved from Phare Circus: https://pharecircus.org/education-cambodia/

MEF, see Ministry of Economics and Finance

MEF. (2018). Budget in Brief: Fiscal Year 2019. Phnom Penh: MEF.

MoEYS, see Ministry of Education, Youth and Sports

MoEYS. (2013). Policy on Technical Education. Phnom Penh.

MoEYS. (2014). Education Strategic Plan 2014 - 2018. Phnom Penh.

MOEYS. (2015a). Curriculum Framework of General Education and Technical Education. Phnom Penh: Department of Curriculum Development.

MoEYS. (2015b). Teacher Policy Action Plan. Phnom Penh: MoEYS.

MoEYS. (2016). Policy Guidelines for New Generation Schools. Phnom Penh.

MoEYS. (2017). Public Education Statistics & Indicators 2016-2017. Phnom Penh.

MPTC, see Ministry of Post and Telecommunication

MPTC. (2016). Fact Sheet: Telecommunication Sector. Ministry of Post and Telecommunication.

National Employment Agency. (2018). Skill Shortages and Skill Gaps in the Cambodian Labour Market: Evidence from Employer Survey 2017. Phnom Penh: NEA.

National Institute of Statistics. (2018). Cambodia Socio-Economic Survey 2017. Phnom Penh: NIS.

ODC, see Open Development Cambodia

ODC. (2015, April 3). Labor. Retrieved from Open Development Cambodia: https://opendevelopmentcambodia.net/topics/labor/

PPP, see Phnom Penh Post

PPP. (2018, October 31). 'Reimagining education' to face 21st century challenges, says Princess Beatrice of York. Retrieved from Phnom Penh Post: https://www.phnompenhpost.com/supplements-special-reports/reimagining-education-face-21st-century-challenges-says-princess

RGC, see Royal Government of Cambodia

RGC. (2018). Rectangular Strategy Phase IV. Phnom Penh: RGC.

Roberta, N. (2018, November 28). Expert generalists. Retrieved from UX Collective: https://uxdesign.cc/expert-generalist-f2a15eab400a

Schaaf, R. (2014, 6 24). 100 Things Students Can Create to Demonstrate What They Know. Retrieved from Teach Taught: http://bit.ly/2AhWckm

Sokhean, B., Sineat, Y., & Amaro, Y. (2017, October 6). Teachers' wage rally blocked. Retrieved from Phnom Penh Post: https://www.phnompenhpost.com/national/teachers-wage-rally-blocked

Stein, Z. (2019). Education in a Time Between Worlds: Essays on the Future of Schools, Technology, and Society. San Francisco: Bright Alliance.

Teach Thought. (2015, July 13). 10 Specific Examples Of Emerging Educational Technologies. Retrieved from Teach Thought:

https://www.teachthought.com/the-future-of-learning/10-specific-examples-of-emerging-educational-technologies/

TransferWise. (2017, 07 18). The Singapore education system: An overview. Retrieved from TransferWise: https://transferwise.com/gb/blog/singaporean-education-overview

UNDP, see United Nations Development Program

UNDP. (2019). Human Development Index 2019. Retrieved from UNDP: http://hdr.undp.org/en/composite/HDI

WEF, see World Economic Forum

WEF. (2017). The Global Human Capital Report 2017. World Economic Forum.

World Bank (2018). World Bank in Cambodia.

World Economic Forum. (2016). The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. WEF.

Xinhua. (2018, June 19). More than half of Cambodians use Internet: Telecoms minister. Retrieved from Xinhua: http://www.xinhuanet.com/english/2017-03/31/c_136174417.htm