Foundational (K-12) Education System: Navigating 21st Century Challenges

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Acknowledgments

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Executive Summary

The foundational education system commonly referred to as K-12 (kindergarten to grade 12) is fundamental for people to succeed in life.[1] Decades of investment have helped the K-12 sector evolve and respond to new demands, but much of its traditional thinking has remained. This hinders its agility and disruptive evolution. In most countries, the national school education system is perhaps the largest single enterprise and is subject to sociocultural, economic and political influences. The system can therefore be difficult to change.

However, as the world transitions from industrial revolution to information revolution and now to knowledge economy, the foundational education sector has been confronted with several simultaneous challenges.

- While access to K-12 education has improved significantly, globally, there are still millions of children out of school, especially among marginalised communities.
- As noted in the World Bank's World Development Report 2018, the learning crisis seems to be a bigger challenge then increasing access to education. A related issue is the relevance of what children are taught.
- Educators must package an exponentially increasing body of knowledge while working within rigid time-bound structures and facing diverse expectations.
- In the midst of a plethora of new pedagogies, educators face the challenge of integrating new understandings of human learning into teaching and learning practices.
- New delivery modalities, some involving technologies, include many options and innovations for educators to consider.
- Technology and data can be used to support governance and performance management and to increase accountability in foundational education.

The monograph reviews and analyses how these challenges may be addressed in a system that is reliant on traditional rigid time frames and complex external pressures that are blurring the boundaries of the school education landscape. It is apparent that doing more of the same may not provide the necessary solutions. There is a need to explore new opportunities for reforming the school education space, including system structures, human resources, curriculum designs, and delivery strategies. This analytical work critiques current practices to encourage K-12 educators to recognise the need to evolve and embrace disruptions in a culture that tends to be wary of change. The key considerations identified through this analytical work are presented below as a set of recommendations captured under four broad areas commonly used in school improvement literature.

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[1] Article 26 of the Universal Declaration of Human Rights states: "'Everyone has the right to education." Since its adoption in 1948, the world has changed significantly, and it is thus time to review the challenges confronting the K-12 school education system in the 21st century.

Recommendations

Governance and Systems

Recommendation #1:
Learning about the general effectiveness of education interventions is not enough. Policy makers and researchers need *systematic reviews* that provide an unbiased assessment of what works and why, by identifying relevant empirical studies and synthesising quantitative and qualitative evidence in ways that are easily accessible to decision-makers and practitioners.

Recommendation #2:
While decentralisation, school-based leadership and governance have been part of the K–12 reform agenda for some time, the impact to date has been mixed. Appropriate evidence-based support is required for structural and functional changes to be understood and implemented as core business. There is an urgent need for detailed job descriptions for principals and for the provision of the training and capacity development needed for them to effectively perform their role. The 21st century, whole-school improvement approach is new, thus clarity of delegation of roles and functions together with rigorous monitoring and accounting mechanisms is necessary.

Recommendation #3:
Adoption of new planning, financing, and monitoring approaches such as medium-term expenditure framework (MTEF) and performance-based planning and budgeting require clear actions, performance indicators and targets, together with appropriate monitoring and reporting mechanisms. To support transitions to these new approaches, considerable capacity development of policy makers and managers at central headquarters and at national agencies is necessary to ensure the required expertise is available to design and implement educational reforms through evidence-based decision-making.

Curriculum and Learning Progression

Recommendation #4:
Due to the exponential growth in the quantum of knowledge, the ubiquitous nature of knowledge and diverse expected outcomes, careful consideration is required regarding what is included in the K–12 education system. Also, the structure of the learning progression must be aligned with 21st century development and human capital needs. It must focus on
(i) big ideas in the disciplines and *nurture interdisciplinary, critical thinking and authentic problems*; and (ii) the ability to develop and adopt and transfer knowledge and skills—key attributes of 21st century K–12 school education.

Recommendation #5:
The structure of the K–12 system to support optimum learning

progression needs to be based on cost-benefit analysis research. One size fits all may not work given the varying levels of readiness and affordability of education in developed and developing countries. The temptations to copy developed economies or to overload the curricula with unrealistic aspirations should be avoided.

Recommendation #6:
Infrastructure investments for K–12 are expensive, hence, a need exists for very careful study of long-term demand analysis, design options for flexibility of use, consideration of alternative delivery sites, shared spaces for learning etc. Equity of access versus equal facilities, maintenance and replacement of equipment, and a sustainable supply of consumables to support high-quality learning opportunities are important considerations for a 21st century K–12 education system.

Recommendation #7:
Review and revise the use of traditional assessments for sorting and tracking students, and gate-keeping entry to academic tracks and universities. Appreciate the purpose of and use national assessments and school-based assessment to monitor learning quality and changes happening to high-stakes testing. National policies for assessment need to include knowledge, applications and dispositions, and be designed and implemented by experts working across national agencies. Assessment data can then also be used to monitor the performance of specific programs and where necessary, appropriate action can be taken to enhance student learning outcomes.

Teacher Development

Recommendation #8:
In light of the increasingly fragmented plethora of micro-pedagogies, a more informed selection of high value pedagogies and classroom practices is required to optimise the effectiveness of time on task and student learning outcomes. The use of student-centred, inquiry-based pedagogies in classrooms and formative assessments should be encouraged to help develop analytical, self-directed learners.

Recommendation #9:
Adopt standards-based teacher training for pre-service training to monitor the quality of programs delivered by private and public service providers. Align programs with international norms for inclusion of discipline knowledge, pedagogy, curriculum and practice teaching, and external quality assurance. Support research and scholarship in teaching to continuously monitor service providers for quality and to encourage the adoption of evidence-based best practices.

Recommendation #10:
Adopt demand-driven continuous professional development (CPD) for teachers, based on external performance monitoring and aligned with national standards for teachers. Facilitate knowledge sharing between public and private CPD providers and adopt a quality-based, competitive approach (including online hybrid models) for selection and delivery of CPD service providers. Incentivise self-directed, self-investment and resourced-based continuous professional development of teachers.

Recommendation #11:
Infrastructure investments to support pre- and in-service teacher training require objective evaluation of lessons learned from previous reform initiatives, and options to use Information and Communication Technology (ICT) to support teachers' professional networks. Consideration should also be given to the design and supply of teaching and learning resources linked to the CPD to maximise the value of professional network infrastructure investments.

Recommendation #12:
Given the increased number of self-funded people graduating with higher education qualifications and looking for work in many DMCs, there is a need to review traditional recruitment, training and supply of future teachers. Means of incentivising targeted cohorts (such as rural teachers, and senior maths and ICT teachers) need to be considered to ensure the ongoing supply of well-qualified teachers.

Teaching and Learning resource

Recommendation #13:
Teaching and learning resources and particularly textbooks have always been a core part of the K–12 education system. Recognition of the need to improve their quality, modernise their content and include supplementary learning resources to provide additional/alterative perspectives to concepts and processes is gradually increasing. Cost-effective but high-quality options should also be considered, including hard copy plus online/offline ICT based Open Education Resources (OERs), and hybrid models of providing learning opportunities, plus providing access to good libraries. The singular focus on textbooks has limited systemic consideration of alternatives.

1: Background and Context

Decades of development partner support for the education sector have increased access to K–12 (kindergarten to Grade 12) education services. In 2011, 95% of all eligible children in the Asia and Pacific region were enrolled in primary schools.[2] Net enrolment rates for primary education in the region ranged from 87% in the Pacific to 93% in South and Southwest Asia to 98% in East and Northeast Asia.[3] During this period, the number of children out of school dropped by almost 50% mainly due to increased school enrolment in South and West Asian countries. Whereas secondary education enrolments vary significantly. For example, Brunei Darussalam, Japan, Kazakhstan, New Zealand and the Republic of Korea report enrolment rates around 90%, while the Lao People's Democratic Republic, Pakistan, Solomon Islands and Timor-Leste have enrolment rates below 45%.[4] Gender parity is excellent for primary education, but is imbalanced in favour of boys for secondary and tertiary education, except in Sri Lanka, Brunei Darussalam, Mongolia, and Kazakhstan where females out number males. One of the reasons for poor enrolment in secondary education has been the perceived lack of relevance which in turn influences consideration of opportunity costs for student to join the workforce, albeit often in the informal sector. Thus, increasing secondary participation rates it is not just about increasing access but equally about the quality and relevance of the education services.

While most ADB developing member countries (DMCs) have achieved reasonable success in increasing access to school education, many are facing serious gaps in student learning outcomes—the World Bank calls it the learning crisis.[5] Half of the students in Grade 5 in India cannot do two-digit subtraction or read connected text, and half of the students who complete primary school in Bangladesh and Pakistan cannot read.[6] The challenge now for DMCs is to improve the quality of learning outcomes and prepare students with 21st century knowledge, skills and dispositions. Competing public and private (community and individual) goals of schooling have existed for decades,[7] but the tension between the public and private purposes of schooling has become more significant with the blurring of boundaries between formal and informal learning. These competing expectations are further confounded by communication technology innovations and the evolving expectations to meet both social ideals and facilitate individual student growth and development. The endless series of pedagogical reforms, curriculum/program reforms, and financing and governance reforms seem to have missed the quality and relevance outcomes. There is an urgency to rethink ways of improving the quality of school education and to consider innovative practices underpinned by the use of technology, the involvement of non-public sector experiences and

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[2] Statistical Yearbook for Asia and the Pacific (2013).

[3] Ibid.

[4] (UNESCO UIS, 2019).

[5] https://www.worldbank.org/en/news/immersive-story/2019/01/22/pass-or-fail-how-can-the-world-do-its-homework.

[6] World Bank. (2018). Learning to Realize Education's Promise. Washington, DC: The World Bank.

[7] Labaree, D. F. (1997). 'Public Goods, Private Goods: The American Struggle Over Educational Goals', *American Educational Research Journal*, 34(1), 39–81. doi: 10.3102/00028312034001039.

partners, and drawing on contemporary research evidence to inform future investment in the K–12 education system.

