



# Transforming Teaching and Learning with New Digital Technologies

A brief on findings from school case studies conducted under the project  
'Situational analysis on the use of frontier technologies in teaching and learning in primary and secondary education'

## Introduction

How are digital technologies supporting innovation in teaching and learning? Are they making any difference in schools in the Asia-Pacific region? While claims of the power of new and emerging digital technologies to transform education and learning abound, the evidence that supports such claims has been equivocal. As the report of UNESCO's International Commission on the Futures of Education points out, 'there is tremendous transformative potential in digital technologies, but we have not yet figured out how to deliver on these many promises' (International Commission on the Futures of Education, 2021, p. 3).

This brief presents snapshots of teaching and learning practices taking place with new digital technologies in some of the schools studied under the project 'Situational analysis on the use of frontier technologies in teaching and learning in primary and secondary education' implemented by UNESCO.<sup>1</sup> It also discusses a number of factors and conditions that may be contributing to the development of innovative technology practices in these schools. It will conclude with four recommendations for education

authorities to consider as they seek to incorporate digital technologies in education and learning.

Twenty-two primary and secondary schools in Bangladesh, China, India, Kazakhstan, Philippines and Thailand were studied from late 2020 to early 2022 in order to obtain an understanding of the ways in which new technology practices may be emerging and making impacts in teaching and learning in some of the schools in the region. Employing semi-structured interviews conducted with teachers, students and school leaders, researchers in the six countries collected data and information under a common framework. Two research questions were asked in these school case studies:

- *How are new digital technologies used and making impacts in teaching and learning in the school?*
- *What helped or enabled the school to generate such impacts?*

The term ‘new technology’ in these school case studies is understood as a technology that is new in the context of the school. The returns of an online survey conducted in preparation for the school case studies showed that technology situations vary greatly from school to school – not only between countries but also within a country – thus warranting a contextual understanding of ‘new’ or ‘frontier’ technology for the school case studies.<sup>2</sup> Furthermore, based on the survey results, it was decided to include different types of schools, such as private and public, rural and urban, and well-resourced and under-resourced, so as to reflect diverse contexts.<sup>3</sup>

## Technology practices impacting teaching and learning

The researchers in the six countries captured a rich diversity of teaching and learning practices taking place using a broad range of technologies in the schools studied.<sup>4</sup> While the infrastructure and resources differ significantly among the schools, and while technologies that are new to the schools vary greatly – ranging from internet, online meeting and game platforms, and multimedia projectors to 3-D printing, virtual reality (VR) and robotics – teachers interviewed in the twenty-two schools seem to be trying out and exploring ways to teach a variety of subjects with available digital technologies.

In order to categorize and analyse the different practices that were found in the schools studied, the Substitution-Augmentation-Modification-Redefinition (SAMR) framework developed by Puentedura (2014 and 2015) was applied. The four dimensions of SAMR are intended for teachers to utilize as a tool to support them in evaluating and understanding how technology is incorporated in their teaching practices. In practices under ‘Substitution’, technology is used to replace an existing conventional method without generating a functional change. Practices under ‘Augmentation’ also use technology to substitute an existing method but with improved functionality. In practices under ‘Modification’, the use of technology facilitates a process for teaching and learning to begin to move away from a conventional method. A practice can be considered to fall under ‘Redefinition’ when it creates a new process that was previously inconceivable without the technology. According to Puentedura, while ‘Substitution’ and ‘Augmentation’ are about using technology to enhance learning, ‘Modification’ and ‘Redefinition’ pertain to using technology to transform learning.

The SAMR framework provides a suitable analytical tool for the project and its focus on the impacts of technology uses on teaching and learning and their relevance to transforming education and learning. Examples from some of the schools

studied are provided below for each of the four dimensions to illustrate ongoing technology practices in these schools with links to further profiles of the respective schools.

