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Addressing Challenges in EdTech in the Philippines

By Cristita Marie Perez

The latest Programme for International Student Assessment (PISA) results in 2018 showed that 15-year-old students in the Philippines "scored lower in reading, mathematics, and science than those in most countries and economies that participated in PISA 2018." The Philippines had the lowest average reading score, on par with the Dominican Republic. Policymakers often look to technology to address these pressing issues.

The demand to use technology to enhance educational outcomes is a perennial policy initiative in the Philippine education sector. However, a close examination of several policy documents reveals that there is yet to be a definitive and comprehensive national policy on the use of information and communication technology (ICT) to improve learning and teaching outcomes. In addition, the Philippines is struggling to keep up with evolving technologies and their potential impact on education.

The lack of a central policy has not prevented the Philippine education sector from implementing ICT use in learning and teaching. This paper traces the evolution of education policy and strategy for mainstreaming education technology in Philippine schools since the K-12 reform. It looks at the main initiatives undertaken by the Department of Education (DepEd) in increasing the access and use of technology in learning and teaching. The first five sections of the paper will present an analysis of (1) DepEd's edtech vision and plans, (2) its infrastructure and connectivity roadmap, (3) quality of content, availability, and access to learning resources, (4) digital literacy, skills and competencies, and (5) organizational capacity and governance. The paper attempts to point out gaps between policy rhetoric and policy implementation. These policy implications are discussed in the final sections to help inform the development of more relevant and impactful education technology policies in the future.

Vision and EdTech Operationalisation Plan

The K-12 reform was the focus of the Department of Education from 2012-2018 (USAID, 2020). The reform overhauled the basic-education curriculum aiming to produce graduates who are "equipped with information, media and technology skills, learning and innovation skills, life and career skills and communication skills" (DepEd, 2019) for the modern world. The DepEd policy guidelines on K-12 implementation emphasized the integration of ICT skills and competencies in the curriculum to help "equip learners with skills that will enable them to cope with the technological demands of our time" (DepEd, 2019). The same set of policy guidelines also acknowledge the need to develop and ICT framework that will govern "ICT integration, tools and systems to support curriculum implementation and sector management, digital learning resource repositories, teacher training and various e-tools and information systems that support the delivery of basic education" (DepEd, 2019).

Again, there is no explicit national plan on education technology (edtech). However, when Secretary Leonor Briones assumed leadership of the Department of Education in 2016, she laid out her 10-point agenda with a "shared vision of a quality, accessible, relevant, and liberating basic education for all" (Briones, 2016). The 10-point agenda included a vision for ICT in education, which is part of the DepEd blueprint Public Schools of the Future, developed by the department's Office of the Undersecretary for Administration.

One can argue that there is a clear vision to integrate ICT in education at all educational levels; however, there is no explicit policy guidance related to ICT in education topics. It is difficult to find a publicly available and comprehensive document outlining how DepEd's Digital Rise Program will be fully operationalised and how ICT will improve learning environments, teaching practices, and administrative processes.

There are, however, clear and strong linkages between Digital Rise and the *Philippine Development Plan 2017-2022*,[1] which outlines the overall strategic framework of the

[1] According to the National Economic and Development Authority (NEDA), the *Philippine Development Plan 2017-2022* is "the first medium-term plan to be anchored on the 0-10 point Socioeconomic Agenda and is geared towards the *AmBisyon Natin* 2040 which articulates the

Duterte administration. It can be inferred that Digital Rise has become a part of a set of government policies under the strategic framework to transform human-capital development towards greater agility. It is also complementary to Sulong Edukalidad,[2] another set of DepEd reforms to improve the quality of basic education. The Philippine Innovation Act (R.A. No. 11293) and the Innovative Startup Act (R.A. No. 11337) are two priority legislative acts that aim to stimulate creativity and innovation. These laws provide the legal framework to create an ecosystem that is conducive for digital innovators and encourage entrepreneurs to look for investment and growth opportunities in the education sector.