A large percentage of secondary students in all DMCs do not progress to university. In Sri Lanka, approximately 30% of secondary graduates enter university[8] and in Azerbaijan less than 40% of secondary school graduates enter higher education institutions.[9] The K–12 program must be mindful to create alternative opportunities for students who do not seek the higher education pathway. Current alternatives through Vocational Education and Training (VET) programs seriously lack quality—they are under-developed, poorly resourced and not aligned with contemporary industry skills and/or entrepreneurial skills to engage with the emerging market opportunities. Lack of high-quality opportunities after basic education contributes to the low enrolment in secondary education. Many DMCs are currently reviewing their VET program to better situate it within the K–12 program, not as a second chance program, but as a high-quality alternative pathway to acquire contemporary and future industry skills.[10]

As DMCs transition to a knowledge economy, adopt technological innovations, deal with increasing within and cross-border tensions, and navigate the Covid-19 pandemic, the ability to access knowledge (to read, interpret and make personal sense) is even more important than before. K–12 education provides foundational knowledge and skills enabling individuals to become self-directed and make personal decisions and be innovative regarding life choices, citizens' rights, financial issues, technological innovations and adapting to the economic changes that occur over their lifetimes. Returns to primary education in India increased during the Green Revolution, with the more educated farmers having the ability to adopt and diffuse new technologies.[11] There is extensive evidence showing a high correlation between basic education cognitive learning outcomes and inclusive growth and economic development.[12] The push for high quality and relevant K–12 education outcomes requires more than investments to increase access, the World Bank points out that 'schooling is not the same as learning'[13]; this posits a challenge for all education stakeholders. Indicators such as years of schools and access to education may no longer be sufficient. As investments are in make in k-12 education it is important to recognise the differences in education ecosystems prevalent in advanced versus developing countries. Better quality physical facilities (classrooms, lab equipment); better qualified and prepared human resources (teachers and principals); and better home environments and family support can have a huge impact on learning outcomes. Therefore, value addition to the K–12 education system through continued investment is much higher than in developed countries. While at the same time, a one size fits all approach has unintentionally homogenised the global K–12 education landscape. All DMCs do not have to push that frontier through innovation, but they need widespread quality and relevant basic education to absorb and adapt the technologies that are already available

[8] Dundar, H., Millot, B., Riboud, M., Shojo, H., Aturupane., H., Goyal, S., and Raju, D. (2017). Sri Lanka Education Sector Assessment: Achievements, Challenges, and Policy Options. The World Bank Group, Washington DC.

[9] Source: Education, Science and Culture, SSC Statistical Yearbook, 2017 and the Ministry of Education.

[10] DMCs such as Sri Lanka, Azerbaijan, Cambodia, and Viet Nam are reforming the VET sector to attract high performing students to diversify and grow their economies.

[11] Hanushek, Eric A., Guido Schwerdt, Ludger Woessmann, and Lei Zhang. (2017). 'General Education, Vocational Education, and Labor-Market Outcomes over the Lifecycle', *Journal of Human Resources* 52 (1): 48–87.

[12] Hanushek, Eric A., and Ludger Woessmann. (2008). 'The Role of Cognitive Skills in Economic Development', *Journal of Economic Literature* 46 (3): 607–68.

[13] World Bank. (2018). Learning to Realize Education's Promise. Washington DC: The World Bank.

globally. Finally, high quality and relevant K–12 education generates benefits for individuals and societies. For individuals, education raises cognitive abilities and emotional abilities such as self-esteem, and furthers opportunities for employment and earnings and a better life style. For a country, it helps to strengthen institutions within societies, drive long-term economic growth, reduce poverty, and spur innovation.[14]

As an aside, many DMCs have also embarked on pre-school education for children aged 2–4 years. However, there is much confusion about the purpose of pre-schools.[15] The delivery modalities also vary from being either 100% public or private/Non-government organization (NGO) provided, or public-private/Non-government organization (NGO) partnerships supported by government subsidies. Consequently, the uptake of pre-schools by DMC governments and by parents is mixed and can benefit from more evidence-based advice. A recent report by the Independent Evaluation Group[16] based on a meta-analysis of pre-school investments to date, provides interesting insights that may guide future support for this sub-sector. While pre-school is not the focus if this paper, the above is worth noting when considering the overall school education costs and planning the supply chain for the K–12 education sector. Many DMCs are struggling to provide high quality K–12 education services within current budgets, therefore, adding three years of pre-school with no corresponding increase in the education sector funding stretches the limited resources, risking regressing the quality of K–12 education services.

Against the above background and acknowledging the emerging quality and relevance challenges for K–12 education products and services, this paper will review and provide analytical discussions on high priority intervention options. The World Bank[17] argues that factors that impede learning are unprepared learners due perceived lack of relevance and lack of foundational knowledge, unskilled and unmotivated teachers, limited and out-of-date teaching and learning resources, ineffective school management and governance, and school inputs that do not support quality of teaching and learning. Added to the above is recent experience from the coronavirus pandemic which has challenged the traditional delivery modalities warranting consideration of more agile and responsive approaches to deal with natural and man-made disaster situations.

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[14] OECD, Eric A. Hanushek, Ludger Woessmann. (2015). *Universal Basic Skills: What Countries Stand to Gain*, OECD Publishing, Paris, https://doi.org/10.1787/9789264234833-en.

[15] In the mix of diversified expectations is the growth and expansion of pre-school education which started as childcare centres for mothers returning to work and progressed to an educational agenda. There is need for clear direction based on evidence—what is the purpose of pre-schools? Are they childcare centres to help mothers return to work; are they play centres combined with facilities to provide appropriate nutrition and mental health support for children in conflict zones and dysfunctional families in the developed economies; are they informal play centres for general socialisation; or are they education centres that are an extension of the formal school system? In Finland, for example, pre-schools are playful learning centres (combining childcare with learning by playing), whereas, in Singapore and Australia, they are more formal with their own curriculum, and thus more an extension of the formal school education system.

[16] Jeffery C. Tanner, Tara Candland, and Whitney S. Odden. Later Impacts of Early Childhood Interventions: A Systematic Review. Working Paper 2015/3. Independent Evaluation Group, World Bank.

[17] World Bank. (2018). Learning to Realize Education's Promise. Washington DC: The World Bank.

2: What to Learn: Knowledge, Skills and Disposition for 21st Century

The exponential growth in knowledge,[18] confounded by competing and diversified private and public expectations, is now challenging the traditional school system which has been slow to embrace change. The continuous innovations in technology, in professional practices and the way we live in the 21st century, make it difficult to apply curriculum theories that evolved in the previous century to serve highly planned economies.[19] In planned economies, anticipated jobs and associated knowledge competencies could easily be identified; therefore, school curriculum could be aligned to address the national human capital demands. However, in a market-oriented system, the continuously evolving and leap-frogging economies of today make it difficult to develop school curriculum for specific professions and anticipated jobs. Undertaking more K–12 curriculum reforms based on planned economy models will only exacerbate the poor quality and irrelevance of the current education system and greater disconnect with a rapidly changing world.

In the 21st century education system there is an increasing interest in developing appropriate soft skills[20] and dispositions to prepare citizens to be agile, productive and live together in harmony as national and global communities. This focus on soft skills has led to a growing emphasis on character skills[21] that encompass "agency, behaviors, dispositions, mind-sets, personality, beliefs, [and] non-cognitive skills".[22] Many high-income countries have been advocating inclusion of 21st century knowledge and skills in the K-12 curriculum, assessments, and instruction, but few have successfully adapted and embraced the required change and, prepared teachers who understand how to teach and assess these skills in the classroom.[23] K–12 curriculum reform initiative requires new lenses to appreciate some of the fundamental disruptions that need to be addressed. Figure 1 is an illustration of the 21st century curriculum model.

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[18] Sarvi, Jouko & Pillay, Hitendra (2015). *Innovations in Knowledge and Learning for Competitive Higher Education in Asia and the Pacific.* Asian Development Bank, Mandaluyong City, Philippines.

[19] Wagner, D.A. (2018). Learning as development: Rethinking international education in a changing world. New York: Routledge.

[20] These skills are important for collaboration, communication, working in teams and problem solving and creativity etc. These 21st century skills are required for the workforce and good citizens, because they regulate inter-personal interactions and intra-personal reflections (UNESCO, 2014).

[21] Fadel., M. Bialik., B. Trilling (2015). Four-Dimensional Education: The Competencies Learners Need to Succeed, Center for Curriculum Redesign, Boston, MA 02130, USA.

[22] Venture capitalist Mary Meeker- said: "We are awash in data, but lacking connectivity and insight." The risk of not being able to connect the dots and make sense can lead to a different model of slavery—captive to talk shows and advocacy groups. https://www.weforum.org/agenda/2020/07/how-covid-19-ended-the-information-era-and-ushered-in-the-age-of-insight/?utm_source=sfmc&utm_medium=email&utm_campaign=2726669_Agenda_weekly-24July2020&utm_term=&emailType=Newsletter.

[23] Care, E., Kim, H., Vista, A and Anderson, K. (Nov. 2018). Education system alignment for 21st century skills: Focus on assessment. Center for Universal Education at the Brookings Institution. USA https://www.brookings.edu/wp-content/uploads/2018/11/Education-system-alignment-for-21st-century-skills-012819.pdf.

KNOWLDGE
"What we know and understand"
Interdisciplinarlty
Traditional (i.e. Mathematics)
Modern (i.e. Entrepreneurship)
Themes (i.e. Global Literacy)

21st Century Education

SKILLS
"How we use what we know"
Creativity
Critical Thinking
Communication
Collaboration

CHARACTER
"How we behave and engage in the world"
Mindfulness
Curiosity
Courage
Resllience
Ethics
Leadership

META-LEARNING
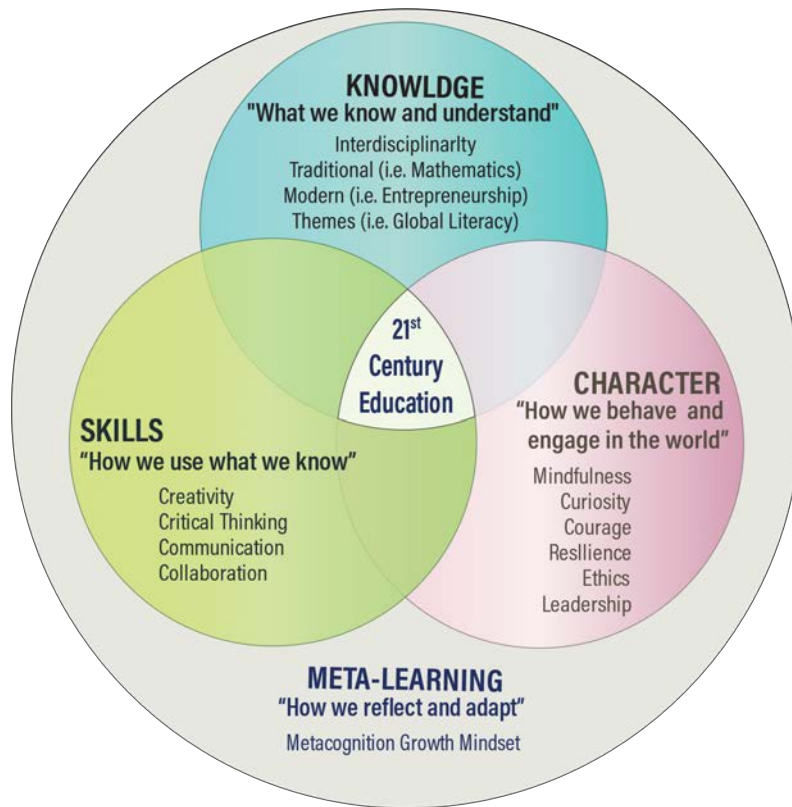"How we reflect and adapt"
Metacognition Growth Mindset

Figure 1. A Coherent Curriculum Framework for 21st Century Competencies
(Center for Curriculum Redesign, Boston, MA, US)

In Figure 1, the knowledge domain goes beyond traditional disciplines to focus on core concepts, big ideas, meta-concepts, and interdisciplinary themes such as systems thinking and digital literacy. The skills domain emphasises 21st century skills: critical thinking, creativity, collaboration, and communication. Character skills add features of motivation, values, ethics, courage, morality, and leadership that moderate how knowledge and skills are implemented, while meta-learning emphasises how students need to plan, evaluate, and regulate their own thinking and actions to accomplish their goals. The four dimensions are intertwined to emphasise the holistic nature of desired education services and provide an excellent framework to guide the redesign of K–12 curricula. Alvin Toffler's (1970) widely quoted observation that "the illiterate of the future will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn" is still very appropriate.