### **Substitution** – replaces an existing method

Practices that fall under ‘Substitution’ are ubiquitous among the schools studied. During the COVID-19 pandemic, many of the teachers were put into a situation where they had to teach remotely. Consequently, they resorted to using digital technologies in one way or another in order to do what used to be done face to face. For example, teachers at an [all-boys secondary school in Bangladesh](#) began to provide lectures through an online meeting platform for the first time during the pandemic. A music teacher at an [urban primary school in Thailand](#) managed to deliver a practicum-focused class remotely with the help of an online learning tool. The school has also made it mandatory for teachers to upload teaching and learning materials and resources online so students can access them from home. In a [rural secondary school in eastern Kazakhstan](#), teachers make use of video lessons and other resources made available on a portal introduced by the government under the pandemic. Although these technology uses enabled the continuity of education delivery in a crisis situation to some extent, it is evident that they resulted in excluding those who do not have access to the required devices from learning opportunities.

### **Augmentation** – improves an existing method

Teachers in several schools observed that using technologies to do what they previously used to do without them has resulted in the enhanced efficiency of teaching and learning processes. For example, teachers in a [public primary school in Philippines](#) use online quiz apps to inspire interest among their students, and a student indeed reports that he feels more engaged in class with such tools. In an [all-boys demonstration school in Bangladesh](#) with an average class size of seventy, teachers found it more manageable with an online meeting platform to reach all students and ensure full class participation. In an [urban secondary school in China](#), VR technology has made it easier for students to find solutions for algebra problems. Similarly in an [urban private school in India](#) where a virtual lab is used in mathematics and science, students find it easier and more engaging to learn and understand theoretical concepts through animation and simulations. These examples demonstrate that technologies that are new to the respective schools are resulting in helping students to participate in learning and to acquire knowledge and understandings more easily and enjoyably.

### **Modification** – begins to move away from conventional practices

Among the schools studied, several cases were found where technologies are facilitating a shift from conventional ‘chalk and talk’ instruction by teachers towards a learning process whereby students play a more active role in their own learning. For example, in an [all-girls secondary school in](#)

[Bangladesh](#) where online learning had been introduced since the beginning of the COVID-19 pandemic, teachers ask students to work in groups to explore and consolidate knowledge on certain topics using the internet and various applications. In an economics class in a [public secondary school in Philippines](#), students interview people in town and create newscasting videos using video-making and editing tools to gain a deeper understanding of an economics concept. In a mathematics class in an [urban primary school in China](#), students work in collaboration to discover and apply the formula for calculating the area of a polygon, presenting and explaining how they worked out the formula using an interactive board, tables and dot-matrix pens. In all three cases, new technologies are playing a pivotal role in supporting students to learn not only by understanding and applying knowledge given to them but also by exploring, discovering and developing knowledge on their own.

### **Redefinition – creates a new process**

Reports from several schools found multiple instances where new technologies are opening a door to a space where students learn not only to develop themselves but also to produce knowledge for the development of communities around them. In Kazakhstan, students in an [urban STEM school](#) and an [IT secondary school](#) create apps and robots to address social issues of their interests. In a [central government-funded school](#) and a [state government school](#) in India, students take the initiative to work together in innovation learning labs in order to design solutions to problems in their communities. In Philippines, students of a [private secondary school](#) produced alcohol-dispensing robots using robotics kits and distributed them in their community during the pandemic. In a [rural primary and lower secondary school in Thailand](#), students are not only creating innovative products using robotics, coding and the Internet of Things (IoT) and sharing them with their community, but people in the community also come to the school to join them in learning robotics and developing robots, turning the school into a robotics hub in the area. These examples point to emerging indications that, inspired and facilitated by new technologies, student-teacher-community relationships are beginning to be reconfigured and the role of a school in society is being redefined.