Other obvious points of policy convergence can be found in the series of policy initiatives led by the Department of Information and Communications Technology (DICT). DICT's National Broadband Plan and Free Wi-Fi for All Project will enhance the necessary connectivity infrastructure that underpins ICT in education initiatives. The Murang Kuryente Act (R.A. No. 11371), which intends to reduce the cost of electricity, is also necessary to ease the burden of technological transformation. Additionally, DICT's Digital Philippines, the government's overall ICT strategy, has a component specifically for education technology called Digital Classroom. The department must work closely with DepEd to formulate and institute policies that will increase technology access and scale up edtech reforms across the country. The DICT will also assist in the provision of "teacher training opportunities related to digital literacy, cybersecurity, and other digital skills" (NEDA, 2017).

The demand for education technology also goes beyond the public sector. Public-private partnerships (PPP) on ICT in education are part of DepEd's ad hoc edtech strategy. There are several partnerships involving DepEd that are either initiated by or led by private telecommunication companies, private edtech providers, or nonprofit organizations working in edtech. However, the department is a mammoth bureaucracy, and the subunit or units (and by extension, the personnel) in-charge change depending on the nature of a particular project (for example, if it is PPP on infrastructure, teacher education, etc.). In addition, the ad hoc nature of managing PPPs complicates supervision hierarchy, making the monitoring and evaluation of these more complex and convoluted.

Education expenditures have been steadily increasing as a share of the country's gross domestic product (GDP). Abrigo (2021) estimates that in 2019, education spending in the Philippines comprised 7.5% of the GDP compared to 5.8% of the GDP in 2005. In the same period, public-sector spending in education increased from 2.1 to 3.1% of the GDP. The pace of increase is admirable; however, the figures are still behind the 4 to 6% benchmark set by the Education 2030 Incheon Declaration. More importantly, there is a dearth of disaggregated data on public financing for ICT in education. The publicly available data on DepEd's budget only covers (1) general

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Filipino people's collective vision of a *MATATAG, MAGINHAWA, AT PANATAG NA BUHAY PARA SA LAHAT (translated as "a strongly rooted, comfortable, and secure life").* It also takes into account the country's international commitments such as the 2030 Sustainable Development Goals."

[2] Sulong Edukalidad in English is "Together, we move forward for quality education." It is a set of DepEd reforms in four key areas: (1) K-12 review and updating, (2) improvement of learning facilities, (3) teachers and school heads' upskilling and reskilling through a transformed professional-development program, and (4) engagement of all stakeholders for support and collaboration.

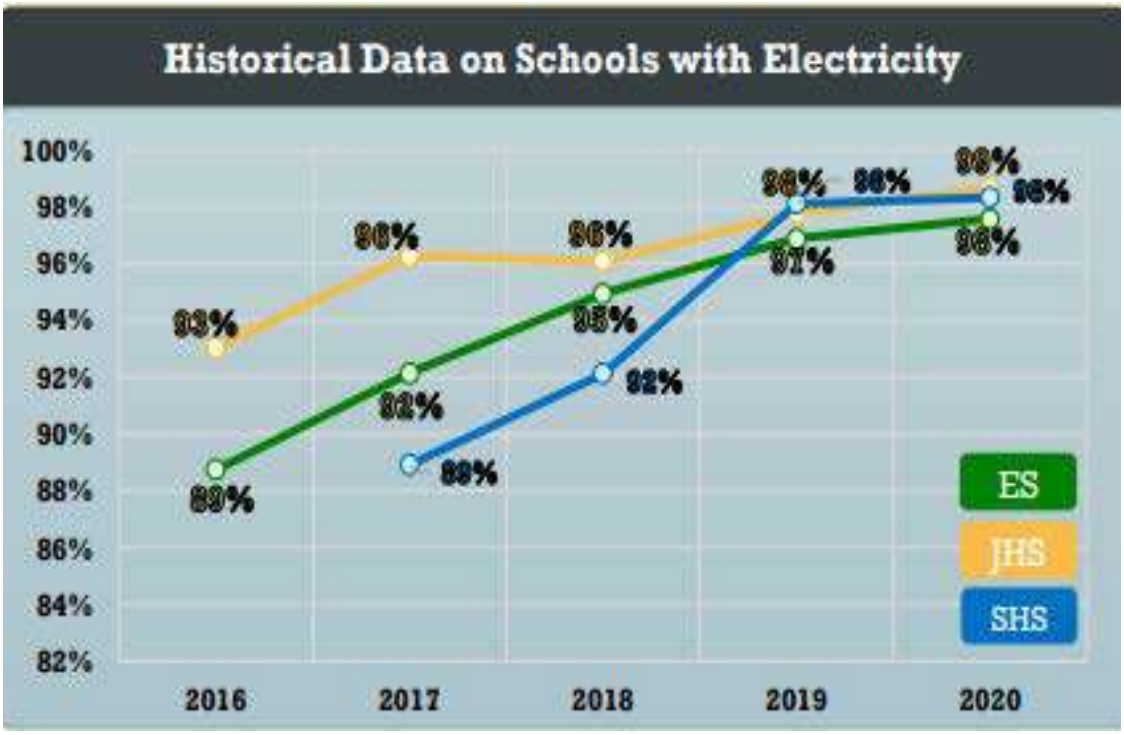
administration and support, (2) support to operations, and (3) operations that are broadly divided into the department's main programs, such as education policy development, basic-education inputs, human-resource development, etc. One can infer that there is a set amount that is regularly and consistently allotted for ICT in education due to the continuous implementation of ICT-related DepEd programs such as Digital Rise, but the lack of ICT in education expenditure indicators makes it difficult to measure the amount of resources allocated to edtech policies and the corresponding impact that these have on education outcomes. It also makes it difficult to determine the appropriate level of resources needed to achieve the goals expressed in DepEd's vision.