In parallel with the above, there is need to move beyond child-centred approaches to learning, to new human capacities such as self-directed and life-long learning so that individuals can construct personal meanings and stay ahead of the curve and remain current in these continuously evolving and uncertain times. We have witnessed a need for such capacity during the covid-19 pandemic, to navigate miss-information, conflicting messages and construct personal meanings. The emphasis should be more on the ability to apply knowledge and skills to new and emerging contexts; develop agility to transfer knowledge and principles to new applications. This requires a flipped Blooms taxonomy (see Figure 2) approach applied to curriculum design where the emphasis on routinised knowledge and skills should be diminishing in school programs and the ability to understand and transfer knowledge and skills are now most sought-after capabilities. This is a significant disruption, and while it may be urgent for senior secondary students soon to exit the K–12 systems, the cumulative nature of these knowledge, skills and required disposition warrants adjustments to learning progression throughout the K–12 systems.

Finally, there is increasing demand for "transferable" or "transversal"[24] competencies which encompass skills that can be applied across m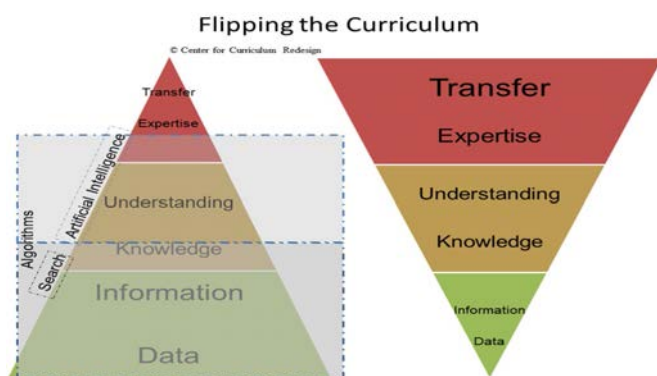ultiple current situations plus in evolving situations in the future. This change in focus disrupts the current push for highly contextualised knowledge which started in the late 1980s. [25] Over-emphasis on the context limits an individual's ability to appreciate how the same knowledge and skills may be equally useful in other contexts—one of the key competencies for 21st century. Similarly, the importance of learning the underlying principles and experimenting with authentic learning experiences and integrated skills such as those seen in STEM programs are considered key capabilities to be effective in the 21st century world.

Figure 2. A flipped Blooms taxonomy for new curriculum design (Center for Curriculum Redesign, Boston, MA, USA)

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[24] Care. E & Luo, R. (2016). Assessment of Transversal Competencies: Policy and Practice in the Asia Pacific Region. Published by the United National Educational, Scientific and Cultural Organization, Paris. ISBN: 978-92-9223-562-8

[25] Jean Lave and colleagues from Harvard and UC Berkeley argue that knowledge is best acquired when the learning occurs in the context where it is generated. Lave, J., & Wenger, E. (1990). Situated Learning: Legitimate Peripheral Participation. Cambridge, UK: Cambridge University Press. They created the concept of situated learning which emphasised the importance of context in the learning process. This was rebutted by Anderson, J. R., Reder, L. M., & Simon, H. A. (1996). 'Situated Learning and Education', *Educational Researcher* 25(4), 5–11. https://doi.org/10.3102/0013189X025004005 who said that all knowledge is not situated and there is a real need for knowledge to be transferable across tasks, and training by abstraction and use of principles is not limited by context thus allowing effective instruction to be achieved for complex, social environments. In each of the above cases, Anderson et al., say that the claims are overstated and that some of the educational implications that have been taken from these claims are misguided.

3: What Children Currently Learn in K-12

The K–12 curricula in most DMCs were designed to serve planned economies and over the years have been tweaked to revise and modernise the content. The changes were often applied in a fragmented manner creating misalignment between subsections of the K–12 systems. New knowledge and skills were added to existing curriculum with little consideration of learning progression and/or value addition and relevance. Often these additions were driven by external political and lobby group influences. As a result, school curricula in most DMCs are overloaded and are continuously getting reorganised to satisfy external requirements rather than to prepare productive citizens for the 21st century. Pritchett and Beatty[26] argue that as consequence, there are curriculum design gaps in Asian and African countries where constant tweaking of curriculum outpaced students' mastery, resulting in shallow learning for most students. Curriculum design is not a simple matter of adding new things to an existing overloaded K–12 curricula, it requires meaningful research and consultation to appreciate how the changes will respond to new and emerging human capacity demands and benefit the students and the country. DMCs need to prioritise what will deliver maximum return on their investment rather than adopting fanciful practices from developed economies without have sufficiently developed the necessary foundational capacities.

There is need for new lenses to understand and accept what the 21st century school curriculum should look like. The continued focus on memory recall of routinised procedures, factual content of single subjects and rehashing old knowledge prevents exposure to authentic applications to appreciate the recognition and transferability of new knowledge such as alternative energy, climate change and Information communication Technology (ICT) application across subjects. Finland[27] is leading the development of a thematic curriculum to facilitate a more trans-disciplinary and authentic learning experience. Other countries like Singapore and Australia are researching lessons from Finland and elsewhere as they continue to evolve their K–12 curricula. The 21st century capabilities are driven by interdisciplinary and trans-disciplinary approaches that require students to combine knowledge and thinking skills across disciplines as they try to solve "real-world" and authentic problems.[28] Twenty-first century human capital development requires a new mix of capabilities such as the ability to identify underling principles in constructs and processes, to transfer knowledge to new contexts, to integrate multiple scientific principles to create new meaning and understanding, to appreciate knowledge embedded in practice, and to be self-

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[26] Pritchett, L., & Beatty, A. (2012). The negative consequences of overambitious [and overcrowded] curricula in developing countries. HKS Faculty Research Working Paper Series RWP12-035, John F. Kennedy School of Government, Harvard University. http://nrs.harvard.edu/urn-3:HUL.InstRepos:9403174.

[27] https://www.oph.fi/sites/default/files/documents/new-national-core-curriculum-for-basic-education.pdf. Also see Monbusho (2001). The education reform plan for the 21 century – The Rainbow Plan: The seven priority strategies, Tokyo: Ministry of Education, Science, Sports and Culture, for integrated curriculum reform in Japan.

[28] A good example is the current push for STEM education. The assumption is STEM will have an interdisciplinary approach, yet most countries are still teaching STEM as a collection of discrete subjects, thus missing very important links between science and the economy, science and wellbeing, and science and green energy.

directed and life-long learners. In particular, the curriculum should develop capacities to become continuous and life-long learners which will be a central feature of 21st century capabilities, particularly given the continuously evolving nature of most economies.

DMCs that emerged from a colonial past, such as Sri Lanka and Nepal, still use the old General Certificate of Education O-level and A-level curriculum with few changes to the original design. Ironically, the United Kingdom where the General Certificate of Education curriculum originated has completely overhauled the General Certificate of Education curriculum for use in the United Kingdom. Singapore on the other hand uses the General Certificate of Education O- and A-level curriculum and assessments but has reformed it to address its local human capital demands. Similarly, in the Commonwealth of Independent States (CIS) countries there is a desire to move to a K–12 model, but the legacy of the Former Soviet Union prevails. Uzbekistan tried to transform their school system to a K–12 model, but apparently, they are now considering going back to the familiar 1–11 system. Others, like Azerbaijan and Armenia, still use the grades 1–11 system inherited from the former Soviet Union, but are considering their options, particularly given their aspirations to be aligned with the EU. The K–12 model will help them benchmark against and seek external validation from EU countries. The Philippines has transitioned to a K–12 system to provide equivalence and support student mobility across the Asia and Pacific region. Transition to a K-12 system with a 21st century program will require some fundamental changes that may not be easy but are essential and will require sustained commitment from governments, as can be seen in the Philippines.

Apart from the national K–12 curriculum, there are other curriculum models also used in many DMCs.[29] For example, the International Baccalaureate[30] (IB) schools and other similar international schools offer the Australian, European Union or United States curriculum for those seeking to pursue further studies in these countries. While these curricula provide alternatives, they are viewed as elitist by the respective national education systems and, hence, limited knowledge transfer occurs between these alternative schools and the public school system. Armenia has the Ararat Baccalaureate and the United World College Baccalaureate curriculum[31], but neither share much with the Ministry of Education. Similarly, there is vertical curriculum design, Marzano's design thinking curriculum which, combined with the alternative local knowledge noted above, may help the public school system to learn and strengthen the K–12 curriculum.

Pritchett[32] argues that prioritising diverse expectations of an education system, amidst an exponential growth in knowledge, is a very difficult challenge for many developing countries, particularly when school education is often captured by political and ideological values. We know from lessons learned in recent development projects that doing more of the same will not achieve the desired reforms.

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[29] Models such as design thinking which started in the US; discovery based (Montessori); authentic problem/scenario based; and theme based (Finland's new approach). These are across traditional subject boundaries. The traditional competency- or outcomes-based curriculum can be very structured and often encourage linear thinking.

[30] https://www.ibo.org/globalassets/what-is-an-ib-education-2017-en.pdf.

[31] http://araratbaccalaureate.am/en/home; and https://uwcdilijan.org/learning/ib-diploma-programme/subjects-offered.

[32] Lent Pritchett, 2019. Keynote – Addressing the learning crisis: First things first. ADB Skills Forum, Manila.