## **Fostering innovative teaching and learning practices**

An analysis of technology practices based on the SAMR framework provides an insight that teachers in the twenty-two schools studied are making impressive efforts to innovate with the ways in which they are using technologies that are new to them. However, these efforts have different implications with regards to the transformative impacts on

teaching and learning. As mentioned earlier, it is the practices falling under ‘Modification’ and ‘Redefinition’ that can lead to the transformation of teaching and learning according to Puentedura (2014 and 2015) who proposed the SAMR framework. How is it that some schools are able to foster such practices that can contribute to the transformation of teaching and learning? A further examination of the cases yielding ‘Modification’ and ‘Redefinition’ impacts suggests that the following four factors may help foster innovative practices that move the frontiers of teaching and learning towards its transformation: 1) Strong leadership supported by national policies; 2) Passionate and willing teachers who take initiative; 3) Co-learning and development among teachers; and 4) Partnership.

### **1) Strong leadership supported by national policies**

Proactive school leaders enabled some of the ‘Modification’ and ‘Redefinition’ schools to foster ‘frontier’ practices. They communicated a sense of determination and urgency for change. They mobilized resources to make technologies available for teachers and created an environment conducive for teachers to innovate. For example, despite being under-resourced, the principal of the [state government school in India](#) managed to mobilize support from external partners so that the school could establish an innovation lab and introduce smart classroom solutions. Another example is the principal of the [IT secondary school in Kazakhstan](#) who built on his experience to lead and motivate teachers to foster a new culture of IT-infused teaching and learning in the school. It is important to highlight that these school leaders could be proactive because of the national government’s support, particularly through various policy advocacies.<sup>5</sup>

### **2) Passionate and willing teachers who take initiative**

Passionate and willing teachers enabled the schools to foster ‘frontier’ practices that make transformative impacts. They are keen to try new practices, go the extra mile to develop innovation and are committed to innovating with technology. For example, the teachers in the [central government-funded school in India](#) take the initiative to explore new practices in their own teaching, disseminating their newly gained knowledge to their colleagues and regularly participating in additional training on technology integration. Teachers of the [public secondary school in Philippines](#) proactively seek out opportunities to develop their knowledge and skills to use technologies. Some teachers joined online platforms where they could access training and teaching resources and engage with like-minded peers from countries around the world. While the newness of a technology may provide an impetus that drives teachers’ interests, the potential for innovation is not in technology per se but in the proactive engagements of teachers to search

for ideas, explore new practices and disseminate knowledge to others.

### 3) Co-learning and development among teachers

Co-learning and development among teachers enabled the schools to foster practices that made transformative impacts. In most of the schools that demonstrate ‘Modification’ and ‘Redefinition’ impacts using new technologies, teachers share and co-construct knowledge around technology practices. For example, in the [all-girls secondary school in Bangladesh](#), despite the school having limited resources, an active learning culture around the use of new technologies helped the teachers to innovate their practices. A handful of teachers who attended training would share their experience with colleagues and students and provide support when anyone faces difficulties. In the [urban primary school in China](#), the teachers and the school administration have biweekly meetings to share experiences and refine their technology-based teaching. The teachers at the school also hold their own workshops to share their technology experiences and to observe and comment on each other’s lessons. Similarly in the [private secondary school in Philippines](#), teachers engage in open peer-to-peer exchanges of knowledge and skills with the more tech-savvy teachers helping those facing difficulties in utilizing new technologies, and they conduct a regular monthly meeting with school heads to discuss and adjust their practices together. Through such collaborative learning and development, teachers co-construct ‘frontier’ practices that begin to move away from conventional methods.

### 4) Partnership

The case stories from schools testify that diverse partnerships enabled them to foster practices that make transformative impacts. The schools that are making ‘Modification’ and ‘Redefinition’ impacts leveraged partnerships to obtain financial, material and knowledge resources. The [urban STEM school in Kazakhstan](#) draws on its growing alumni network, which provides the school with free access to a programming platform and training. Alumni investments in the school’s endowment fund also provide additional resources that support technology initiatives. The [rural primary and lower secondary school in Thailand](#) partnered with a local university, the local community, a private sector company and the government. The university provided training support, the local community contributed to the students’ learning, and the private sector company and the government offered financial and material support. The diverse and broad partnerships helped these schools to create a holistic technology ecosystem capable of nurturing innovation.

## Toward transforming teaching and learning with new digital technologies

The twenty-two school case studies have allowed the project to catch a glimpse of what education and learning may become and how this can be done with the support of new digital technologies. By providing concrete illustrations of the ways in which ‘classrooms [are] constructed and experienced differently’ (International Commission on the Futures of Education, 2021, p. vii), stories from teachers, students and school leaders interviewed give indications that new digital technologies can assist in transforming teaching and learning and that, in some cases, they have indeed done so. Based on the experiences of the twenty-two schools studied, the following recommendations are put forward for countries in the region as they endeavour to transform teaching and learning with the support of new digital technologies and advance towards the Sustainable Development Goal 4 on education.

### 1) Strengthening school capacities to sustain strong leadership

Strong leadership provides clear direction and boosts the confidence of teachers to create momentum toward transformative technology use. Visionary and supportive school leaders enact such guidance, and governments must support and invest in developing the capacities of school leaders.

### 2) Honouring and supporting teachers’ passion and willingness to take initiative

To ensure teachers can confidently initiate and embed innovations, their passion and willingness should be honoured and given credit. The recognition of their achievements may serve to motivate teachers taking the initiative to develop practices using technology. Supporting teachers to take initiative also requires respecting and protecting teacher autonomy, such as engaging in collaborative decision-making with teachers. For teachers to act as agents of change, their voices must be heard.

### 3) Creating conditions for teachers’ co-learning and development

Governments and schools should encourage teachers to share and exchange knowledge and practices and explore and develop them together so that innovation practices are not limited to a few motivated individuals but also expand to and are owned by a broader segment of teachers. Cultivating a collegial school climate, promoting opportunities for collective experimentation and exploration, and diffusing an understanding that the

development of knowledge requires not just training but also collaboration would inspire sustained co-learning and development among teachers.

#### 4) Stepping up government's role in partnership building

Partnerships to support schools must be strengthened and nurtured. The government should play a more proactive role in bringing together various partners, such as the private sector, universities and international, national and community organizations and guiding them to achieve mutually beneficial goals. By fostering and promoting partnerships, the government not only improves coordination among different sectors in society but also ensures the quality, relevance and sustainability of partnerships.

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<sup>2</sup> The online survey asked two questions: 'What is the most advanced technology used in your school?' and 'Are there any impacts that this advanced technology is making in your school?' It was conducted in twelve languages: Burmese, Chinese, English, Indonesian, Khmer, Korean, Japanese, Lao, Malay, Russian, Thai and Vietnamese, translated by the SEAMEO Secretariat and UNESCO staff. Over 7,000 responses were received from 30 countries.

<sup>3</sup> As only three to four schools were selected in each country, they are not representative cases of all the schools in the country.

<sup>4</sup> A list of links to summaries of the twenty-two school case study reports can be viewed here: [https://bangkok.unesco.org/sites/default/files/assets/article/Education/files/Futures/Case studies/List of links to summaries.pdf](https://bangkok.unesco.org/sites/default/files/assets/article/Education/files/Futures/Case%20studies/List%20of%20links%20to%20summaries.pdf)

<sup>5</sup> For example, Bangladesh's Digital Bangladesh, China's Education Informatization 2.0 Action Plan, India's National Policy on Information and Communication Technology (ICT) In School Education, Kazakhstan's Digital Kazakhstan, Philippines' DepED ICT4E Strategic Plan, and Thailand's ICT for Education Master Plan.

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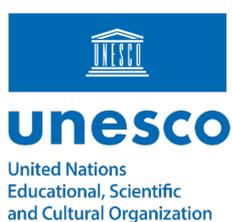
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