Connectivity, Devices, and Systems

The availability of low-cost ICT infrastructure is essential in implementing any edtech policy. DepEd's (2022) latest data on electricity supply showed that 90% of public schools in all levels of basic education are energized by electricity coming from major or local power distributors (commonly referred to as *grid supply*), while around 3 to 7% of schools use alternative sources of power such as solar power, hydroelectric, etc. (referred to as off-grid supply) and combined grid and off-grid sources, respectively. The remaining 2% of public schools have no source of electricity. The PDP targets for basic-education social infrastructure, specifically, the indicator on electricity connection of schools has set the following targets: (1) 95% for elementary schools and (2) 100% for both junior high and senior high schools. The latest data shows that the elementary level has attained this target since 2018, while the junior high and senior high school levels are short by 1 to 2% of their respective targets (see Figure 1).

Figure 1.

Historical Data on Schools with Electricity (2016–2020)



Source: *DepEd Data Bits*: Data on Electricity Supply, (February 2022).

DepEd's (2022) data on functional computers shows that more than 80% of public schools in all levels of basic education have functional computers. The definition of *computers* include the following: (1) tablets, (2) desktops, (3) desktop virtual terminals, and (4) notebooks or netbooks. These computer units are used for both academic and administrative purposes. One computer is shared by 19 elementary school students, nine junior high school students share one computer, and one computer is shared by three senior high school students. The ratio of learners to computers decreases as the level of basic education increases. The ratio of distributed computer units to the number of learners varies by region (see Table 1).

Table 1.

Ratio of Distributed Computer Units to Number of Learners by Region School Year 2020-2021

Region	Elementary School	Junior High School	Senior High School
Region I	1:25	1:8	1:3
Region II	1:13	1:5	1:2
Region III	1:20	1:7	1:2
Region IV-A	1:5	1:4	1:2
Region IV-B	1:18	1:10	1:3
Region V	1:21	1:13	1:6
Region VI	1:32	1:10	1:5
Region VII	1:44	1:15	1:4
Region VIII	1:21	1:8	1:4
Region IX	1:27	1:12	1:4
Region X	1:30	1:9	1:4
Region XI	1:33	1:15	1:4
Region XII	1:30	1:10	1:3
Caraga	1:15	1:10	1:4
BARMM	1:26	1:9	1:3
CAR	1:34	1:10	1:3
NCR	1:33	1:8	1:4
National	1:19	1:9	1:3

Source: *DepEd Data Bits*: Functional Computers and Internet Connectivity (January 2022).

DepEd (2022) data also shows that 64.2% of elementary schools, 72.2% of junior high schools, and 67.3% of senior high schools have access to the internet. The National Capital Region (NCR) has the highest percentage of elementary and junior high schools that are connected to the internet, while Region III has the highest internet connectivity for senior high schools.

Table 2.

Percentage of Schools with Internet Connectivity by Region School Year 2020-2021

Region	Elementary School	Junior High School	Senior High School
Region I	83.3	85	74.9
Region II	80	85.6	78.6
Region III	77.6	85.3	78.7
Region IV-A	79	81.8	71.5
Region IV-B	69	76.4	77.7
Region V	46.4	60.7	55.9
Region VI	67.5	74.5	69.7
Region VII	58.2	73.9	66.7
Region VIII	54.9	61.1	60.1
Region IX	51.2	67.1	56.5
Region X	58.4	59.4	65.1
Region XI	54.9	58.9	65.3
Region XII	58.3	64.8	65.1
Caraga	54.1	69.4	60.4
BARMM	51.5	50.8	54.2
CAR	76.2	75.4	69.2
NCR	97.9	95.4	73.5
National	64.2	72.2	67.3

Source: *DepEd Data Bits*: Functional Computers and Internet Connectivity (January 2022)

DepEd aims to provide electricity to schools in remote areas by providing alternative sources of energy such as solar panels. It also wants to connect more schools to the internet. These priorities, however, are not translated into concrete and measurable action plans. The closest publicly available document that outlines the department's ICT infrastructure goals is the *ICT Infrastructure Roadmap* outlined in a 2018 speech given by Alain Del B. Pascua, DepEd's undersecretary for administration. The 2022 target ICT packages for schools differ depending on the grade level (see Table 3).

Table 3.

ICT Packages for Schools and Alternative Learning System (ALS)

	2018	2019	2022
ALS	Laptop for mobile teachers	Laptop for mobile teachers	All mobile teachers have a laptop
Kindergarten to grade 3	Laptop with projector	10,000 elementary schools with digital classrooms[3]	All grade levels have digital classrooms
Grade 4 to grade 6	14 terminals per computer laboratory	42 terminals for all elementary schools with 400+ students	All elementary schools have 1 computer laboratory per 6 classes
Junior high school	42 terminals per computer laboratory	All junior high schools have at least 1 computer laboratory	All junior high schools have 1 computer laboratory per 6 classes
Senior high school	50 standalone personal computers per computer laboratory	All senior high schools offering the ICT track have at least 1 computer laboratory	All senior high schools have 1 computer laboratory per 6 classes
	50% of senior high schools have at least 50 tablets	All senior high schools have at least 50 tablets	All senior high school classes have 50 tablets
Internet connectivity	20,000 schools in 8 regions are connected to the internet	All schools are connected to the DepEd WAN[4]	All schools are connected to the Internet
Innovation hub[5]		Science high schools have an innovation hub	All divisions have an innovation hub

Source: PowerPoint presentation of Undersecretary Alain Del B. Pascua (2018).

[3] Undersecretary Alain Del B. Pascua, in a speech delivered at the National Consultation on Office of Undersecretary of Administration (OUA) Program Implementation and Office Coordination on November 7, 2018, defined the digital classroom as "equipped with a digital board, LCD/LED TV display, or Interactive Screen Display as a replacement or in addition to the traditional use of whiteboards and blackboards. These digital displays enhance the teaching-learning process by using videos, interactive applications and games, virtual field trips, and as gateways to access digital information in the world's information highway."

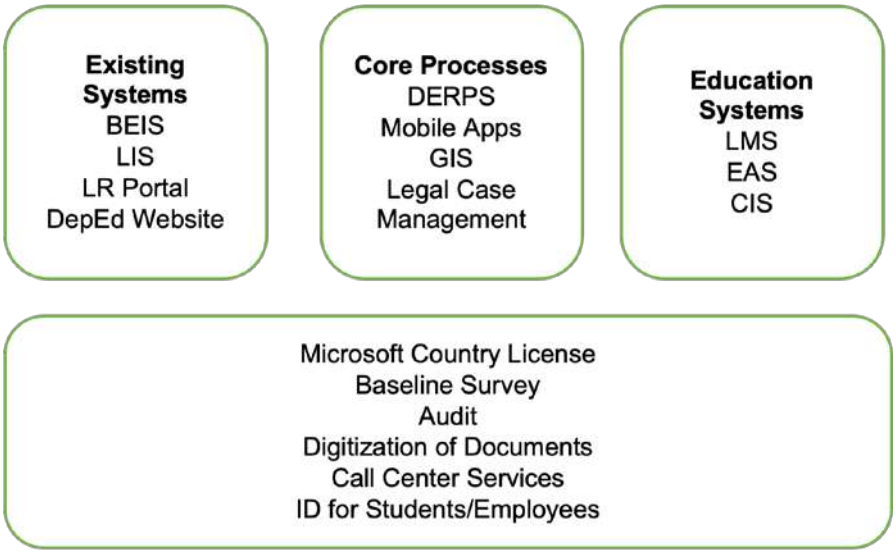
[4] *Wide area network*. *Merriam-Webster* defines WAN as "a network of computers (such as the Internet) in a large area (such as a country or the globe) for sharing resources or exchanging data".

[5] In the same message delivered in 2018, Undersecretary Pascua defined an *innovation hub* (iHub) as "where the latest available emerging technologies are provided for the use and manipulation of learners having ICT as an elective. These iHubs enable them to solve local and community ICT-based problems, issues, and concerns with the use of available technologies aligned with the industry standards. The iHub houses 3D Printing Technology, Makerspace, Robotics Engineering and Simulation, Mechatronics Facilities, and Drone Technology, among others."

Internet connectivity in schools is largely dependent on how successful the National Broadband Plan is implemented. Improving the country's broadband ecosystem is a complex and multistakeholder undertaking that is beyond the DepEd's scope and mandate. However, it is unclear how the department determined its ICT infrastructure targets and how they will be met. There is also no concrete definition on what a computer is, what constitutes its use/s, what its intended use is, who uses it, where it is used, who owns the equipment, and what are the educational goals that will be achieved as a result of computer use. Progress reports with success indicators are also not publicly available and accessible. Operation and maintenance costs also need to be factored in, in addition to procurement and distribution costs. Lastly, a reliable mechanism for ICT infrastructure maintenance also needs to be put in place. These details may seem minute and inconsequential, but as Trucano (2019) argues, "Efforts to define and construct a big picture to guide the implementation of large scale national initiatives to promote the use of new technologies in education can often falter if insufficient attention is paid to individual pixels."

Figure 2.

Components of the DepEd ICT Information Systems



Source: PowerPoint presentation of Director Abanil (2018).

Figure 2 provides a snapshot of the components of DepEd's information systems. DepEd's *ICT Information Systems Roadmap* provides a rough sketch of how the department plans to improve its existing systems, core processes, and education systems. The department's education system are composed of the following: (1) Learning Management System (LMS), (2) Education Assessment System (EAS), and (3) Curriculum Information System (CIS). "The LMS is a software that will allow teachers to create virtual classes where they can assign the activities that the learners need to go through, monitor if the activities have been completed, grade submissions, and conduct online quizzes to assess comprehension in conditions where face-to-face

classes are not allowed" (DepEd, 2020c). The department's LMS has three components, (1) an LMS for teachers and learners that is used to conduct online classes (https://lms.deped.gov.ph), (2) an LMS that is used to conduct online trainings for teaching and non-teaching personnel (https://training.deped.gov.ph), and (3) an LMS that is used to conduct national tests and assessments (https://assessment.deped.gov.ph).

DepEd opted to use Moodle, an open-source learning platform for its LMS requirements. The department chose Moodle for the following reasons. First, the department did not have to undergo the usual lengthy and bureaucratic procurement process since it is free, allowing it to deploy the system in time for the school opening. Second, it provides greater and cheaper accessibility to learners who use mobile phones compared to other free LMS platforms such as Google Classroom, Edmodo, etc. And lastly, the department already has a sizable number of personnel who are trained to use the platform.

The COVID-19 pandemic accelerated the launch and deployment of the LMS. The *ICT Information Systems Roadmap* indicated that deployment to all schools will be finished by 2019 and that enhancements to the system will be made in 2020. However, a July 2020 DepEd memo from Undersecretary Pascua indicated that although the LMS for online classes have been completed, "its release has been deferred until the engineering challenges that are being encountered in the server setup that can scale to more than 8 million users has been fully resolved." The same capacity issues are encountered in the LMS for online training and "additional work needs to be performed to ensure that the servers do not break down if it is accessed by all teachers" (DepEd, 2020c). The latest information available on the LMS for national tests, on the other hand, indicated that it is still at the pilot stage and has not yet been deployed nationally (DepEd, 2020c).

It can be observed that DepEd has been prudent in choosing the technology for its LMS. However, the department still faces issues on costs (especially for its servers), capacity, and scaling. Additionally, DepEd also did not require all schools to adopt its Moodle-based LMS for online classes, so integration to Moodle later on will be a challenge once the department decides to impose uniform use of its LMS in the future.

Another key digital system that the department is in the process of implementing is the Department of Education Resource Planning System (DERPS). The DERPS will link together DepEd's various disparate systems and will give the department access to data on (1) asset inventory and management, (2) project management, (3) procurement, (4) human resource management, (5) accounting and finance, and (6) compensation and benefits. The goal is to make organizational processes more efficient and provide real time access to accurate data for better decision making. Publicly available procurement plans from the department show that the phased national deployment of DERPS is regularly funded and dedicated personnel are assigned to monitor and evaluate its implementation.

Other ICT infrastructure projects that the DepEd is implementing include the following: (1) conduct of baseline surveys on the availability and status of schools' ICT infrastructure, (2) ICT infrastructure nationwide audit, (3) the setup of the

department's call-center services, and the (4) implementation of a national digital ID for students and department employees.

As previously pointed out, any infrastructure-related undertaking should take into consideration not just procurement and installation costs but also ownership and maintenance costs. Trucano (2019) estimates that although overall costs may vary over time, they typically lie between 10 to 25% of the total cost. Assessments of the total true costs of edtech initiatives are missing and should be undertaken to enable more informed and evidence-based policymaking.

Content Quality, Availability, and Access to Learning Resources

It can be observed that the K-12 curriculum is in a constant state of development and iteration. The content of each subject's syllabus is painstakingly mapped to a core competency and skill that each student needs to learn. Although the curriculum's progression corresponds to a particular chapter or unit in the department's recommended text books, digital content and/or digital learning resources are not specifically highlighted. Some digital content is available to improve learning, but the nature of their use is supplementary; content delivered through traditional methods remains to be the primary mode of learning.

COVID-19 protocols and closures forced the Philippine education system to rely on digital and/or blended modes of learning. As education moved online, the access to the DepEd Commons became widespread and available. "The DepEd Commons is an online platform for public school teachers to support distance learning modalities. It was designed as a direct solution to give access to online review materials and Open Educational Resources (OER) during class suspensions and other similar circumstances" (DepEd, 2020a).

The digital content available in the platform are "authored by public school teachers who are subject experts, properly cited and acknowledged" (DepEd, 2020b). Teachers are encouraged to "retain, reuse, revise, remix, and redistribute the content by blending it with a learning management system to deliver a distance learning modality." The department also partnered with Smart and Globe, the two biggest mobile-communications companies in the Philippines to provide free mobile-phone access to the site. Mobile-phone subscribers who access the site using Globe/TM or Smart/Sun/TnT networks will not incur data charges.

The *DepEd Commons Framework* and the *DepEd Commons Roadmap* clearly articulate how the department sees the platform as a key component in modernizing learning delivery modalities. Urgent tasks to further make the DepEd Commons an accessible, collaborative, and effective edtech tool includes the need to recruit OER developers and edtech specialists to convert the entire K-12 curriculum into interesting OER content. Additionally, content uploaded to the DepEd Commons needs to be vetted and monitored for quality assurance. A common vetting and monitoring framework needs to be developed and vetting teams recruited and trained. Another huge challenge would be to make the DepEd Commons content available offline. Lastly, multiple applications and systems such as the LMS, Learner Information System (LIS), and others also need to be integrated with the DepEd Commons.

Skills, Competencies, and Professional Development

DepEd's Digital Rise was conceived as a framework to prepare students to take advantage of the opportunities of digitalization. It also seeks to use technology to redefine teaching processes by leveraging technology for curriculum development and instruction. For ICT to become a core competency for students, the changes brought about by the use of ICT needs to be comprehensively integrated into the curriculum. DepEd's efforts at this stage is still towards enhancing ICT use in the existing curriculum. There are, however, initiatives in reviewing the existing curricula and content to develop common teaching and learning strategies using ICT, and DepEd plans to comprehensively review the K-12 curriculum to cater to new developments.

For any all-encompassing edtech policy to work, the competency standards of both teaching and nonteaching DepEd personnel need to be improved. There was a DepEd ICT Competency Standard for Teachers that was developed when the Five-Year Information and Communication Technology for Education Strategic Plan (DepEd ICT4E Strategic Plan) was rolled out in the early 2000s, but it is unclear if this standard remains in operation. Teachers and school heads receive regular training on the pedagogical use of ICT and have access to related ongoing technical and pedagogical support. As previously mentioned, an LMS that is used to conduct online training for teaching and nonteaching personnel (https://training.deped.gov.ph) and ICT-related resource centers for teachers, such as the DepEd Commons, are also available. However, as previously mentioned, the LMS for online training has capacity issues, while the resources available in the DepEd Commons need to be properly sorted, rated, and certified based on their quality and usefulness. And although DepEd has a system for ranking, it is unclear if ICT-related core competencies bear a larger weight during promotion applications.

The DepEd has designated information technology officers (ITOs) from the national to the division levels. These personnel are in charge of addressing and maintaining the technical requirements of laboratories and equipment. They are also tasked to support the capacity building of teachers. Data needs to be collected on the appropriate number of ITO per number of public schools or equipment to ensure the proper maintenance of systems and equipment. In addition, a set of competency standards should also be developed to ensure that ITOs keep apace with the latest technological developments.

Organizational Capacity and Governance

The United Nations Development Programme (UNDP) defines organizational capacity as "the internal policies, arrangements, procedures and frameworks that allow an organization to operate and deliver on its mandate, and that enable the coming together of individual capacities to work together and achieve goals." It is difficult to evaluate DepEd's organizational capacity in implementing its Digital Rise Program, primarily because of the lack of publicly available indicators to measure relevance, effectiveness, efficiency, and sustainability.

Measuring organizational capacity requires not only a comprehensive and robust monitoring and evaluation system but also a survey of the accountability framework, mapping out who makes the final decisions regarding ICT in the department. DepEd

has taken the initial step in setting up an ICT-governance framework by assigning decision-making authority of the Digital Rise Program to the Office of the Undersecretary of Administration (OUA). The OUA appears to take the lead in setting the direction of the department's ICT policies and plans as well as in monitoring the implementation performance.

The successful integration of ICT into the education system requires a coordinated approach not just within DepEd's ranks but from other external stakeholders as well. Getting the cooperation and commitment from parents, the private sector, and local government units is necessary in achieving the desired results.

Insights and Implications

First, "appropriate ICT policies and strategies are at the core of an enabling environment for ICT" (Watson, 2007). ICT in education would do well with a holistic and coordinated approach. A common vision and set of standards can help align disparate activities of various stakeholders (Vergel de Dios, 2016).Although DepEd's Digital Rise provided a de facto policy direction on topics related to ICT in education, an explicit master plan and its accompanying operationalisation plan or plans would be helpful in articulating common goals and ensure that all stakeholders' actions are consistent with national policy. ICT master plans, following Vergel de Dios (2016) signals "important priorities to support, helping to avoid duplication efforts and ensuring an equitable distribution of resources—especially where needs are greatest and action needs to be taken quickly—by highlighting particular needs and challenges among specific beneficiary groups and in specific geographic locations." A master plan is also useful in mapping out the edtech ecosystem's stakeholders, their roles, contribution, and areas for collaboration. This is especially useful in articulating PPP models related to ICT in education.

The department does not need to start from scratch. A significant amount of time, effort, and resources were already spent in drafting several master plans in the early 2000s. These documents can be reexamined, the baseline data and targets updated, and monitoring and evaluation systems institutionalized. A comprehensive inventory of projects and donations should also be undertaken to replicate or scale up successful initiatives. In addition, a carefully developed, well-thought-out master plan can help address intangible factors such as demand, perceptions and misconceptions, political stability, and regulatory transparency, among others (Watson, 2007), alongside tangible factors such as internet connectivity and hardware. This is especially useful for a country like the Philippines, wherein an administration change is often accompanied by an overhaul of the agenda and systems built by predecessors.