Thus, deciding how best to reform the K–12 curricula to address 21st century knowledge and skill demands requires disruptive thinking.[33] Unfortunately, in most DMCs the K–12 curriculum planners are subject content experts and not familiar with the broader human capital development requirements. The challenge for curriculum developers will be to select what constitutes core basic knowledge that prepares and allows students to continuously expand their knowledge and skills and give them the ability to apply basic knowledge to new and emerging contexts and merge with new content knowledge as necessary. Thus, curriculum designers will need to balance essential and desirable subject content and determine how to fit public and private expectations into the timeframe available on the school calendar. While building on essential core discipline knowledge (for example, language, arts and humanities, mathematics, and science), the 21st century capabilities should also be embedded into the school curriculum.

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[33] Disruptive thinking requires new lenses to not only understand but see value in new practices—new ways of doing things. An example of not being able to implement disruptive thinking can be seen in the Indonesian Ministry of Education and Culture efforts to develop a new curriculum in 2013 (called K13) to modernise the school education system. It specified competencies in each subject area in terms of knowledge, skills, and attitudes of the students. Despite the good intentions, a review in 2016 found complex and overlapping objectives; overcrowded curriculum with too many tasks for teachers; the same old conventional topics in different formats; voluminous textbooks with information overload; and a curriculum misaligned with exams. This occurred mostly because people were reluctant to change.

4: Learning Progression Pathways

The curriculum design is influenced by children's development stages and the complexity of the content knowledge to ensure the content is within the Zone of Proximal Development[34] of the learner. Traditionally, the most common structure to map the learning progression has been: kindergarten, primary and secondary levels. Travel and safety concerns associated with young children travelling far to get to school, meant that kindergarten and primary schools were usually located close to home communities. A number of primary schools would then act as feeder schools to a common secondary school which requires more specialist library and workshop facilities, thus are comparatively more expensive. However, this structure has evolved in different ways—we now have pre-school (ages 2–4); kindergarten for 5-year-old children; primary school for grades 1–6; lower secondary or middle school for grades 7–9; secondary school for grades 10–11 and higher secondary for grades 12–13.

The rationale for having the various sub-structures is to help children better mediate socio-emotional adjustments as they transition from one level to the next. Transition from home to school is supported by school readiness programs such as kindergarten which is now expanded to pre-school. Transition from primary to secondary schools is affected by socio-`psychological adjustments and now may include junior secondary/middle years as a means to break this progression into more manageable steps. While these intermediate steps may have merit, there is little research evidence to support that having additional stages increases the learning outcomes, retention or participation rates.[35] There is a need to better understand the value addition achieved by having the various sub-structures, because the more sub-structures we create, the more categories of specialised teachers, buildings and facilities, curriculum designs, textbooks and learning materials, leadership teams and management overheads, are required to accommodate the various levels. A thorough 'Return on Investment' analysis is necessary to determine what is an optimal structure and one that provides an appropriate level of access, safe progression and promotes quality learning outcomes.[36] This is particularly important when education sector funding is not increasing as anticipated, yet the demands made on the K–12 system are increasing exponentially.

In most countries, the K–12 curriculum has pathways to either continue academic studies or to pursue vocational education and training (VET) programs. These pathways are typically accessible after grade 9 (for K–11) and grade 10 (for K–12). Some countries have adopted a dual system—with separate VET and academic programs—whereas others have integrated VET subjects within the K–12 as electives in the final two years of the school education system. Traditionally, VET programs were designed for non-academically oriented students (a second chance program) to take up craft and trade programs and, thus, have attracted a

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[34] The zone of proximal development (ZPD), is the difference between what a learner can do without help and what he or she can do with help. It is a concept developed by Soviet psychologist and social constructivist Lev Vygotsky (1896–1934).

[35] International Initiative for Impact Evaluation (3ie). https://www.3ieimpact.org/evidence-hub/publications.

[36] Australia had pre-school/primary/secondary and then went to pre-school/primary/middle years and secondary. After few years of trial, having spent a lot of money, they could not see the value of the latter so reverted to pre-primary/primary/secondary.

stigma which still is attached to VET programs. While VET has often been treated as a separate education sub-sector, the articulation between K–12 and VET has been a challenge. As we move to 21st century industries, the VET sector is increasingly being driven by information technology and other rapidly evolving technologies and practices, making traditional craft-based VET curriculum rapidly obsolete. Given the significant shift in what constitutes 21st century VET programs and providing meaningful progression from general education to VET, including involving significant input from industry, may require serious disruptions to the traditional craft type VET programs, associated infrastructure and equipment, and human resources.

In light of the increased quantum of knowledge, skills and dispositions expected in K–12 curriculum, along with the simultaneous demand to accelerate the human capital development process, there is need for innovative thinking to accommodate expectations and better sequence learning progression within a fixed school calendar. Determining essential foundational knowledge to support an effective and efficient learning progression through the various stages of the formal K–12 curriculum is a complex process and often underestimated by education planners and policy makers. The challenge of accommodating the ever increasing expectations may require additional time thus, options such as expanding the number of days of schooling was debated in the 1990s,[37] and more recently US Senator Harris[38] floated the idea of a longer school day, but neither was favourably received. Countries such as the Republic of Korea and Japan have fewer days of formal K–12 education but use after-school tutoring to fit in special activities to support formal learning progression and meet expectations. Given the increased access to information and opportunities to learn outside the formal school system, recent research[39] suggests leap-frogging learning by adopting a hybrid learning environment to embrace learning opportunities outside the traditional formal system; a wider profile of educators to include peers, community, parents, industry experts, museum curators, and librarians; and to identify foundations of quality teaching/instructional practices by re-defining teaching standards, outcomes and teacher professional development. This research is forward thinking and will disrupt traditional K–12 systems, but to accommodate the ever increasing expectations within a fixed and overcrowded calendar it provides an alternative for the 21st century education planners. However, there is need for rigorous research to develop deeper understanding of its efficacy and how best to operationalise the leap-frogging. This is particularly important given the mixed results of decades of investment in K–12 curriculum reforms. The education ecosystem in many low-income countries (LICs), low and middle-income countries (LMICs) and middle-income countries (MICs) can be very different, therefore, many of the assumptions and system capabilities for leap-frogging may not be ready and need to be developed first before embarking on any leap-frogging. The International Initiative for Impact Evaluation (3ie) team

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[37] Aaron Benavot. (1992). 'Curricular Content, Educational Expansion, and Economic Growth', *Comparative Education Review* 36(2) (May, 1992), pp. 150–174.

[38] https://www.motherjones.com/politics/2019/11/the-school-day-is-two-hours-shorter-than-the-work-day-kamala-harris-wants-to-change-that/.

[39] Learning to Leapfrog: Innovative Pedagogies to Transform Education, Policy Brief, Sept 2019. Presents summary of a report written by David Istance and Alejandro Paniagua. https://doi.org/10.1080/00393541.2017.1368286

calls for a need to engage in objective analysis of 'evidence gap'.[40] While there is much research about what should be included in 21st century school curriculum, not much evidence-based research is available to advise how to accommodate all expectations and implement the curriculum reforms.

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[40] International Initiative for Impact Evaluation (3ie). https://www.3ieimpact.org/evidence-hub/publications. Evidence Matters policy brief is based on 3ie working paper #20, 'Quality education for all children? What works in education in developing countries' (2013) by Shari Krishnaratne, Howard White and Ella Carpenter.

5: Assessment / Examination

The complementarity of curriculum and assessment cannot be emphasised enough. Constructive aligning of K–12 curriculum, assessment and teaching practices is often missed because of fragmented approaches adopted to reform each of these key components.[41] A key feature of sound curriculum is an accompanying meaningful assessment regime. A comprehensive assessment of students learning outcomes (processes and final results) requires a combination of school-based assessment (aka continuous assessment) plus national examinations. School-based assessment (SBA) broadens the scope of assessment to include learning activities such as science laboratory projects and social science group projects as a percentage of the final grade, which can reduce the stress of 100% high-stakes examinations. However, this is not easy to implement as teacher and school biases can impact the trustworthiness of the assessment results. To ensure equity and fairness, complex and costly moderation may be necessary. One way to mitigate such biases when dealing with large student numbers is to conduct sample-based moderation. This course of action could in turn raise concerns about the capacity of examination departments to implement sample-based moderation, and about trust in the system. Many DMCs have trialled SBA and achieved mixed results, largely due to not having the capacity and capability within the existing examinations agencies to implement and institutionalise appropriate SBA policies and procedures.

SBA is often confused with formative assessment, but these are different things. SBA contributes towards the final summative assessment, whereas formative assessment is a key aspect of good pedagogy as it informs the feedback[42] loop in teaching and learning process. Formative assessment,[43] despite being a critical aspect of good pedagogy, is often given limited attention in all teacher training reform initiatives. In an e-learning environment, intelligent analytics can provide formative assessment feedback to students at appropriate stages within a program of instruction. Recent developments in Artificial Intelligence (AI) are developing the feedback capacity and exploring how an e-learning system may learn the sorts of feedback valued by students and self-refine and provide such feedback. One of the most salient competencies of teaching is the ability to provide timely and clear formative feedback to students, yet it is often missing in most teacher training programs.

The other issue with assessment and examinations is the ability to develop good examinations that can comprehensively and fairly evaluate student learning outcomes and also provide good diagnostic data about the K–12 education system. Well-designed examinations have the capacity to provide disaggregated data such as which parts of the curriculum are well taught and understood by students or otherwise. The analysis of the

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[41] See Professor John Biggs' Constructive Alignment and the Presage, Process and Product (3-P) Model of School Education System.

[42] Hattie, J. (2012). Visible learning for teachers: maximizing impact on learning. NY: Routledge.

[43] Nancy Frey, John Hattie and Douglas Fisher, 2018. Developing Assessment-Capable Visible Learners, Grades K–12: Maximizing Skill, Will, and Thrill.

examination data should be able to identify which subjects/topics and processes are better understood by different subgroups of the student population, such as males/females, by region/districts or urban/rural cohorts etc. There is need to develop capacity to use examination data to learn about the system's effectiveness, as can be seen in Program for International Student Assessment (PISA) results. Analysis of examinations data can help develop appropriate support mechanism for areas showing weakness. For example, such information can help better target in-service and teachers' professional development programs; and additional teaching and learning materials to help supplement teachers' knowledge and competency to deliver meaningful lessons.

Ongoing issues in examinations, such as reducing the number of memory recall questions and increasing the number of questions that test reasoning and application abilities, remain a concern in many DMCs. In addition, those designing future exams need to be cognizant of the need to include soft skills necessary for 21st century economies. This may require new complimentary approaches to assessment to understand how to include soft skills in the final student assessments. The need for continuous skill-upgrading of staff to develop test items to cover all aspects of learning outcomes is a challenge for examination experts, not only in many DMCs but also in developed countries. In many DMCs, the examination directorate does not only deal with K-12 examinations, but also other examinations such as the public service examination, civil service examinations plus other professional qualification examinations. This very broad role of the examinations office limits specific competencies for designing meaningful K–12 examinations that can provide details to evaluate the system as well as the student learning outcomes. Finally, the sensitive and confidential nature of examinations data requires good security and a high level of systems integrity to prevent leakage and malpractices. To ensure the above, many examination directorates in DMCs are located under the highest level of government and not any line Ministry. This inadvertently creates problems in accessing examination results data for research and analysis. There is a need to develop a mechanism to share de-identified examination data for performance evaluation of K–12 systems.

Despite the recent innovations in ICT applications as a tool for assessment, not much has not been adopted and trialled by the DMCs. IT applications such as optical scanners for marking multiple choice, learning analytics built into Learning Management Systems (LMSs) to provide formative assessments to evaluate content and learning outcomes, and Turn-it-in software for checking plagiarism (given the increased easy access to information on the internet) are being trialled in higher education but not so much in the K–12 systems. This is a greenfield area for research and development as IT has potential to help improve the assessment and evaluation systems.

6: 21ˢᵗ Century School Teachers

The quality of the K–12 education service is much dependent the quality of teachers. Over the last decade, significant reforms have targeted teachers, but in light of the continuous change and the evolving diversified expectations of schools, continued investments in the capacity development of teachers will be necessary. Teachers need to be trained to effectively introduce the 21ˢᵗ century curriculum noted in the previous section. They need to be trained in new pedagogies, content knowledge and evolving education expectations to implement the new curriculum. However, the traditional approach of mandatory site-based annual CPD programs may no longer be effective. A standards-based pre-service program supplemented by demand-driven continuous professional development should be adopted. The CPD should be a joint responsibility between individual teachers and the MOE and include a mix of targeted intensive in-service programs plus continuous self-directed learning.

Teacher Quality and Supply

Teachers are key to improving the quality of the education system, yet they remain an enigma to education systems all around the world. The system cannot do without them but it has always been a challenge to prepare and retain high quality teachers in the system.[44] The rapid expansion of K–12 resulted in the emergence of different models of pre- and in-service teacher training and qualifications within countries.[45] While diversity can be good, a possible consequence is it creates a large 'teacher variance'[46] within the teaching cohort in a country. Managing this variance to ensure a minimum quality is achieved in the country may be addressed at the national level, as it is in many other professions, by developing minimum national professional standards[47] for teachers. Such benchmarking of teacher quality will not only promote national equivalence and recognition but also support teacher mobility within and across countries. Given the increase in both public and non-public teacher training providers, ensuring minimum national teacher professional standards[48] is essential to consistently produce teachers of above minimum quality standards.

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[44] Eric A. Hanushek, Marc Piopiunik, Simon Wiederhold. (2019). 'Value of Smarter Teachers: International Evidence on Teacher cognitive skills and student performance', *Journal of Human Resource* (54)4.

[45] In Armenia, they have: Teach for Armenia, UNICEF program, Araratian Baccalaureate (AB) teachers; the National Institute of Education programs, Pedagogy University programs; Comprehensive University programs (Yerevan State University); and United World College teacher programs. The situation is similar in many other countries.

[46] The most convincing within-country studies show that teacher impacts on student reading and maths performance differ greatly and a huge variation in teacher value-add exists (Hanushek and Rivkin, 2012).6. See also Boote, D.N. (2006). 'Teachers' professional discretion and the curricula', *Teachers and Teaching: theory and practice*, 12(4), p 462.

[47] These are not qualifications to join the civil service or teacher registration requirements, but teacher professional competencies as applied in the classrooms.

[48] Pillay, Hitendra K., Muttaqi, Iqbal Aziz, Panth, Yagya Raj, & Herath, Nihal (2017). Innovative strategies for accelerated human resource development in South Asia: Teacher professional development – special focus on Bangladesh, Nepal, and Sri Lanka. Innovative Strategies for Accelerated Human Resource Development. Asian Development Bank, Mandaluyong City, Philippines.

One of the challenges in adopting a national teacher standards approach is getting an agreement with teacher training institutions to comply. The history and political capture of the teacher training and retraining institutions, pedagogic universities, National Institutions of Education (NIEs) unfortunately, prevent these institutions from evolving as can be seen in developed economies. In most DMCs, teacher training institutions offer degree programs and are considered Higher Education Institutions (HEIs) yet they are not governed by and subject to the Higher Education Law and Quality Assurance process and procedures.[49] These teacher training institutions, being under the Ministries of Education do not respond to a national teachers standards developed by higher education quality assurance agencies thus have little external scrutiny of the quality of their programs, the academic staff and graduates. There is need of significant political will and sustained reform to modernise the teacher training institutions and their programs. In parallel, many comprehensive universities in the DMCs have established Faculties of Education that also provide teacher training programs, but these can be very different to what is provided in institutions that are under the Ministry of Education.

As discussed in sections 2 and 3 above, supplying well trained teachers to K-12 levels, such as middle years and pre-school, often requires separate programs and qualifications for each level of the K–12 system. The more levels created the more fragmented and difficult it becomes to develop and deploy high quality teachers for all levels. The benefit or value addition of having so many levels of specialised teachers needs to be carefully evaluated because it can be expensive and restrict teacher deployment across the different levels. It can create barriers to having overlapping appointments between different levels (particularly in small and/or remote schools) and the transfer of teachers between levels. The continuous changes in school structure and curriculum also have a direct impact on the ability to develop and supply high quality teachers for all levels (pre-school, primary, middle years, secondary, and senior secondary school teachers). Education planners need to undertake an evidenced based cost-benefit analysis to appreciate what is essential and what is desirable before creating special categories of teachers, particularly when the education sector budget is not increasing to match the additional costs.

In some countries, teachers are recruited first and then given a scholarship for initial training, considered to be in-service training, thus incurring costs for a salary plus a scholarship. At the same time, in many of the same countries, there is a large number of self-funded graduates who are unemployed. A large percentage of the unemployed graduates are from education faculties, yet they are not considered for teaching positions. There is a need to explore more efficient and effective mechanisms to recruit and train teachers and to leverage the availability of self-financed unemployed graduates in many DMCs. There are also models such as "Teach for Armenia" and "Teach for Nepal" where non-teacher education graduates with a high level of discipline knowledge are recruited and provided short, intensive teacher training to prepare them to teach in schools. In both of these cases, the classroom learning activities improved, but there is a high attrition rate among these teachers. While teacher

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[49] Historically, in most DMCs, a significant percentage of teacher training has been done by training institutions established under the Ministries of Education. For example, in Indonesia the Balai Pelatihan Guru, Pusat Peninkatan dan Pelatihan and the LPMPs; in Bangladesh, the primary teacher training institutes (PTI) and the secondary teacher training institutes (TTI); in Sri Lanka, the National Institute of Education (NIE) and National College of Education (NCoE) are both under the Ministry of Education; and in Central and Western Asian countries like Armenia and Azerbaijan, the pedagogic universities and teacher training and retraining institutions.

turnover has been considered a constraint, perhaps, the traditional concept of teaching as a life-long career may be changing. As seen in many other 21st century professions, multiple careers are not uncommon and it could be a good thing to have some new injections of enthusiasm and innovative instructional practices every five years, if that can be sustained.

In many DMCs, as a norm, to manage recruitment of quality teachers, a minimum qualification of a 2–3-year diploma in education is required for kindergarten and primary teachers and a graduate qualification is required for secondary teachers. However, in reality the minimum qualification policies are not enforced for various reasons such as inability to attract appropriately qualified teachers to rural and remote schools and the political capture of the local teacher recruitment process. For instance, in Sri Lanka, only 40% of grade 10 (O-Level) teachers are graduates and a large percentage of primary teachers do not have the required diploma qualification.[50]

Likewise, the concept of supporting teachers by providing teacher resource centres, education training centres, teacher training centres, teacher computer training centres etc.[51] has not been very effective in improving teachers' professional competencies and consequently student learning outcomes. Most of these infrastructure investments comprised meeting rooms with almost no resources and many are either not used at all or underutilised and poorly maintained. Future support for improving the quality of teachers should focus on providing practical and classroom focused teaching and learning resources and not just empty infrastructure. Consideration should be given to partnering with local municipalities or universities to strengthen the library services by uploading teacher development and teaching and learning reference materials onto their systems. This will also strengthen the sustainability of the library facilities; as multiple users have a vested interest in making it work.

Teacher Development Programs and Training Institutions

Currently, teacher development programs in the SE Asian region for primary education range from Cert in Ed to DipEd to BEd and MEd. For secondary education, they range from (3+1) BSc/BA plus PGCE or PGDE to (2+2) BEd – two years of discipline and 2 years of pedagogy and 1–2 year MEd.

While the 2+2 BEd programs may be suitable for K–primary teachers, they lack sufficient coverage of discipline knowledge for secondary teachers. The increased quantum of knowledge and diversified expectations of secondary education is further impacting the preparation of high quality teachers. The two years of discipline knowledge in BEd pre-service university programs is considered insufficient time to prepare high quality teachers as these programs have abstract theoretical knowledge about human learning, limited practice

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[50] Providing Quality Teachers for all Classrooms in Sri Lanka, Policy Insights, 12th February, 2018. Institute of Policy Studies of Sri Lanka.

[51] Pillay, Hitendra K., Muttaqi, Iqbal Aziz, Panth, Yagya Raj, & Herath, Nihal. (2017). Innovative strategies for accelerated human resource development in South Asia: Teacher professional development – special focus on Bangladesh, Nepal, and Sri Lanka. Innovative Strategies for Accelerated Human Resource Development. Asian Development Bank, Mandaluyong.

teaching and often disconnected with the curriculum and everyday classroom practices.[52] In some DMCs, a large percentage of the training program context is allocated to general education to make up for the poor level of secondary education of the teacher trainees. Consequently, the trend in secondary education in many EU countries and in Australia is going back to the 3+1 model to ensure teachers have sufficient levels of discipline knowledge. Given the increased quantum of knowledge, the challenge for teacher educators is to decide what to include in the teacher training programs to provide the foundation knowledge and skills on which teachers may continuously upgrade through a life-long learning process. The split between pedagogy, discipline content, practice teaching and interpreting and applying the curriculum in everyday classrooms in teacher training programs is getting crowded by other *'general education'* subjects in most teacher training programs.

In an attempt to accelerate the impact of investments in teacher capacity development, most development projects have focused on upgrading teachers in the system through in-service training. This may have benefited the teachers in the system but not the new trainees, thus not addressing the source of poor quality of teachers. Pre-service programs in many DMCs still produce traditional teachers, using the old programs and obsolete pedagogies. This became very evident during the COVID-19 pandemic when remote teaching was required but teachers lacked the agility to be responsive. If the pre-service training is reformed to encourage teachers to self-learn and be adaptive, then the extent of in-service training required may be reduced significantly and allow the special in-service training to be better targeted. Limitations in the pre-service program cannot be remedied by offering endless in-service professional development programs. There is need for a more systemic and sustainable approach to supporting teacher quality improvement which must include pre-service training with innovative pedagogies and delivery modalities.