Second, data on devices—including an updated equipment inventory indicating the availability of devices, what their uses are, and who uses them—is important. First, it is necessary in determining the operation and maintenance costs of devices and systems installed in schools. Second, these "ownership" costs should be factored into any large-scale equipment procurement and distribution plan of the department to ensure that the equipment will be fully utilized for edtech initiatives and not left in one corner after turnover because there is no budget to have it fixed after a malfunction. Third, the baseline data is also useful in determining the optimal ratio between learners and computer devices that would help achieve learning

goals. The data should also include the number of available IT personnel that can be called on to help maintain the hardware, fix any technical issue, and work with the schools in fully implementing their IT plans. Similar to the optimal device-to-learner ratio, the data will also help determine how many IT personnel per school is the ideal. Lastly, a capacity-development program for IT personnel is also helpful in updating their skills and ensuring that they can keep up with the latest technologies.

Third, the development of educational digital content should be in parallel to the distribution of hardware. This is a critical complementary investment that cannot be postponed at a later date. Educators should also have a clear understanding of the relevance of such materials to the curricula. Hence, mapping out relevant digital content to the basic education curriculum is a huge undertaking that involves a lot of resources and stakeholders but the development of common standards for digital content is necessary to (1) assure that good quality materials are produced and distributed and (2) the content is relevant in achieving explicit objectives and goals detailed in the curriculum. Certifications and other similar incentives that would encourage the production of good, quality content can also be offered. Competency standards for students can also be developed to measure and assess how well ICT is learned and used in education. The results of the assessment will also help in evaluating the effectiveness of the digital content developed.

Fourth, competency standards for both teaching and nonteaching personnel can also be developed. Basic technology literacy for all teachers is a necessary requirement in developing performance standards that set high expectations and incentivize continuous improved performance. A standardized training curriculum is useful for aligning how teacher-education institutions teach integrating ICT into teaching and learning. A comprehensive monitoring and evaluation system should also be built into the development and standardization of competency standards.

And lastly, in the absence of a national educational technology agency, a comprehensive and aligned approach to ICT in education can be developed by the establishment of a national coordinating council that can, as Vergel de Dios (2016) notes, “open lines of communication between DepEd and partner institutions, breaking down institutional barriers by providing a venue where institutions could raise issues, share information and find opportunities for collaboration.” The existing ICT unit in DepEd can be strengthened. Since the DepEd’s Digital Rise Program is lodged under the Office of the Undersecretary of Administration (OUA), it then follows that taking on the additional responsibilities will require additional funding, staffing, and leadership support.

Conclusions

Filipino students benefit from a sustained government commitment to edtech policy. However, an analysis of the education policy and strategy for mainstreaming edtech in the Philippines since the K-12 reform showed that the articulation of a de facto edtech policy strategy (i.e., DepEd's Digital Rise Program) is insufficient in scaling up edtech initiatives. Clear and explicit plans are necessary to ensure that the needs, issues, and challenges are correctly identified and addressed. The absence of operationalization plans makes it hard to align and scale up worthwhile initiatives.

The Philippines' edtech program seems to be largely driven by hardware accumulation and distribution. Students are taught about technology in education and how to use the technology in school, but initiatives that help them learn with technology are often few, uncoordinated or loosely coordinated, and sometimes conflicting. Hence, mapping out the available digital content to explicit objectives in the curriculum helps meet learning goals. Another key component in assuring quality education setting up standardized competency frameworks for both DepEd teaching and nonteaching personnel and devising holistic capability-development programs that would address the perceived and articulated gaps.

A large-scale edtech program requires coordination. The establishment of a coordinating body in the absence of a national edtech agency will enable various actors to align goals, interests, and initiatives. The DepEd can lead this body and invite other relevant government departments such as the Department of Information and Communication Technology (DICT) and stakeholders to take part in implementing its edtech vision.

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Konrad-Adenauer-Stiftung e. V.
Regional Economic Programme Asia (SOPAS)
Coordination: Cristita Marie Perez, Senior Programme Manager
Sakuya Iwakawa, Programme Management Assistant
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