Given the diverse expectations, exponential growth in knowledge and growing plethora of pedagogies, teacher educators need to be pragmatic and go back to basics—to focus on things that have the greatest impact[53] on student learning outcomes. Teacher quality requires a balance between the scope and depth of professional knowledge and capacities. Trying to overreach and cover every new pedagogy and education practice can be overwhelming for teachers and teacher developers and can become a distraction and a hindrance. There is a push to accommodate populist concepts and procedures (that lack rigorous empirical evidence), such as the many new pedagogies and specialised practices that may apply to small special groups instead of the majority of the student population. There is a place for special groups and special pedagogies, but they may not be very effective in designing the mainstream education system. The core teacher development concepts and their assumptions need to realign to a centrist approach and not target 'outlier cases' involving small special groups. Focusing on outliers and the lowest common denominator risks regressing the system, instead, targeted intervention may be more effective for special and outlier cases. In addition, a consequence of the sudden expansion of teacher training providers, warrants a close scrutiny of the relevance and appropriateness of the competencies of the teacher educators. Many teacher educators in DMCs are still situated in

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[52] For example, despite many DMCs adopting STEM policy and curriculum, teachers are still unable to explain how the concepts are integrated and link to authentic everyday experiences to make learning meaningful and facilitate knowledge transfer across subject areas. This is because insufficient time in training programs is allocated to develop deeper understanding and application of STEM knowledge and practice.

[53] Lent Pritchett, 2019. Keynote – Addressing the learning crisis: First things first.

the past practices of the industrial models of education and training, thus risk perpetuating old practice and hinder the transition to 21st century pre-service teacher training.

In recent years, there has been a push for K–12 teachers to have higher qualifications including post-graduate degrees. For instance, at a huge cost, Indonesian government supported all teachers in gaining a graduate qualification (S-2 qualification in the Indonesian classification) but found this did not improve the quality of teaching or of student learning outcomes. The lesson from Indonesia is that simply credentialing teachers through low quality training programs is not effective. Sri Lanka is considering leap-frogging primary school teachers from a Cert-in-Education to a bachelor's degree; they may benefit by reviewing lessons from Indonesia[54]. It may be prudent to upgrade teachers' qualifications; however, it must be more than just credentialing, it must provide knowledge and skills that adhere to some national teacher professional standards. The assumption is teachers with higher qualifications should be better teachers but there is no evidence that post-graduate qualifications, in particular, improve student learning outcomes in the classroom. Post-graduate programs can be useful, however, if one seeks to specialise in specific areas such as school leadership and management or subject leader/coordinator for science, technology or IT curriculum etc.

Despite the current pre- and in-service training provided to teachers in all DMCs, the variance in teacher quality within schools, regions and national systems is huge.[55] Effective teaching requires committed, empowered, active agency to exercise discretion in routine classroom practice. This requires appropriate training and support at both pre- and in-service levels to develop capabilities to recognise and leverage formal and informal learning opportunities for children in the K–12 system.[56] New innovative pedagogies driven by the assumptions that teachers are able to effectively exercise their professional discretion and agency and apply them effectively to maximise student learning outcomes may suit developed economies and the top quintile of the teacher cohorts in developing countries. However, the same may not be true for the majority of teachers, particularly those in the lowest quintile. While teacher variance is equally an issue in developed economies[57], this limitation is perhaps more exaggerated in developing countries where many of the fundamentals that ensure high quality teacher performance may not exist. For example, teacher professional ability is exacerbated in DMCs where the quality of both in-service and pre-service programs is less than satisfactory, the only teaching and learning resources are a textbook, and preparation and review time for teachers is minimal. The teacher variance

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[54] As study of teaching and learning in Indonesia identified, "the main problem is a vast number of teachers who are not sufficiently qualified to implement the new methods, and do not have access to the required types of learning materials" (UNESCO, 2015, p.150).

[55] Boote, D.N. (2006). 'Teachers' professional discretion and the curricula', Teachers and Teaching: theory and practice 12(4) 462.

[56] See Kim, G-J. (2014). Asian Education in a Changing World: Emerging Trends and Policy Responses. Presented at the conference Education in Asia 2014: What Global Issues? 12–14 June 2014. Centre international d'études pédagogiques (CIEP). School is only one social institution providing learning opportunities for students, so teachers can only do so much. Other social institutions such as family, community groups, museums, local libraries, associations such scouts, social clubs etc. all have a role. Overloading the school curriculum impacts on teachers' ability to do their jobs, as it overwhelms them. In economies such as the Republic of Korea; Singapore; and Hong Kong, China education is highly valued by society/parents and thus viewed as a shared responsibility.

[57] Taylor's scientific management standardisation allows wider scope, accurate planning, timely delivery, standardised procedures, lesser costs, better quality, and minimum wastage of material, time and energy.

research provides evidence that while teachers at the top end will excel exercising professional discretion and being innovative, more support is necessary for those at the lower end.

Support to mitigate teacher variation without compromising teacher professional discretion may benefit from lessons in other sectors that also seek to ensure consistency of service delivery and minimum level of performance[58]. We know the current continuous in-service training has not been effective in supporting and improving the performance of the lowest quintile of teachers. Use of standard operating procedures as a safety net, supplemented by standardised material such as teacher guides can help these teachers deliver a minimum quality of learning experience required to achieve minimum student learning outcomes.

In light of the above assumptions and evidence supporting current structure, content and delivery modality of both pre-service and in-service CPD training programs for teachers needs to be reviewed to prioritise the inclusion of more appropriate and recent innovative models. The traditional models of very abstract and overloaded training programs and teachers being taken out of schools for in-service training may require rethinking to include online blended models and self-directed approaches for professional learning and self-development. Also, the 'talk show' type of in-service training has not delivered anticipated benefits to date. It is considered not to be effective as many teachers forget the details of what was presented in the workshops. Instead, trainers need to provide reference material to teachers (resource kits) during in-service training so teachers can refer to that later when working in classrooms. Finally, instead of looking inwards and being precious, teacher development should look at other similar professions to learn and share policies and practices.

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[58] Boote, D.N. (2006). 'Teachers' professional discretion and the curricula', Teachers and Teaching: theory and practice 12(4) 462.

7: Principals and Education Managers for 21st Century K-12 Education

Education systems in ADB developing member countries range from very large and dispersed to small and localised. In large countries, centralised management of schools may not be effective and thus we have seen reforms to delegate the responsibility and accountability for school performance to local education authorities and school principals. But confusion exists as to whether the delegated responsibility is de-concentrated (implementation is delegated) or decentralised (policy and implementation both are delegated). In principle, delegation is appealing but to successfully implement such a policy is not easy because in many cases the underpinning assumptions of such a model are not yet fully in place in many DMCs. Education leadership in current times involves dealing with complex systems where problems are constantly evolving, with emergent behaviours and there is no single, empirically correct solution.[59] Consequently, in an attempt to strengthen school level governance, many DMCs have implemented a more dynamic and locally responsive approach of school-based management (SBM) and school improvement plans to adopt a whole-school-approach.

Translating national education policy to a more responsive and agile management at the local school-level requires competent leadership as well as smart managers to implement the leadership vision. Education planners and principals require skills to simultaneously navigate through competing agendas of compliance and innovation.[60] It requires a wide range of leadership skills and dispositions such as instructional, democratic, transformational leadership and entrepreneurial knowledge skills and compassion. Thinking of leadership as a set of fragmented actions risks undermining an appreciation of the complexity of a whole-school improvement approach. Figure 3 illustrates the wide range of factors that constitute the 21st century role of a principal when dealing with a school-based management and leadership system.

Principals play a central role and perhaps the most critical role for local level interventions and they have to own the risk and benefits of management decisions. The principal provides overall leadership and vision for the school and also manages daily administrative matters to enhance the performance of the schools—student achievement, health and safety compliance issues related to infrastructure resources meeting minimum national standards, school finance and teacher performance etc. They play a critical role in developing and communicating a shared vision, shaping a culture of trust within and with outside stakeholders (community), and supporting and monitoring collegial learning. School committees provide an external voice to ensure transparency and encourage community ownership of the schools. While the role of community is necessary, it is becoming complex because of competing external interests and thus governments are becoming more reliant on school principals to provide the necessary leadership. In Bangladesh, communities are

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[59] Snyder, S. (2013). The simple, the complicated, and the complex: Educational reform through the lens of complexity theory. OECD Education Working Papers, No. 96. doi: 10.1787/5k3txnpt1lnr-en.

[60] Lessons from reform projects have highlighted the challenge of translating and implementing leadership vision and related policy directives. Importantly, having the capacity to implement a vision requires appropriate organisational systems and good (entrepreneurial) management and administration capacity.

hampered by political capture; in Sri Lanka, the school inspectors override the school principals' decisions; and in Armenia, the Marzs seem to micro-manage school operations.
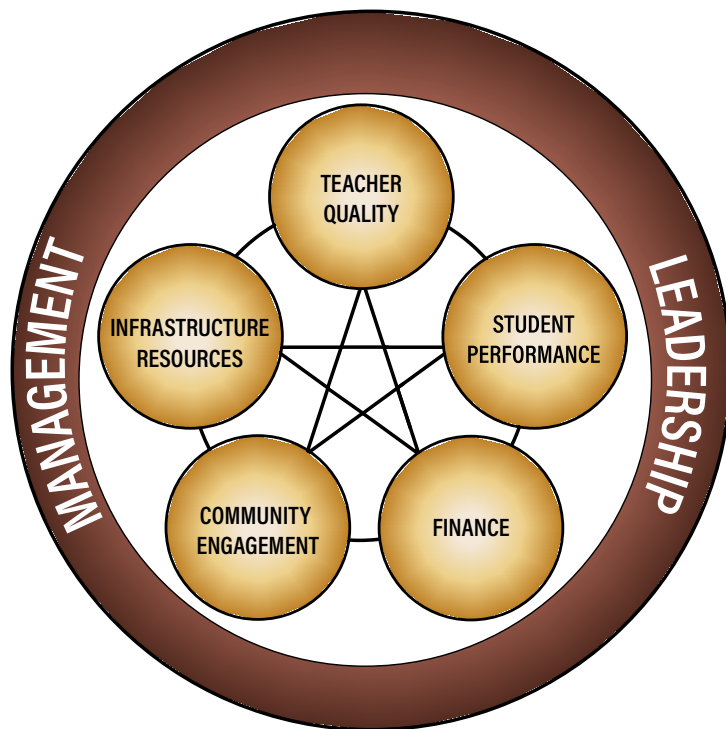

Figure 3. School-based leadership factors

These external pressures add another layer of complexity to the school principals' roles. In many cases school principals are expected to be accountable for the schools' performance but are given limited autonomy and responsibility. More clarity of roles and functions, and appropriate mechanisms to support principals to provide effective leadership may be useful.

For effective implementation of SBM, the role and job description of the principal need to change. A 360-degree management and governance requires competency and time to execute necessary actions. However, many DMCs still do not have full-time school principals or head teachers and of those that do, a majority of principals are not sufficiently exposed to the role and function of modern governance and management. Many developed economies have post-grad education management programs aligned with the occupation standards of the 21st century for school principals. However, education leadership and management qualifications are not valued and/or not available in many DMC jurisdictions. Despite a lack of capacity development options, principals and head teachers are expected to take on new roles and tasks, risking successful implementation and institutionalisation of SBM practise.

While the principals are required to contribute to collecting compliance data for the national education management information systems (EMIS), unfortunately many principals do not use the same data to review their own school-level performance. Instead, these data are used to monitor the sector's performance to support national level resourcing and operational practices rather than inform school level strengths and weaknesses. To set up an EMIS to capture sector profile and demographic data in the DMCs, government and development partners would have invested a lot of time and money. However, it is becoming apparent that to adopt an integrated approach to monitor the sector, the EMIS may need to transition to an Enterprise Resource Planning (ERP) system where the local level value of monitoring data needs to be paramount and the same data may be aggregated upwards to feed into the needs for national planning and monitoring.

Another approach to strengthening K–12 school governance and management is the adoption of private-public partnerships. The UK successfully implemented PPP—giving management contracts to private companies to manage public schools for an agreed fee and a performance bonus based on operational costs and agreed targets and indicators. The

private sector practices include an apparent focus on demand rather than supply side factors and its engagement in cost-benefit analyses to determine the nature and scope of required services and level of investment.[61] Apart from adopting PPP, there are lessons that may be meaningfully applied to public sector management processes which are worth considering to increase the efficiency and effectiveness of school leadership and governance. Many of these lessons could be learned from some private schools in DMCs.

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[61] Cardini, A. (2006). 'An analysis of the rhetoric and practice of educational partnerships in the UK: an arena of complexities, tensions and power', *Journal of Education Policy* 21(4) 393–415.

8: Teaching and Learning Resources

In many DMCs, teaching and learning resources are limited to subject textbooks for each class which is the only resource for both teachers and students. In such circumstances, it is not surprising that teachers 'teach to the textbook'. Unlike teachers in developed economies, the DMC teachers collect very few resources during their pre-service training or from other sources during their professional careers due to prohibitive costs. As noted earlier, the majority of the teacher CPD programs are talk and discussion workshops with limited if any reference resources made available for teachers to take back to schools. Even the teachers' guides as a professional resource is being replaced with a push for teachers to be innovative and use professional discretion to improvise and develop appropriate classroom resources. Such assumptions maybe appropriate for developed economies and necessary for developing countries, but the preconditions for such assumptions to work in DMCs must be put in place first.

While access to core textbooks for primary education has been reasonably good, access to 'high quality' books and alternative teaching and learning resources remains a challenge. In regard to secondary education, many DMCs are still facing challenges in providing high quality textbooks to all secondary students. Textbooks are the second largest cost to the K–12 education sector after teachers' salaries. Through support from development partners, some DMCs have established textbook revolving funds to develop a sustainable mechanism to provide textbooks for all students. However, there are mixed views about how successful these schemes have been.

The quality of textbooks is affected by three things: (i) content; (ii) instructional design; and (iii) the integrity of the production process to ensure durability. Content is often rehashed old materials and is thus outdated and lacking relevance to 21st century knowledge, skills and dispositions.[62]. This is confounded by the very abstract manner in which the content is often presented, lacking authentic and everyday applications. The instructional design should motivate and prompt student engagement, using techniques such as visualisation and scaffolding to navigate the "zone of proximal development", optimal sequencing and articulation of content to support personal meaning making. The quality of the instructional design of textbooks has been an ongoing challenge. Currently, they are mostly linear and sequential and do not encourage divergent thinking or consideration of alternative solutions to problems noted in respective discipline areas. Adoption of soft skills, and authentic and applied content is also very limited, if covered at all, in most textbooks. Moreover, the majority of the textbook authors are from the 'old regime', where the more content covered the better the quality of the book; this was the guide for good textbooks. Finally, production quality is important to ensure the textbooks last at least three years, the paper quality does not have ink blotting through the pages, and the bindings do not open up within a short time. The legacy of established printing houses, both private and public enterprises, and in some cases

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[62] Content such as local socio-cultural issues, economic and wellbeing; implications of climate change; the various alternative energy innovations; IT applications; green economy; green technology; effects of gene technology on our wellbeing; and food security.

government departments has slowed the reform in this area. There is still much work to be done in many LICs through to MICs to modernise the publication and distribution system and improve textbook quality.

Some DMCs are experimenting with digital textbooks but the majority of these are currently just digitised versions of existing hardcopy textbooks, so this experimentation is at a very early stage. Hong Kong, China has made more progress in developing interactive digital textbooks, but the interactivity is dependent upon the availability of high quality yet affordable internet access. Many publishing houses such as Pearson[63] and Edtech[64] are gradually moving towards developing more e-books and interactive e-learning teaching and learning resources as alternatives to traditional textbooks. Perhaps a good example of how political will and private sector philanthropy can help ICT support for teaching and learning resources can be seen in EkStep foundation's work.[65] The advantage of digital learning materials is they may be reused as many times as required, can be continuously upgraded at minimal cost and may be used in combination with a range of practices and subject areas. Digital learning materials may incur a high initial capital investment, but given the possibility of repeated use, scalability and, ongoing modification and updates at minimal cost, this can be a cost-effective solution in the long-term to provide high-quality contemporary teaching and learning resources.

To date, the use of ICT driven OERs has not been considered in a systemic way to support the development of the next generation of K–12 teaching and learning materials. While it is acknowledged that huge amounts of resources are available on the internet, it is assumed teachers can readily search, find and consume these materials themselves. This may be possible for a select group of teachers in developed economies, but not in most DMCs. In LIC and LMIC where teachers have multiple jobs just to provide for their families, time is a major constraints and internet access may be unavailable or unreliable. Considering the high degree of similarity of school curriculums in the Asia and Pacific region, it may be prudent to develop a common set of OERs for K–12 and share this with all ADB DMCs to customise for their national curriculum applications. Having easy access to curriculum-indexed materials can be powerful in changing the mindset and practice of K–12 education service delivery. The capacity of ICT resources to provide rich simulations, to support mastery through repeated practice, and to enable interaction and create powerful learning mechanisms, presents a huge opportunity to modernise learning experiences. Such high quality, rich and relevant resources can help teachers develop and deliver engaging lessons and encourage students to engage in independent and self-directed learning.

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[63] See https://www.pearson.com/us/prek-12.htmlhttps:// plus www.pearsoncanadaschool.com/index.cfm?locator=PS3eZw.

[64] https://edtechbooks.org/k12handbook/oer also see https://www.education.com/resources/.

[65] EkStep was established by Mr Nilekani; Co-Founder and ex-Chairman of Infosys Technologies Ltd. EkStep created an open digital infrastructure which provides access to learning opportunities for 200 million children, as well as professional development opportunities for 12 million teachers and 4.5 million school leaders. Both teachers and children are accessing content which ranges from teaching materials, explanatory videos, interactive content, stories, practice worksheets, and formative assessments. By monitoring which content is used most frequently—and most beneficially—informed decisions can be made around future content. See details at https://ekstep.org/.

In many developed economies, access to alternative learning resources is made available by establishing good school libraries. In addition, in many of these countries, centrally located municipality libraries and other types of libraries may also be accessible to teachers and students. Whereas, to date, there has been very limited investment in good school libraries in most DMCs. This perhaps has hindered the development of a culture of reading and of self-directed learning. Digital libraries are now another option, but access to appropriate materials may be a challenge. As noted above, the assumption that teachers in DMCs have access to good teaching and learning resources may not be true due to limited internet access and time constraints. The limitation inhibits fostering a reading culture and support for self-directed learning competencies, key attributes of 21st century K–12 school learning outcomes.

In light of the discussion above, the option of an e-library may not be an unreasonable consideration to support K–12 students and teachers. To support self-directed learning, by both teachers for their own professional development and for students to improve their learning outcomes, increasingly resource-based learning is emerging as an effective pedagogy. Such an approach actively involves students, teachers and resources in the learning process. This places 'resources' in the foreground of learning, and the learner's interaction with and selection of these resources is the driving principle of self-directed learning.[66] As noted above, there is an abundance of resources available, but education development often is still grounded in a scarcity approach. In a world of abundance, the emphasis is less on the development of specific learning materials than on the selection, aggregation and interpretation of existing materials. Rapid technological change is raising the stakes and is already playing a crucial role in providing support to teachers, students, and the learning process more broadly. Technology can help teachers better manage the classroom and offer different challenges to different students. Millions of students around the world are benefiting from the effective use of technology, but millions more in the developing world are not. Finally, lessons from the recent pandemic have demonstrated the advantage of having high quality, soft and hard copy, teaching and learning resources that may be readily mobilised to respond to remote learning when required.

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[66] Ryan (2000) uses the following definition for RBL, taken from the Australian National Council on Open and Distance Education. RBL is "an integrated set of strategies to promote student centred learning in a mass education context, through a combination of specially designed learning resources and interactive media and technologies" (Alberta Education, 2004, p. 110). Learning that "actively involves students in the meaningful use of a wide range of appropriate print, non-print, digital, and human resources".

9: Governance and Management

ADB DMCs include small nations with populations of around a few hundred thousand and very large nations such as India, the People's Republic of China and Indonesia, three of the world's most populous and politically complex countries. ADB DMCs have a mix of governance models such as decentralised, deconcentrated and central systems, and there are various ways in which these models have been conceptualised and implemented over the years. To support the MOE to become more efficient and effective, decentralisation has become the 'buzz' word. Unfortunately, most decentralisation implementations in the education sector have created confusion regarding what is being decentralised and who is responsible for what. Typically, three key aspects of good governance are authority, accountability and responsibility. In most cases, decentralisation is about accountability and responsibility, but not authority. There seems to be some mix up between what is considered de-concentration versus decentralisation in management and governance models.[67] At times, these two models have been used interchangeably, thus adding to the confusion.

Larger countries have Federal, State and municipality level government and the education sector is a shared responsibility[68]. Smaller countries just have national governments. Given the diversified approach to governance, a single model may not be best option for all DMCs. For instance, decentralisation may be appropriate for large countries with mature governance and administration systems at the State and Province levels, but a de-concentration model may be better for smaller countries where the local authorities and schools implement the national policies and decisions. In small countries, the Ministry of Education can readily access schools from the central office and due to the size, there is often a lack of local level capacity to make decisions and to generate alternative local revenue to supplement education sector budgets, as envisaged in decentralised models of shared responsibility.

Governance and management of K–12 is further challenged by an increase in non-public providers of K–12 services to supplement the public sector investments and meet the increased demand. Countries like the People's Republic of China, where traditionally education services have been provided by the public sector are also embracing private stakeholders in the K–12 education sector. In Bangladesh, a significant percentage of primary education is provided by BRAC which is an NGO; in Nepal, private secondary education is expanding and challenging the public secondary education services in both access and

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[67] Armenia and Georgia are examples of this confusion—delegating the implementation function is not decentralisation. Armenia has a unique setup; it has outsourced the management of all primary school to the local Marzs which reports to another Ministry and not Ministry of Education. The Ministry of Education only centrally manages secondary schools. Sri Lanka has several types of schools that are managed and resourced differently. The main types are provincial, national and plantations schools where the national schools are managed directly by the Ministry of Education and are the most privileged schools. Provincial schools' governance is decentralised to the provinces and the plantation schools are managed through partnerships between the Ministry of Education and the Plantation Authority.

[68] In Canada, K–12 education is the responsibility of the provincial governments, in Australia it is the responsibility of the state governments, and in Indonesia there is shared responsibility between several jurisdictions (municipality, district and provincial government). Whereas, in small Pacific Island states, the total responsibility is with the Central Ministry of Education.

quality; in Armenia, the schools supported by diaspora foundations are perceived to be increasing access to better quality   K–12 education systems. Similarly, in Australia and Pacific island countries, church and other community groups manage a significant percentage of K–12 schools. It is being increasingly recognised that governments alone cannot provide education services, and that partnerships with private sector (non-public entities) are inevitable. Therefore, developing mechanisms to support such partnerships will be an important feature of K–12 education governance and management.

To increase efficiency and effectiveness, DMCs are adopting program-based sector strategies for planning and resourcing the K–12 education sector. The intention is to move away from annual block grants and norm-based financing to programs and outcomes. This change helps to streamline the resourcing and monitoring by allowing effective analysis of K–12 sector performance by monitoring key program indicators. In turn, this will help the MOE to better understand how to support quality improvement and the relevance of the services contained in each of the programs. Programs are aligned to sector strategy which has continuous reform aspirations and specific outcomes and targets. In many developing countries, sector strategy is about sustaining the current system rather than improving and innovating, so education policy makers require a new mindset. Programs may involve multi-year activities with annual performance indicators, hence the attractiveness of the MTEF model to the MOE's budgeting process. Such an approach should ensure continued support until the reform activity is fully completed and institutionalised. Given the novelty, MOEs in most DMCs will require considerable capacity development support to re-engineer processes and procedures to help implement performance/program-based financing.

Sound planning, resourcing and monitoring should focus on enhancing the efficiency and effectiveness of programs or activities. This requires prioritisation (you cannot do everything in one year) which in turn requires a good diagnostic process (feasibility studies and monitoring mechanisms). This capacity for good planning and resourcing is not something that can be achieved through a one-off input, thus capacity has to be built into MOE's national or decentralised regional systems or be outsourced. In light of the above, transactional staff at central Ministries of Education and national agencies such as examinations departments, teachers' development and deployment, education sector policy development, sector monitoring and evaluation, curriculum development, research and development, finance and resource allocations—people who develop and support the implementation of policies to promote 21st century K–12 learning—also need to be informed about and given the capacity to respond to new ways of doing business. Collectively, there is the need to develop and monitor appropriate national, regional, and school level indicators which in turn will impact resource allocation and utilisation. The World Bank's Global Education Policy Dashboard[69] initiative will provide governments with a system for monitoring how their education systems are functioning, from learning data to policy plans, so they are better able to make timely and evidence-based decisions. Policy makers

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[69] The World Bank, with support from the Bill & Melinda Gates Foundation and the UK's Department for International Development, is developing a Global Education Policy Dashboard, which will measure the drivers of learning outcomes in basic education around the world. In doing so, it will highlight gaps between current practice and what the evidence suggests would be most effective in promoting learning, and it will give governments a way to set priorities and track progress as they work to close those gaps. This collaboration will advance the goals of the Human Capital Project, a global effort to accelerate more and better investments in people for greater equity and economic growth. https://www.worldbank.org/en/topic/education/brief/global-education-policy-dashboard.

particularly in low- and middle-income countries are working hard to improve student learning, but often find themselves flying blind.

At the same time, innovations in IT systems together with DMCs adopting Business Process Models[70] (BPMs) are streamlining the education sector through the adoption of standardised management and reporting processes. Lessons from other sectors such as business, ICT, health and civil works show that adopting standardised business processes can improve the service delivery and enhance outcomes. Advantages from standardisation, beyond direct cost and quality improvements, include:

- reduced expenses in the development of innovative new practices, and in the administration of processes;
- consistently reliable processes and less variation in the quality of outcomes;
- easier comparisons of the performance between different units of an organisation; and
- process standardisation which is an important prerequisite for the standardisation of IT systems.

Over the last decade, DMCs with support from development partners have made significant investments in EMISs which perhaps need to transition to ERPs and provide a unified platform to standardise governance and management processes, and to develop integrated data sets and organisation units to increase synergy and efficiency.[71] While the above may sound logical, currently there is a plethora of different software, design architecture, applications, data fields etc. and most of these focus on process compliance and an obsession with large data (accounting) and not accounting for a meaningful system's performance. The is a need to move to the new way of thinking about accounts and accountability.[72]

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[70] Clare Chow-Chua, Mark Goh, Tan Boon Wan, (2003). 'Does ISO 9000 certification improve business performance?', *International Journal of Quality & Reliability Management* 20(8) pp. 936–953, https://doi.org/10.1108/02656710310493643

[71] The SABER system developed by the World Bank and used in many ADB DMCs, provides a useful mechanism to monitor and optimise resource allocations to improve sector performance.

[72] Dan Honig and Lant Pritchett, (2019). 'The Limits of Accounting-Based Accountability in Education (and Far Beyond): Why More Accounting Will Rarely Solve Accountability Problems.' CGD Working Paper 510. Washington, DC: Center for Global Development. https://www.cgdev.org/publication/limits-accounting-based-accountability-education- and-far-beyond-why-more-accounting-will.

10: Infrastructure and Learning Space

Over the last decade, increasing access to K–12 was supported by huge investments in infrastructure and physical facilities. This included not only classrooms but also science labs, technical workshops, auditoriums, and computer labs to accommodate the increased demand for K–12 education. In parallel, many different infrastructure investments[73] such as, teacher resource centres, teacher training and retraining centres, and teacher ICT centres were also provided to support K–12 teachers' quality improvement. While significant achievement has been made in providing safe infrastructure to accommodate K–12 students, there are still over 200 million children aged between 6–17 years who are out of school.[74] Therefore, continued infrastructure investment will be necessary for now. However, the blurring of boundaries between formal and informal learning, and lessons learned from previous infrastructure investments, suggest the designs of future school infrastructure may be challenged and require innovative thinking. Also, apart from traditional utilities like water and electricity, there is now need to consider internet connectivity.

In some DMCs, planning of infrastructure investment is being challenged by increasing internal migration, particularly in the South Asia and Central Europe regions. Population movements to urban centres and newly developed technology parks and innovation hubs, in search of employment opportunities, has resulted in student numbers decreasing significantly in rural areas and raising concerns about the viability of existing schools. This phenomenon is not exclusive to developing countries and happens in developed economies as well. Consequently, many of the infrastructure investments risk being underutilised while at the same time the pressure on urban schools to enrol more students is increasing. Increased internal migration also raises questions about the wisdom of investing in large standardised permanent buildings that end up catering for unsustainable small numbers of children. Options such as boarding schools, particularly for secondary education, may be viable and have been effectively used in the rural remote areas such as the mountain regions in Nepal and the People's Republic of China, remote farmers in Australia and, in the small Pacific island nations. Infrastructure investments are expensive and often not portable, thus careful planning and rational debate among stakeholders is necessary as part of the future infrastructure planning process. Scarcity of available land for expansion in urban centres has forced policy makers to adopt 'double shifts' in many DMCs which is not the best option for delivering high quality education services.

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[73] Pillay, Hitendra K., Muttaqi, Iqbal Aziz, Panth, Yagya Raj, & Herath, Nihal (2017). Innovative strategies for accelerated human resource development in South Asia: Teacher professional development – special focus on Bangladesh, Nepal, and Sri Lanka. Innovative Strategies for Accelerated Human Resource Development. Asian Development Bank, Mandaluyong.

[74] 63 million children of primary school age (about 6 to 11 years) plus 61 million adolescents of lower secondary school age (about 12 to 14 years) and 139 million youth of upper secondary school age are not enrolled in school. The youth cohort, between the ages of about 15 to 17 years, are four times as likely to be out of school as children of primary school age, and more than twice as likely to be out of school as those of lower secondary school age. http://uis.unesco.org/en/news/education-data-release-one-every-five-children-adolescents-and-youth-out-school.

Recognition of the ubiquitous nature of 21st century learning opportunities has seen multipurpose and flexible classrooms for instruction and group learning; multi-science labs (combined physics, chemistry and biology); multi-tech-labs (IT, electronics, fabrication); and libraries and learning hubs, seriously disrupting the traditional learning environment infrastructure designs. Furthermore, the emergence of new types of learning infrastructure, such as maker space, learning hubs, studio rooms etc. requires careful and thorough research to understand if the value is in the learning space design or the way classroom space is used or both. New buildings may be exciting until the novelty runs out. In many DMCs, there are facilities such as science labs, technical workshops and computer labs that are either underutilised or not used at all. Often this underutilisation is not due to the lack of infrastructure, rather it is the fear of damaging the equipment, or the lack of budget to procure consumables and to carry out regular maintenance of equipment.

As noted in the section on learning progression pathways, having many sub-levels in the K–12 system may require different sets of infrastructure and specialist rooms that may not be used all the time, thus creating inefficiencies. However, co-location of more than one sub-level can allow sharing of resources and facilities to increase efficiency. Co-location can also risk creating very large schools with a student population of over 4000 which may present management challenges. Similarly, in the teacher development section, it is noted that underutilisation of infrastructure to support and facilitate teacher collaboration and professional learning circles provides lessons that may be worth researching before planning future infrastructure investments. As noted previously, "doing more of the same infrastructure will not be good enough". It is expansive investment and must be considered very carefully for safety, adaptability, portability etc.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members—49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance