

Trends mapping study

Digital skills development in TVET teacher training



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Abbreviations

BSF	Bibliothèques Sans Frontières	ODL	Open and distance learning
CEDEFOP	European Centre for the Development of Vocational Training	OECD	Organisation for Economic Co-operation and Development
CPD	Continuous professional development	OER	Open educational resource
DigCompEdu	European Framework for the Digital Competence of Educators	SELFIE	Self-reflection on Effective Learning by Fostering the Use of Innovative Educational technologies tool (European Commission)
DTPF	Digital Teaching Professional Framework	STEM	Science, technology, engineering and/or mathematics
EdTech	Educational technologies	TALIS	OECD Teaching and Learning International Survey
ETF	Education and Training Foundation (UK)	TVET	Technical and vocational education and training
ICT	Information and communication technologies	UIS	UNESCO Institute for Statistics
ILO	International Labour Organization	UNESCO	United Nations Educational, Scientific and Cultural Organization
ITU	International Telecommunication Union	UNEVOC	UNESCO International Centre for Technical and Vocational Education and Training
LMS	Learning Management System	VET	Vocational education and training
MOOC	Massive open online course	WB	World Bank
NGO	Non-governmental organization		

Background and context

Digitalization has led to extensive changes in the skills required for work and life. For technical and vocational education and training (TVET) institutions to remain relevant and attractive, they need to identify and introduce digital skills and competencies for the changing world of work, and to better utilize the opportunities provided by digitalization, particularly distance learning. Their success in harnessing the benefits and tackling the challenges of digitalization largely depends on the digital capabilities of TVET teachers and trainers.

Teachers and trainers face multiple challenges to keep up with the latest digital transformations and to upgrade their skills to apply modern technology-aided instruction. Likewise, managers of TVET institutions are hindered by the lack of support in creating enabling digital environments and building innovative institutions.

The COVID-19 pandemic has revealed countries' different levels of preparedness in terms of distance learning and their varying abilities to address this challenge effectively.

Purpose of study

The purpose of this study is to map trends and challenges in the training of TVET teachers and trainers in the context of digitalization, and to identify examples of innovative TVET teacher training efforts that have proven successful. The study builds on the recently published *UNESCO-UNEVOC Study on the Trends Shaping the Future of TVET Teaching* (UNESCO-UNEVOC, 2020a) and complements its enquiry on the digital skills required by TVET teachers and trainers to fulfil their role in preparing learners for the future of work and of learning.

The study provides a snapshot of trends and challenges in TVET teacher and trainer digital skills development. Its findings – in terms of data, policy trends and the identification of good practice examples concerning TVET teacher training – will inform UNESCO-UNEVOC's work in support of TVET teachers and trainers.

Analytical framework and methodology

To gain a better understanding of latest trends in **digital skills development in TVET teacher training**, this study explores its status both **before and during**

the COVID-19 pandemic. It examines how different countries have responded to the need to move to **remote learning environments**. It also considers how countries have supported TVET teachers and trainers to develop the skills and competencies needed to use digital tools, services and technologies to deliver quality, learner-centred education and training, in particular practice-oriented learning, which is the hallmark of quality TVET provision.

This study uses an analytical framework that separates out the two key aspects of digitalization for TVET teachers and trainers, namely:

- (a) the **use of digital tools and services for teaching TVET**; and
- (b) the **digital delivery of TVET through distance learning**.

The first dimension refers to the integration of digital tools and technology in **teaching** TVET. This includes, for example, using augmented reality technology to construct virtual 3D models and allowing learners to interact with state-of-the-art tools and equipment used in the workplace and to practise executing complex tasks in a controlled environment. The second dimension refers to the use of digital tools and digital content to **deliver** TVET at a distance. This includes, for example, using videoconferencing tools (such as Zoom) to communicate with students or online learning platforms (such as Moodle) to share learning resources and monitor student performance.

Each dimension requires differentiated support for TVET teachers/trainers. The UNESCO-UNEVOC study (2020a) makes clear that **preparing teaching staff to make effective use of digital tools and services for teaching TVET** involves:

- (a) building TVET teachers'/trainers' digital **skills**, as well as their **knowledge** of new digital technologies, equipment and/or practices in the workplace; and
- (b) developing teachers'/trainers' **skills and competencies** in applying **new pedagogical approaches**, instructional tools and/or educational technologies to deliver learner-centred teaching and training which builds learners' digital competencies and future-oriented skills.

Preparing TVET teachers/trainers to competently use digital tools, technologies and resources to deliver effective online or offline distance learning requires:

- (a) training TVET teachers/trainers to **use** digital communication tools and online learning platforms; and
- (b) developing teachers'/trainers' skills and competencies to **apply** these tools, technologies and resources in a pedagogically effective manner. Effective online education entails more than simple online content delivery. High-quality e-learning is flexible, interactive, inclusive and student-centred (Hodges et al., 2020). Furthermore, the knowledge, skills and competencies required by TVET teachers/trainers to teach in technology-mediated environments differ from those required for face-to-face teaching, especially when the mode of delivery is asynchronous rather than synchronous (Barbour, 2012).

The two dimensions of digitalization are not mutually exclusive. For instance, teachers/trainers delivering fully online modules may decide to integrate educational technologies to teach specific concepts or skills. However, separating out the two aspects for analysis provides sharper insight into issues in TVET teacher professional development, particularly in the light of adjustments made during the COVID-19 pandemic.

TVET teacher training does not exist in a vacuum, and introducing digital technologies into TVET cannot be an end goal in itself. To maximize returns on investment in digital tools and technologies, a clear vision of educational goals, with well-developed and well-resourced policies and strategies for achieving them, is needed (Kleiman, 2000). This requires moving beyond quantitative objectives, such as student/computer ratios, and instead basing technology and training decisions on how well they support educational goals.

To ensure technology is used effectively, or indeed used at all, teachers need not only training on how to apply it to motivate students and improve their acquisition of knowledge and skills, but also time to integrate it into their teaching practices. Technical support is also required to quickly overcome issues that interfere with teachers' ability to seamlessly integrate digital tools and technologies into teaching and learning processes.

The **analytical framework** applied in this study is shown in Table 1. Exploring trends across the eight cells allows for an assessment of global progress made and challenges that remain in advancing digitalization in TVET teacher training, both before and during the COVID-19 pandemic. This will be the focus of Sections 2 and 3 of this report.

Table 1. Analytical framework for trends mapping study of digital skills development in TVET teacher training

Aspects of digitalization	Support for TVET teachers/trainers	Before pandemic	Since pandemic
Use of digital tools and services for teaching TVET	Measures to develop TVET teachers'/trainers' basic and advanced digital skills, as well as their knowledge of new digital technologies, equipment and/or practices in the workplace.	Section 2 findings	Section 3 findings
	Measures to build TVET teachers'/trainers' skills and competencies in applying new pedagogical approaches, instructional tools and/or educational technologies to deliver learner-centred, future-oriented teaching and training.		
Digital delivery of TVET through distance learning	Measures to develop TVET teachers'/trainers' skills in using digital communication tools and online learning platforms to deliver online or offline distance learning.		
	Measures to build TVET teachers'/trainers' skills and competencies to employ pedagogically effective distance/e-learning methods.		

The main method of collecting data and information for this study was desk research (literature review and documentary analysis) to identify trends, challenges and practices across different regions and country contexts. The study focuses on the digital skills training received by teachers/trainers in formal public and private TVET institutions, while acknowledging that the training received by TVET teachers/trainers operating in non-formal or informal contexts may differ.

Interviews were held with selected TVET teacher training institutions that had been identified through the desk research as having innovative or impactful practices. The aim was to gain a deeper understanding of how TVET teacher training institutions have responded to the opportunities presented by digitalization and to collect further information on innovative TVET teacher training efforts that have proven successful in tackling digitalization challenges.

Structure of this report

The study's findings are presented in four sections.

- Sections 2 and 3 examine global progress made and challenges that remain in advancing digitalization in TVET teacher training before (Section 2) and since (Section 3) the COVID-19 pandemic.
- Section 4 provides details of several promising concepts and practices that may help countries to overcome some of the challenges preventing them from advancing digitalization in TVET through TVET teacher and trainer training.
- The final section summarizes the findings of the previous three sections and proposes future actions that TVET stakeholders should consider implementing to harness the benefits of digitalization and meet the emerging expectations of TVET in a rapidly changing digital world.

Evidence for this section is primarily drawn from surveys undertaken by UNESCO-UNEVOC, the Organisation for Economic Co-operation and Development (OECD), the European Commission and the International Labour Organisation (ILO) (in cooperation with UNESCO and the World Bank), which pre-date the pandemic and cover both aspects of digitalization. These surveys were chosen for their proximity in time to the pandemic, their global or regional coverage, and their multi-TVET-stakeholder dimensions.

Main data sources for this section

SURVEYS:

1. *UNESCO-UNEVOC Study on the Trends Shaping the Future of TVET Teaching*, which collected data from 87 respondents (comprising 25 government/national body representatives, 34 TVET institutional representatives and 28 TVET practitioners) across 56 countries between November 2019 and January 2020 (UNESCO-UNEVOC, 2020a). It is one of the few surveys offering global data on TVET teacher training prior to the pandemic, so is relied upon for this study, despite its small sample size.
2. OECD 2018 Teaching and Learning International Survey (TALIS), which gathered data from over 260,000 teachers and 15,000 school leaders from 31 OECD countries/economies and 17 non-OECD member countries in 2018 (OECD, 2021b; OECD, 2019). TALIS provides information on upper secondary vocational education and training (VET) teachers' most urgent professional development needs as well as the main barriers to VET teachers' professional development.
3. European Commission SELFIE (Self-reflection on Effective Learning by Fostering the Use of Innovative Educational technologies) tool, which gathered data from upper secondary VET teachers in OECD countries who used the tool between October 2018 and December 2020 (OECD, 2021b).
4. ILO-UNESCO-World Bank online survey of 985 TVET providers across 92 countries conducted between 3 April and 15 May 2020 (ILO et al., 2021). Unlike the other sources listed in this section, this survey benefited from 20/20 hindsight that a global pandemic would occur in 2020, so was able to gather post hoc data on the status of digitalization in TVET prior to the COVID-19 pandemic.

OTHER SOURCES:

5. *World Report on TVET*, which was commissioned by UNESCO in 2015 and provides information on the status of and main drivers for digitalization in TVET (Mead Richardson and Herd, 2015).
6. *Report of the Joint ILO–UNESCO Committee of Experts on the Application of the Recommendations concerning Teaching Personnel*, which outlines global trends and issues concerning TVET teacher education programmes (Rawkins, 2018).

The following four areas are examined in order to document pre-pandemic trends and challenges in TVET teacher digital skills development.

- **Access to training:** Consideration is given to how far TVET teaching staff were offered opportunities to develop their digital skills through pre-service and/or in-service training, and in what cases and for what reasons such training was not available.
- **Uptake of training:** Just because digital skills development opportunities are available does not mean that TVET teachers/trainers will take them up. Reasons for not engaging may be specific to digital skills (e.g. technophobia), or apply generally to all training (e.g. lack of time).
- **Capacity to apply digital skills:** Digital skills development occurs on a continuum, beginning with **acquisition** of digital skills and progressing to the ability to **apply** digital tools and services in ways that enhance teaching and learning processes. The coverage and depth of the digital and pedagogical skills training received by TVET teachers/trainers will determine their capacity to effectively integrate digital tools and resources in teaching/training in meaningful ways.
- **Propensity to apply digital skills:** Beyond the capacity to apply digital tools and services in teaching and training processes, TVET teachers/trainers must also have a propensity to do so. This will be influenced by the presence of institutional structures and culture to support, encourage and enable teachers'/trainers' efforts.

Access to training

The most significant differences in access to digital skills training observed in the available global surveys and literature pre-pandemic pivoted on countries' income levels, including the following points.

TVET teachers'/trainers' access to any kind of training, including in digital skills, differed according to their countries' income level.

UNESCO-UNEVOC (2020a) survey respondents from low- and lower-middle-income countries were more likely than those in higher-income countries to report resource constraints (often linked with TVET's low status), which meant that TVET teachers/trainers had less access to training opportunities in general. A 2015 ILO report noted that in many low- and lower-middle-income countries, 'pre-service programmes and in-service programmes for teachers and instructors are often not in place, creating difficulties for personnel working in a sector such as TVET, which is highly

dependent on innovations and technology-driven, to function effectively without their own training support framework' (Axmann et al., 2015).

In sub-Saharan Africa, digital skills development opportunities were restricted. According to UNESCO (2020b), prior to the pandemic only 50% of secondary teachers across sub-Saharan Africa had received the minimum required teacher training, which in many cases did not build their digital skills.

The reasons for TVET teachers' and trainers' **lack of access to training in general** included the following:

- **Systemic lack of resources.** The 2015 UNESCO *World Report on TVET* noted: 'In Zambia, where the level of government subvention to TVET institutions is very low (less than 6% in some cases) it is cost-prohibitive for institutions to progress the use of ICT [information and communication technologies]. The costs have to be passed on as increased fees to learners, which then reduces the number of the population who can afford TVET courses' (Mead Richardson and Herd, 2015, p. 14). A 2015 study on TVET teacher education in Africa found that lack of resources led to there being limited professional development opportunities for TVET teachers, whose skills often became quickly outdated (Grijpstra, 2015). Similar issues were observed when teacher education programmes were provided by international agencies, donor organizations and/or non-governmental organizations (NGOs): they were often not universally available, sustained or well-integrated into national provision (Rawkins, 2018).

Specifically addressing teachers'/trainers' **lack of training in digital skills**, barriers included:

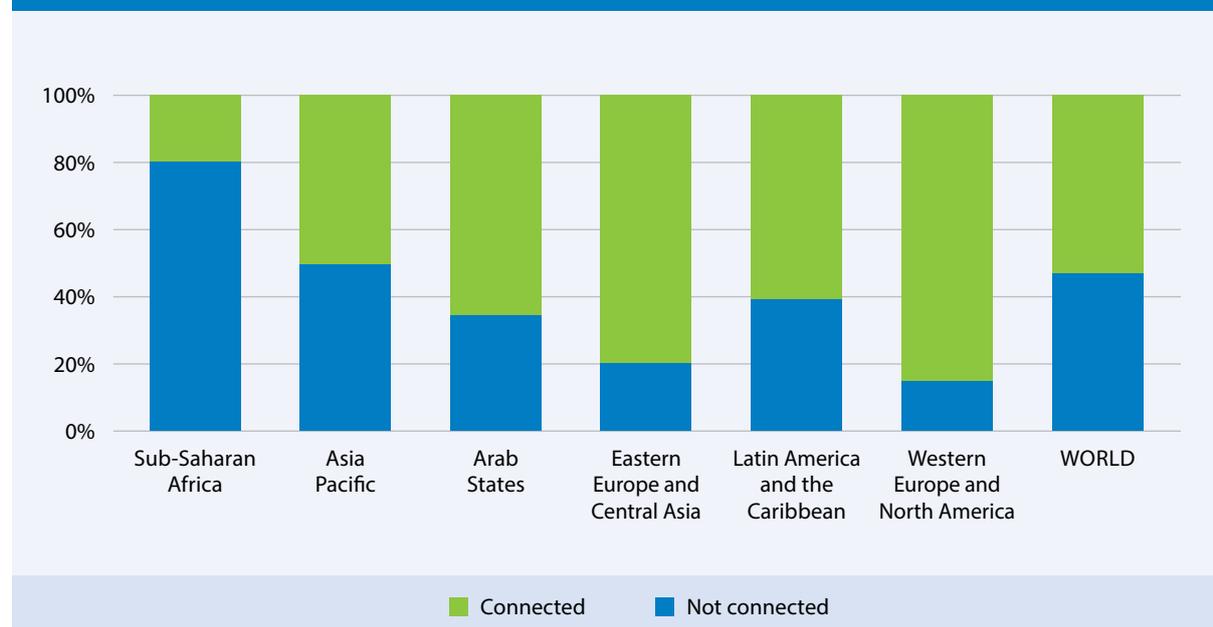
- **Lack of digital access and infrastructure**, such as a lack of electricity, computers and/or internet for pedagogical use (see Table 2), and restricted opportunities for the use of digital tools and technologies for teaching, especially in rural areas (Haji et al., 2017). In 2019, 80% of primary and secondary students in sub-Saharan Africa and 50% in the Asia-Pacific region lacked home internet access (see Figure 1). Furthermore, the use of low-tech digital distance learning approaches to increase access to and inclusion in TVET was not viable in many low- and lower-middle-income countries owing to limited access to communication devices. As the *Global Education Monitoring Report 2020* noted: 'Among the poorest 20% of households, the share of those who owned a radio was 7% in Ethiopia (2016), 8% in the Democratic Republic of the Congo (2014), 14% in Madagascar (2016) and 30% in Kenya (2014), with none owning a television' (UNESCO, 2020a, p. 60).

Table 2. Percentage of public schools with electricity, computers and internet used for pedagogical purposes in 2018

	Electricity	Internet	Computers
Sub-Saharan Africa	29%	6%	14%
Northern Africa and Western Asia	100%	90%	95%
Central and Southern Asia	100%	46%	42%
Eastern and South Eastern Asia	99%	97%	99%
Oceania	100%	63%	33%
Latin America and Caribbean	100%	61%	83%
Europe and Northern America	100%	100%	100%

Source: Langthaler and Bazafkan (2020c, p.13); adapted from UNESCO (2020a, pp. 393-9)

Figure 1. Percentage of students with internet connection at home in 2019



Source: Giannini (2020)

- **Lack of trained trainers with the skills and knowledge** to develop TVET teachers'/trainers' digital skills and to advance digitalization in TVET (Burns and Lawrie, 2015). As the 2015 UNESCO *World Report on TVET* noted, in developing countries '[t]here are few examples of pre-service teacher training institutions, able or ready, to integrate ICT into the teacher training curriculum' (Mead Richardson and Herd, 2015, p. 6). As a result, in many African countries, such as Zambia and Botswana, teachers are trained by traditional distance learning modes using low-tech, traditional methods such as print-based materials (ibid., p. 7).

Lack of access to training, lack of access to digital resources and infrastructure, and lack of digital skills among TVET teaching staff linked to **resourcing issues** have been highlighted by many studies as the key barriers to use of digital technologies for teaching TVET in low- and lower-middle-income countries (Langthaler and Bazafkan, 2020; Mead Richardson, 2011). A 2018 study of digitalization in education in sub-Saharan Africa confirmed this: 'The main challenges facing the region include lack of sufficient budget to sustain ICTs in schools, inadequate ICT infrastructure, untrained teachers and technicians on ICT integration, and ineffective coordination of ICT initiatives, which leads to an unfriendly curriculum which does not specify where, how, and when to use ICT for educational purposes' (Tilya, 2018). UNESCO-UNEVOC survey respondents from low- and lower-middle-income countries ranked these obstacles more highly than respondents from upper-middle and high-income countries (UNESCO-UNEVOC, 2020a). TVET provider capacity was more likely to be overstretched and their infrastructure inadequate.

The influence of national income disparities on TVET teachers'/trainers' access to training generally, and specific to the use of digital tools, was confirmed by the findings of the ILO-UNESCO-World Bank survey, which asked respondents to comment on their pre-pandemic use of online and other forms of distance learning.

- 18% of respondent TVET providers reported having used online or other forms of distance learning regularly and 12% very often (ILO et al., 2021, p. 17). However, more than 30% had never used online and/or offline distance learning for courses or trainings prior to the COVID-19 pandemic, while a further 30% had used it only occasionally. TVET providers in the Asia-Pacific, Americas, and Europe and Central Asia regions were most likely to have used distance learning approaches very often or regularly (in around 30% of cases), while TVET providers in Africa were least likely to have used

them very often or regularly (in just over 5% of cases) and most likely to have not used them at all (in two-thirds of cases) (see Figure 2).

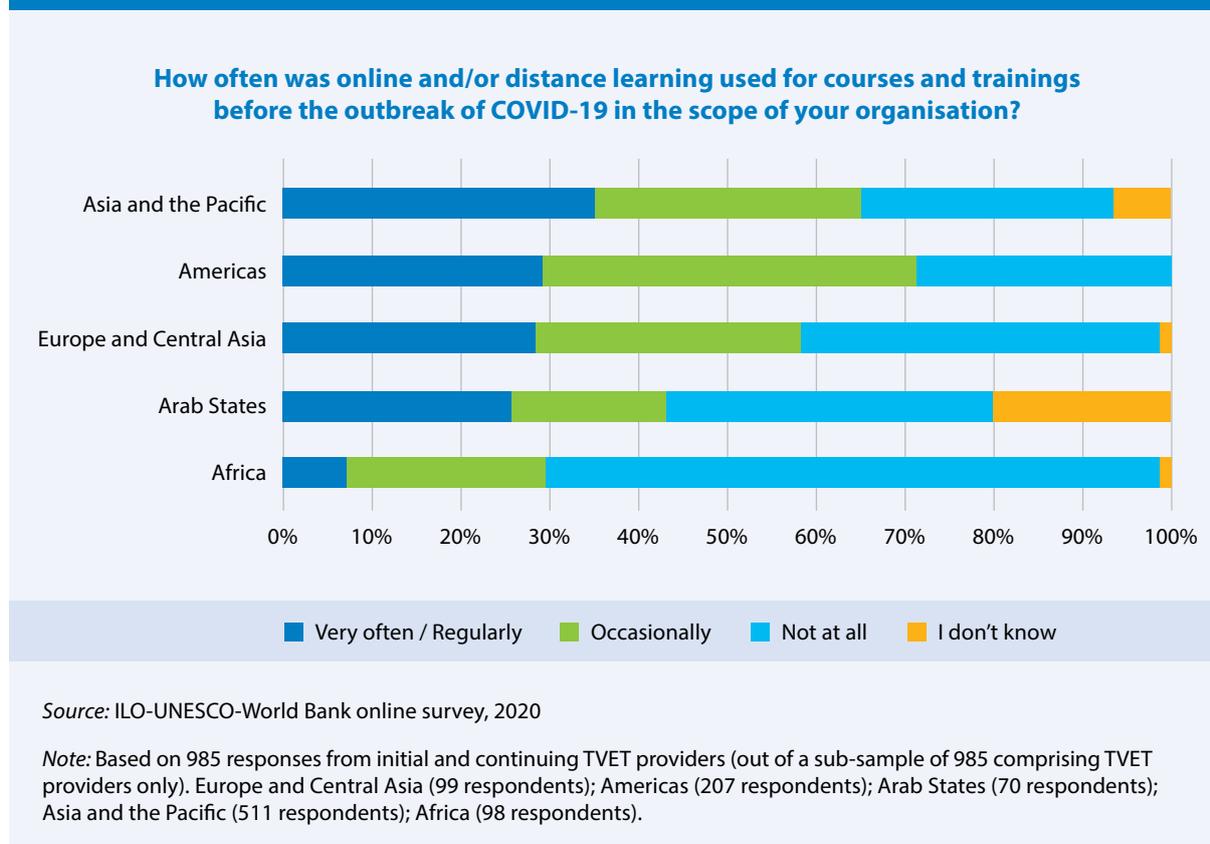
- There was variation within national income categories. For example, in Australia 14–20% of TVET units were taught online before the pandemic, whereas in Portugal the use of e-learning methodologies in TVET was 'very rare' (Cox and Prestridge, 2020, p. 15; Silva et al., 2017). TVET teachers/trainers in some low-income countries had participated in capacity-building projects to develop their digital skills, which improved their response during the pandemic. According to the Commonwealth of Learning (2020, p. 7), which supported 93 TVET institutions across Africa to implement a flexible and blended model of TVET prior to the pandemic, '[c]ountries with existing capability [in fully remote or blended learning] were able to leverage this quickly' when the pandemic hit.

The impetus for digitalization in TVET differed between developed and developing countries, and this affected the focus of the digital skills training received by TVET teachers/trainers.

- In upper-middle-income and high-income countries, the key driver for introducing digital technologies in TVET – and thus also in TVET teacher training – was to transition to knowledge economies and respond to changes taking place in the world of work (Mead Richardson and Herd, 2015; UNESCO-UNEVOC, 2020a, p. 13). An evaluation of the use of digital technology in initial TVET in Europe showed that by 2005 nearly all EU Member States had taken steps towards integrating digital tools to provide learners with the skills relevant for the future of work and lifelong learning (European Union, 2005).
- By contrast, in most developing countries (with structurally different economies and labour markets), the main driver for the use of digital tools in TVET was to expand access to TVET through digital delivery in order to accommodate the growing numbers of young people exiting secondary education (Mead Richardson and Herd, 2015). The push for digitalization in TVET came mainly from donors and international partners, rather than governments, and took the form of support (including capacity building for TVET teaching staff) for flexible and blended learning, rather than fully remote training.

While there are many examples of developed countries offering flexible training delivery options, their initiatives tended to target specific groups (e.g. older workers) through continuing TVET rather than initial TVET.

Figure 2. Use of online and/or other forms of distance learning by TVET providers before the COVID-19 outbreak, by region



Source: ILO et al. (2021, p. 18)

When training in the use of digital tools was available, it tended to (a) focus on the use of tools for teaching TVET rather than on alternative forms of course delivery, (b) teach teachers/trainers how to use technology rather than how to apply different digital options, (c) not be targeted to reach a multigenerational teacher/trainer workforce, and/or (d) lack relevant content.

(a) **Lack of focus on digital TVET delivery.** 73% of TVET practitioners responding to the UNESCO-UNEVOC survey reported having received training in digitalization areas; over 90% of them stated that the training had covered how to use new instructional tools and/or educational technologies for teaching TVET and 75% stated that it had covered new digital technologies, equipment and/or practices in the workplace (UNESCO-UNEVOC, 2020a). Only 52% of the TVET practitioners reported having received training on how to deliver TVET using alternative (including digital) formats, indicating that a sizeable proportion of TVET teachers and trainers were not prepared for the transition to fully remote training when the COVID-19 pandemic hit.

(b) **Lack of focus on the application of digital tools and technologies.** The findings of the OECD TALIS survey suggest that in many cases TVET teachers/trainers were taught digital skills and introduced to digital technologies but were not taught how to apply them in their teaching practices. Of the upper secondary VET teachers from OECD countries/regions who responded to TALIS 2018, 46% cited training in digital skills for teaching as their most urgent professional development need (OECD, 2021b, p. 112). An even higher percentage (59%) of the 481 training providers surveyed by the UK Education and Training Foundation in 2018 reported urgently needing further training on how to use digital tools and other new technologies for teaching and learning (Education and Training Foundation, 2018).

(c) **Age-related differences in TVET teachers'/trainers' access to digital skills training** are also indicated by the results of the UNESCO-UNEVOC survey. While 69% of government/national body respondents stated that digital skills for teaching were taught in pre-service training programmes

for secondary-level TVET teaching staff in their country, only 36% of TVET practitioners reported having been taught such skills for teaching during their pre-service training (UNESCO-UNEVOC, 2020a). These findings suggest that these skills have only recently been added to countries' pre-service training curricula, giving younger/newer TVET teachers and trainers greater access to digital skills development opportunities than their older, more experienced counterparts. While older/experienced TVET teachers and trainers could access digital skills training by participating in continuing professional development (CPD) programmes, most of those surveyed reported having engaged in CPD activities only once or twice (61% of respondents) or not at all (25% of respondents) over the past two years.

- (d) **'Lack of relevant content'** was cited as the second greatest barrier to participation in professional development programmes by 50% of VET teachers from OECD countries who took part in TALIS 2018 (OECD, 2021b). While most upper-middle-income and high-income countries (over two-thirds) represented in the UNESCO-UNEVOC survey conducted regular skills forecasts to track changing labour market needs – with nearly all countries (over 90%) collecting data on the new skills required in a digital economy and most (67%) compiling data on the new skills required in a knowledge economy – dissemination channels for transmitting this data to TVET institutions and practitioners were found to be weak (UNESCO-UNEVOC, 2020a). Only 11% of TVET institutional respondents reported receiving information from their governments on changes taking place in the world of work. This figure fell to 5% for TVET practitioners who reported receiving this information from their employing institutions. Given that TVET institutions were the main providers of in-service training for TVET teaching staff prior to the pandemic (ibid., p. 37), weak labour market information systems have implications for the relevance of training received by TVET teachers/trainers.

One reason for these issues was a lack of strong policies/strategies for digitalization in TVET and in TVET teacher training.

- In most low-income and lower-middle-income countries, national policies on digitalization in education prior to the pandemic were still in the development stages and tended to target general education, with little or no attention paid to TVET (Mead Richardson and Herd, 2015). One study on

sub-Saharan Africa described how: 'Specific digitalization strategies for TVET hardly exist. Rather TVET is subsumed as one of the education system's sub-sectors' (Langthaler and Bazafkan, 2020, p. 15). Where national digitalization policies were in place (e.g. Nigeria), they were often focused on achieving quantitative objectives, such as learner-to-computer ratios, or could not be fully implemented owing to funding and infrastructure issues (Dele-Ajayi et al., 2021).

- While most upper-middle-income and high-income countries had a digital skills strategy in place prior to the COVID-19 pandemic, few had a coherent strategy (ILO, 2020c). Efforts to digitalize TVET and skills systems tended to be covered by multiple and sometimes contradictory policies and regulatory frameworks. Even when countries had a national policy on digitalization in education in place, these policies often did not cover the TVET sector (European Commission, 2020b, p. 103–08). Thus, digital innovation in TVET tended to be driven by individual TVET institutions or by individual teachers or teacher communities.

Well-planned and well-resourced national strategies for digitalization in TVET, which include measures for upgrading teachers'/trainers' skills and competencies in line with changing labour market needs, are required to produce a critical mass of teaching staff who are well prepared for, confident in and capable of incorporating digital tools, technologies and e-learning into their practices in transformative and innovative ways (Latchem, 2017; CEDEFOP, 2015).

The specific challenges that TVET teaching staff faced in accessing training in online and/or offline distance learning approaches tended to stem from negative perceptions regarding their relevance and/or effectiveness, and/or the high costs of digital TVET delivery for TVET institutions.

- **Perceived lack of relevance of distance learning for TVET.** Many pre-pandemic studies argued that TVET may not be well-suited to fully online education: 'Within TVET programmes learners acquire knowledge, but also need to master practical and soft skills ... [which] can be up to 80% of a programme and may be impossible to develop online' (Commonwealth of Learning, 2020, p. 1). Prior to the pandemic it was recommended that some parts of TVET programmes be delivered face to face, while other parts could be taught online or at a distance: 'the hands-on experience needed in vocational

programmes and work-based learning [is not] able to be fully replicated online' (British Council, 2021). However, some TVET programmes were found to be more suited to being taught remotely – such as those with a stronger emphasis on academic subjects or on work-specific skills that do not require manual activities (e.g. cybersecurity) – while others, especially those that depend heavily on learning by doing, were not (Hoftijzer et al., 2020). Examples of TVET programmes requiring substantial hands-on training, which were regarded as not easily taught through virtual practical training, include automobile mechanics, hair and beauty, hospitality and catering, nursing and social work (Commonwealth of Learning, 2020, p. 4).

- **Perceived lack of effectiveness of distance learning approaches.** Open and distance learning (ODL) carries a stigma of being of lower quality than face-to-face learning (Hodges et al., 2020; Hoosen and Butcher, 2017, p. 185). Such perceptions varied by country according to literature reviews, with students in Turkey and Russia preferring traditional face-to-face education over distance learning, while those in Nigeria, Pakistan and Romania had a more positive view of ODL (Clifford et al., 2013, p. 41). Nevertheless, remote training in TVET, as in general education, was in some cases found to produce worse outcomes than face-to-face approaches. A study of fully online teaching in VET in Australia concluded: 'Like other education sectors, VET currently experiences lower successful completion rates for its online students than its face-to-face students' (Cox and Prestridge, 2020, p. 15). Likewise, a synthesis of global evidence on ODL in higher education found that 'drop-out and lack of completion rates in ODL were high ... [and] ODL students appeared to be less satisfied in comparison to their peers attending traditional institutions' (Clifford et al., 2013, p. 45). The effectiveness and attractiveness to students of online and/or offline distance learning options affect governments' and TVET institutions' decisions on whether to invest in remote training modalities, including whether to train teachers/trainers in distance learning modalities.
- **High costs of digital TVET delivery for providers.** While it is assumed that distance learning can make education and training more accessible and affordable for students – at least for those with easy access to digital resources – it often involves high costs for TVET institutions. As a study on the costs of ODL and ICTs in TVET concluded:

'Economic concerns can raise major barriers to offering ODL programmes in TVET. This is particularly challenging in contexts where government funding for TVET is low' (Hoosen and Butcher, 2017, p. 185). Use of digital technologies or multimedia resources to deliver TVET can raise costs as the complexity and sophistication of the technologies used increase. As the ILO (2020c, p. 72) notes, while use of simulation technologies to develop TVET learners' advanced and industry-specific skills 'carries lower risk and lower costs than creating workplace scenarios, creating and maintaining such simulations requires significant investments in manpower as well as equipment, often in cutting-edge technology that has not yet been standardized and may be considered outdated within mere months'. The unit costs of designing digital learning materials or purchasing simulation packages and training teaching staff to use them are only likely to be low if large numbers of students enrol in distance learning programmes. Yet, '[i]n the case of TVET, training demand in most developing countries is for small numbers of graduates in a wide range of occupational areas' (Hoosen and Butcher, 2017, p. 197). Economic concerns affect institutional decisions on whether to implement distance learning in TVET and train staff in the skills needed to deliver TVET digitally.

Uptake of training

Just because digital skills training opportunities are available does not mean that TVET teaching staff will take them up. Some barriers to TVET teachers'/trainers' uptake of digital skills development opportunities applied to all training, while others were specific to training in digital skills.

Barriers to TVET teachers'/trainers' willingness to participate in professional development opportunities in general included lack of time owing to workload pressures and high costs of undergoing training, while a lack of institutional incentives to counter these challenges constituted a further barrier.

- **Lack of time for training.** 'Conflicts with my work schedule' was cited as a key barrier to professional development by 63% of VET teachers from OECD countries who participated in TALIS 2018, while 59% of institutional representatives responding to the UNESCO-UNEVOC trends mapping survey said that 'TVET teaching staff [are] too busy and/or paid too little to engage in training' (OECD, 2021b, p. 103; UNESCO-UNEVOC, 2020a, p. 43). Time/workload pressures can affect teachers'/trainers'

motivation to undergo training, especially in developing countries, where student-teacher ratios are often higher than in developed countries and where teachers' remuneration is often irregular, delayed or low (Burns and Lawrie, 2015). Three-quarters of TVET institutional respondents to the UNESCO-UNEVOC survey who said that teaching staff in their institution are too busy and/or paid too little to engage in training came from low- or lower-middle-income countries.

- **High costs of undergoing training** were another barrier to TVET teachers'/trainers' participation, since TVET teaching staff were often expected to pay some or all the costs of training themselves. Of the TVET institutional representatives responding to the UNESCO-UNEVOC survey, 45% said that teaching staff in their institution had to fund their own training (UNESCO-UNEVOC, 2020a, p. 25). An even higher proportion (65%) of OECD VET teachers taking part in TALIS 2018 cited financial barriers as the main reason they did not participate in professional development activities (OECD, 2021b, p. 103). Financial barriers tended to be greater in low-income countries and especially in Africa, since low funding for the TVET sector meant that teaching staff often had to organize and fund training themselves (Rawkins, 2018).
- **'No incentives'** was cited as a key reason for not participating in professional development by 57% of VET teachers from OECD countries responding to TALIS 2018, closely followed by 'lack of employer support' (45%) (OECD, 2021b, p. 104). As the OECD defines it, 'employer support' encompasses inducements such as time off work or financial support (e.g. training budgets at VET providers), while 'incentives' refers to rewards such as increased salary or promotion prospects given to teachers/trainers to encourage them to participate in professional development activities.

Research suggests that incentives and inducements are necessary to overcome teachers'/trainers' reluctance to participate in training owing to low salaries, work time pressures, negative attitudes towards new technologies or other issues (Friedman and Phillips, 2001). This is especially important in TVET systems without compulsory training requirements for teaching staff, which characterized 40% of countries and around 50% of TVET institutions represented in the 2019 UNESCO-UNEVOC survey (UNESCO-UNEVOC, 2020a).

The most frequently used incentive, cited by more than 50% of respondents to the UNESCO-UNEVOC

survey, was financial support and/or training budgets (UNESCO-UNEVOC, 2020a). However, governments and TVET institutions in low- and lower-middle-income countries often lacked systems and/or budgets to offer such incentives (Burns and Lawrie, 2015).

According to the UNESCO-UNEVOC survey, the training incentive most valued by TVET teachers/trainers was the opportunity to gain an additional qualification, since this enhances teachers'/trainers' reputation and marketability in the labour market, especially if the qualification is recognized and linked to career progression (UNESCO-UNEVOC, 2020a). However, less than 50% of the TVET institutions responding to the survey offered teaching staff opportunities to gain an additional qualification, while even fewer (39%) offered teachers/trainers paid time off work to engage in CPD.

In terms of digital skills training specifically, the main barrier to TVET teachers'/trainers' participation in externally organized programmes was negative attitudes/resistance stemming from lack of knowledge of the benefits of digitalization for teaching and learning, while a key challenge for those organizing their own training was lack of knowledge/information regarding the digital skills required in the labour market.

- **Negative attitudes towards new technology/resistance to change** affected teacher/trainer reactions to the introduction and integration of digital technologies in education and training systems, including their decisions on whether to participate in digital skills training (Bingimlas, 2009; Sabzian and Gilakjani, 2013). The results of the UNESCO-UNEVOC survey suggest that, while most TVET teachers/trainers across the world did not have negative attitudes towards new technologies, a sizeable proportion did. 41% of government/national body representatives and 31% of TVET institutional representatives responding to the survey said that TVET teaching staff in their country/institution had negative attitudes towards new technologies and/or resistance to change (UNESCO-UNEVOC, 2020a). In most cases, these negative attitudes stemmed from teachers'/trainers' lack of understanding of how using digital tools and resources would benefit their own work and their students' learning (Becta, 2004, p. 17).

Research showed a strong positive correlation between teachers' computer experience and attitudes towards digital technology, suggesting that increasing teachers'/trainers' exposure to

digital skills training is the key to overcoming negative attitudes (Sabzian and Gilakjani, 2013). However, to ensure teachers/trainers realize the advantages of using technology in their teaching, teacher training programmes should highlight their benefits for teaching staff as well as for students (Becta, 2004).

- **Lack of knowledge/information concerning digital skills required by the labour market** was another key barrier to TVET teachers'/trainers' engagement in digital skills training, especially in contexts where teachers and trainers were responsible for their own professional development. The results of the UNESCO-UNEVOC survey suggested that TVET teachers/trainers often had limited knowledge of what digital skills and knowledge they required owing to a lack of sufficient information on labour market requirements. Of the TVET practitioners who responded to the survey, 57% reported lacking knowledge/information regarding the skills and competencies required for digitalization,¹ while 50% said they lacked information on national, regional and/or local labour market needs (UNESCO-UNEVOC, 2020a). A sizeable proportion (75%) of the TVET practitioners who indicated that they lacked information on labour market needs came from low- and lower-middle-income countries.

Capacity to apply digital skills

Even when TVET teaching staff received training in the use of digital tools and services for teaching TVET, they were seldom provided with the level and depth of digital and pedagogical skills needed to transform TVET learning environments in meaningful ways. A further issue was a general lack of knowledge and information regarding the pedagogical skills needed for effective digital TVET delivery.

Use of digital tools and services for teaching TVET

In its publication *Improving the Quality of TVET Using Technology: A Practical Guide*, UNESCO-UNEVOC (2020b) presented a four-stage model of technology adoption (see Table 3), which can be used to determine the extent to which digital tools and technologies are being integrated into TVET learning environments (see Table 4). The model focuses on two dimensions – technology and pedagogy – and is based on the idea that introducing technology into TVET learning environments is not enough; learners, not technology, must be the focus of technology-enhanced teaching and learning activities. To effectively integrate digital tools and technologies into TVET to achieve intended learning outcomes and to support and empower learners, TVET teachers/trainers need strong pedagogical knowledge, skills and competencies, as well as an understanding of how to use digital tools, technologies and resources to teach course content.

Table 3. Four-stage model of ICT adoption in TVET

Emerging	Teachers/trainers acquire basic digital skills and knowledge of instructional tools and educational technologies that can be used for teaching course content. The focus is on learning how to use these tools and technologies (e.g. spreadsheets) for administrative purposes or communication with colleagues (e.g. email).
Applying	Teaching staff can blend digital tools and technologies into their teaching practices without making significant changes to those practices. For example, they may prepare PowerPoint presentations containing graphical images to accompany their lectures or encourage learners to submit their work electronically.
Infusing	Teachers/trainers can select from and use an array of digital tools, technologies and resources to deliver course content and manage students' use of technology for undertaking assigned learning activities. Teachers/trainers can also combine the use of new technologies with the use of more learner-centred pedagogical approaches and can see the benefits of digitalization in terms of improved student engagement and outcomes.
Transforming	Teaching staff can experiment with a range of digital tools and pedagogical approaches to create engaging and meaningful learning environments. Their role changes from initiators to facilitators of student learning, as they encourage learners to engage in technology-enabled interdisciplinary group projects or self-learning and reflection. Teachers/trainers are likely to collaborate with colleagues to improve their teaching practices as well as their use of digital tools and technologies for teaching and self-learning.

Source: UNESCO-UNEVOC (2020b, pp. 19-21)

¹ Entrepreneurship and education for sustainable development were also covered by the survey question. The three areas were combined in a single answer choice.

Table 4. Overview and indicators related to the four stages of ICT adoption in TVET

Stages of ICT adoption	Scope of ICT use by TVET teachers	Examples of the practical use of ICTs	Outcomes for TVET teachers	Resources available	Limitations
Emerging	Use of available ICT tools	Spreadsheet application to calculate assessment marks	Awareness of opportunities of ICTs to enhance TVET teaching and learning	Limited ICT infrastructure and hardware	Limited opportunities to apply digital tools in courses or programmes
Applying	Use of ICT productivity tools for teaching and learning	ICT-enabled presentations with multimedia elements. Use of worksheets by students to record ideas.	Awareness of opportunities offered by ICTs for teaching/ learning. Teachers seize opportunities but there is no change in the pedagogical strategies adopted by teachers in ICT-enabled learning environments.	ICT infrastructure and hardware in place on campus	Teachers continue to act as the main drivers of learning
Infusing	Integration of ICT tools in lessons and courses to accommodate different learning needs	Virtual experiments conducted using digital mobile devices	Begin to use ICTs to support and empower students to monitor and manage their own learning	Necessary infrastructure and hardware are available to support ICT-enabled learning environments.	Teachers are still the main organisers and initiators of teaching and learning activities.
Transforming	Use of ICTs to support and empower students to monitor and manage their own learning. Teachers scaffold students' reflections on their learning processes and outcomes.	Use of internet-enabled applications such as learning management systems and e-portfolio systems. Use of e-portfolios as a form of assessment for student internships.	Use of a range of ICT tools with different pedagogies to create meaningful learning environments.	Teachers have access to robust ICT infrastructure, hardware and resources, and a transformed curriculum.	Teachers facilitate student learning that may be bound by available content and institutional resources.

Source: UNESCO-UNEVOC (2020b, p. 22)

The findings of the UNESCO-UNEVOC survey suggest that, prior to the pandemic, most TVET teachers/trainers globally were at the 'applying' or 'infusing' stages but had not reached the 'transforming' stage of technology adoption. Most TVET practitioners responding to the survey who reported having received training in digitalization areas said they had been taught how to use new instructional tools and/or educational technologies for teaching their subject (94%), had learned new pedagogical approaches for teaching their subject (81%), and/or had been trained to use, create and/or share online resources (75%) (UNESCO-UNEVOC, 2020a). However, only 56% said they had been taught how to facilitate student self-learning using technology, and only 44% said they had been taught how to assist students in developing and sharing their own learning materials. Changes in teaching practices, curriculum and teaching materials required to reach the 'transforming' stage take years and require teachers/trainers to receive frequent professional development and support, which is continuously adjusted as teachers/trainers progress through the stages of technology adoption.

TVET teaching staff in low- and lower-middle-income countries who received digital skills training often did not progress beyond the 'applying' stage. A recent study on digitalization in education in sub-Saharan Africa confirms this finding: the 'majority of countries are at emerging and applying stages in ICT adoption and use in education, with only Seychelles, Mauritius, and South Africa at infusing stage' (Tilya, 2018).

Digital delivery of TVET through distance learning

Research and information are lacking regarding the pedagogical skills that teachers/trainers require to deliver TVET effectively through online and/or offline distance learning. As noted in a study on the use of fully online teaching in VET in Australia conducted before the pandemic: 'Despite the importance of VET as an education sector, and despite its move toward online education, VET remains an under-valued research sector and little is yet understood about the pedagogy of VET online' (Cox and Prestridge, 2020, p. 15). TVET teaching staff need to know how to effectively teach at a distance, to design engaging digital learning materials and environments, and to support students to ensure the success of distance learning initiatives. A seminal article on e-learning in postsecondary education concluded: 'As with other types of instruction, e-learning's effectiveness depends on how well it is designed to create the instructional experience that makes learning possible' (Bell and Federman, 2013, p. 170).

The pedagogical competencies that TVET teachers/trainers need in order to deliver effective online and/or offline distance learning are additional to, but distinct

from, those that they require for face-to-face teaching. For this reason, a global review of literature on the use of e-learning in VET has argued that 'adjusted pedagogical concepts should be designed and developed explicitly for e-learning' (Belaya, 2018). The gap in knowledge regarding what constitutes good student-centred distance learning pedagogy is evident from an examination of the four-stage model of ICT adoption shown in Table 4, which was designed to assist TVET teaching staff to gauge their technology-related professional development needs but is not relevant for teachers/trainers who are planning to use digital tools and services to deliver TVET remotely. **A new framework is needed to build teacher/trainer competencies in digitally-enhanced distance learning approaches.**

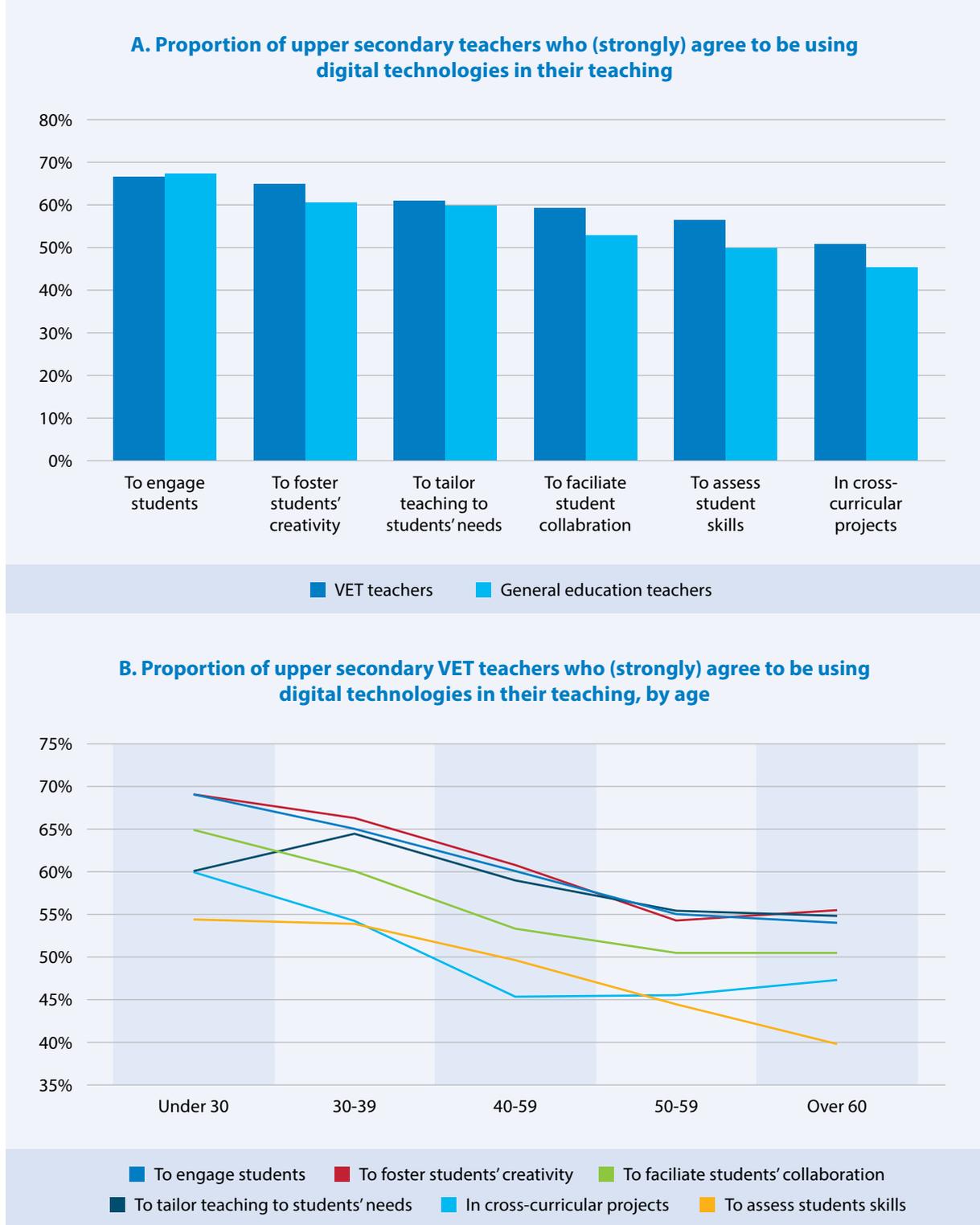
Propensity to apply digital skills

The extent to which TVET teachers/trainers are likely to use digital tools and resources for teaching TVET and/or delivering TVET through distance learning is influenced by their exposure to digital skills training, the level and focus of the training that they receive, and the resources and support they receive from their employing institution.

TVET teachers'/trainers' tendencies to use digital technologies prior to the pandemic differed according to their countries' income level as well as their age.

- As Figure 2 shows, pre-pandemic use of online or other forms of distance learning for teaching TVET was higher in regions containing mainly high- and upper-middle-income countries and lowest in those containing mainly low- and lower-middle-income countries. More than 70% of TVET providers in the Americas used online and/or other forms of distance learning very often or occasionally, compared to less than 30% in Africa.
- Data from the European Commission's SELFIE (Self-reflection on Effective Learning by Fostering the Use of Innovative Educational technologies) tool suggests that while most upper secondary VET teachers from OECD countries had integrated digital technologies in their teaching practices, a sizeable proportion (estimated at 34%) had not (see Figure 3). The SELFIE results also showed significant age-related differences, with younger VET teachers more likely to use digital tools and resources in their teaching than older VET teachers.
- Equivalent data is not available for low- and lower-middle-income countries. However, given that many teacher/trainers in these countries were at the 'emerging' stage of technology adoption (if they had digital skills at all) and that their access to digital resources in schools tended to be low (see Table 2), it might be assumed that their use of digital tools and services for teaching TVET was limited.

Figure 3. Proportion of OECD upper secondary VET teachers integrating digital technologies in their teaching



Note: All percentages refer to share of high responses (i.e., 4 and 5 on a 5-point-scale). Participation in SELFIE is anonymous and voluntary, thus the data are not representative. Not all OECD countries are available and included in the dataset.

Source: SELFIE database (extraction October 2018 - December 2020); Hippe, R., Pokropek, A. and P. Costa (2021), Cross-country validation of the SELFIE tool for digital capacity building of Vocational Education and Training schools, in preparation.

Source: OECD (2021b, p. 132)

Reasons why TVET teaching staff did not apply and build upon the digital skills and competencies that they gained included lack of confidence and negative attitudes/resistance to change.

- **Lack of teacher/trainer confidence** was cited by the OECD (2021b, p. 139) as ‘[o]ne of the likely reasons why many VET teachers do not use digital technologies as part of their teaching’. 26% of VET teachers from six OECD countries and regions who responded to TALIS 2018 said they did not feel well-prepared to support student learning through use of digital technologies (OECD, 2021b, pp. 138-139). Likewise, around 25% of upper secondary VET teachers from OECD countries who used the SELFIE tool between October 2018 and December 2020 reported lacking confidence in their abilities to use digital technologies for classroom teaching or for providing feedback to students (ibid., pp. 139–40). This percentage varied across countries (e.g. 45% of Slovenian VET teachers) and VET teacher age profiles (e.g. 47% of those aged 60+ compared to 24% of those aged 30–39).
- **Negative attitudes/resistance to change** were a key barrier to the use of digital tools among TVET teaching staff in low- and lower-middle-income countries, especially in cases where digital technologies were introduced without teachers/trainers being trained on how to use them effectively to convey course content. A study on the use of digital tools in teaching and learning in Cameroonian secondary schools reported ‘formal opposition by teachers to use pedagogical tools that they were not initially trained to utilise in a professional way’ (Haji et al., 2017). In Sudan, a government policy plan to encourage digitalization in the education sector was met with resistance by TVET teachers, who had ‘no strong desire and interest to integrate ICT in TVET classes, in accordance with the glance view of ICT policy in education, [owing to] lack of ICT infrastructure, financial support, and teacher training in the basic computer skills’ (Ramadan and Chen, 2018, p. 650).

Negative attitudes towards use of technology were not an issue among TVET teachers/trainers in upper-middle-income and high-income countries, according to a survey of 190,000 students, teachers and head teachers from 31 European countries conducted in 2011–12 (European Schoolnet and University of Liege, 2013). The survey found an ‘overwhelmingly positive opinion of teachers about the value and impact of ICT on T&L [teaching and learning]’ but also a lack of teacher confidence in integrating technology: ‘Despite having access and

positive attitudes towards implementing ICT in teaching and learning, teachers often find this difficult and require support – not only technical but also pedagogical’ (ibid., pp. 13-18). Technology teachers tended to have more positive attitudes towards digitalization than teachers of all other subjects, according to a pre-pandemic study examining teachers’ attitudes in 11 European countries (Hämäläinen et al., 2021).

Overcoming teachers’/trainers’ negative attitudes and lack of confidence in using digital tools requires training in pedagogy as well as digital skills, providing teaching staff with time and access to digital resources for self-learning, and ensuring that technical support is available when things go wrong.

To change attitudes towards the use of digital tools and technologies in TVET, teachers/trainers need access to continuous training and support to build their digital skills as well as their confidence in applying them. A study on factors that enable the use of technology in teaching concluded: ‘Having a positive attitude is an important factor enabling teachers’ use of ICT but in order to have a positive attitude, a teacher may need to have some ICT skills and feel confident in using ICT’ (Cubukcuoglu, 2013). Increasing teachers’/trainers’ exposure to and competency in using digital tools for teaching can be a powerful means of overcoming negative attitudes. A study examining Nigerian teachers’ concerns regarding digital technologies found that teachers had the highest levels of concern during the ‘awareness stage’, when they had little or no experience in using technologies, and the lowest levels of concern during the ‘consequence stage’, once they had integrated digital tools into their teaching and learning practices and were waiting to see their impacts on student learning (Dele-Ajayi et al., 2021).

In cases where access to formal professional development opportunities is lacking, informal support mechanisms such as peer-learning networks and mentoring have been found to be an effective substitute, especially at the start of teachers’/trainers’ careers (OECD, 2021b, p. 166). Appointing early adopters of technology and new teaching paradigms as ‘champions’ to assist and encourage colleagues to implement technology-enhanced teaching approaches was also found to change attitudes and practices in some African TVET institutions prior to the pandemic (Mead Richardson and Herd, 2015, p. 13).

The literature suggests that overcoming teachers'/ trainers' lack of confidence in applying digital skills requires three other interrelated barriers to be addressed (see Figure 4):

- **lack of teacher competence** owing to a lack of relevant digital skills training, pedagogical training and/or 'self-training', which may be defined as time and opportunities to practise using new technologies and to explore how to integrate digital tools and technologies in teaching practices;
- **lack of teacher/trainer access to digital resources**, both inside and outside of school, since these are needed to increase teachers'/trainers' opportunities to engage in self-training to improve their digital skills and overcome their fears that their students may know more than them or that things may go wrong during lessons; and
- **lack of just-in-time technical support** to quickly address problems encountered during lessons and to reassure teachers/trainers who fear things may go wrong during lessons.

Figure 4. Relationships between lack of teacher/trainer confidence and other barriers to technology adoption



Source: Becta (2004, p. 21)

Data from the European Commission's SELFIE tool suggests that upper secondary VET teachers from OECD countries often did not get the support they needed to confidently apply digital technologies in the classroom. Challenges included (OECD, 2021b, p. 145):

- **Lack of time to integrate digital skills into teaching and learning processes:** Only 31% of teachers reported having had time to explore how to improve their teaching with digital technologies.
- **Lack of opportunities to experiment with technology-enhanced pedagogical approaches:** Only 52% of teachers reported having received support from school leaders for trying out new ways of teaching with digital technologies.
- **Lack of employer support for digital competence development:** Only 45% of teachers said that school leaders had discussed with them their professional development needs for teaching with digital technologies.
- **Lack of employer support for informal digital skills development through peer-learning:** Only 51% of teachers said that school leaders had supported them in sharing experiences within their school about teaching with digital technologies.

Summary of pre-pandemic trends and challenges

The pre-pandemic situation for the training of TVET teachers and trainers in the use of digital tools to enhance pedagogy and to enable remote course delivery can be summarized as follows.

- Prior to the pandemic, a strong positive correlation existed between TVET teachers'/trainers' access to digital skills development opportunities and their national income level.
- The primary reasons for low access to digital skills training in low- and lower-middle-income countries were supply-side factors – in particular, a systematic lack of resources, which restricted TVET teachers'/trainers' access to all professional development opportunities; a lack of digital and other infrastructure; and a lack of trained trainers with digital skills and knowledge. In upper-middle and high-income countries, the main issue was the quality of digital skills development programmes rather than TVET teachers'/trainers' access to them.
- Across all countries, policies/strategies for digitalizing TVET were weak, and the focus of government digitalization efforts was on general education rather than TVET. Labour market information systems were also weak, affecting the relevance of training received by TVET teachers/trainers.
- Little attention was paid to developing teachers'/trainers' skills and competencies in delivering TVET remotely. This was due to negative perceptions regarding the relevance and/or effectiveness of distance learning approaches for TVET, as well as the high costs of digital TVET delivery for TVET institutions.
- Demand-side factors – in particular, TVET teachers'/trainers' low salaries and work time pressures, which were often not offset by incentives to participate in CPD – also played a role in limiting teachers'/trainers' acquisition of digital skills.
- In many countries, efforts to digitalize TVET were stalled by a lack of understanding on the part of TVET teachers/trainers of the benefits of integrating technologies into teaching and learning processes, insufficient teacher/trainer training on how to apply digital tools to convey course content, and/or inadequate opportunities to master and build on digital skills gained.

These combined trends and challenges resulted in countries' TVET systems being at different stages of digitalization when the COVID-19 pandemic hit.

Evidence for this section is primarily drawn from surveys undertaken by the ILO (in cooperation with UNESCO and the World Bank), the OECD (in cooperation with UIS, UNESCO, UNICEF and the World Bank), eLearning Africa and EdTech Hub, and the European Commission. These surveys were chosen for their global and regional coverage of countries' pandemic responses as well as their multi-TVET-stakeholder dimensions.

Main data sources for this section

SURVEYS:

1. ILO-UNESCO-World Bank online survey of 985 TVET providers across 92 countries, conducted between 3 April and 15 May 2020, which examined the status of digitalization in TVET (ILO et al., 2021).
2. OECD/UIS/UNESCO/UNICEF/World Bank Special Survey, which gathered data on national responses to COVID-19 school closures from officials in charge of school education and education statistics in 38 OECD and partner countries from January to February 2021 (OECD, 2021a).
3. eLearning Africa and EdTech Hub survey of 1,649 educators and technology specialists from 52 African countries, conducted between 15 June and 15 July 2020, which provided information on the training and support available to African TVET teachers/trainers during the pandemic (eLearning Africa and EdTech Hub, 2020).
4. European Commission survey of 262 (mainly VET provider) respondents from 26 European countries, conducted from 18 March to 11 May 2020, which collated information on initiatives undertaken to ensure continuity of teaching and learning during education and training institution closures (European Commission, 2020a).

OTHER SOURCES:

5. ILO Sectoral Brief on 'COVID-19 and the education sector', which examined measures taken by governments and TVET providers during the early pandemic period up to June 2020 (ILO, 2020a).

To document trends and challenges in TVET teacher digital skills development during the pandemic, three areas are examined:

- **Access to training:** Consideration is given to how far TVET teaching staff have been able to access training and support to assist them in delivering TVET remotely during school closures, and in what cases and for what reasons such training and support have not been available.
- **Propensity to develop and apply digital skills:** Another area to be explored is how far TVET teachers/trainers have been supported and

encouraged to learn about and apply digital tools and technologies to deliver high-quality distance learning.

- **Partnerships for advancing digitalization:** Finally, the involvement of non-traditional TVET partners in supporting teachers and trainers to access, use and integrate digital tools to provide remote training is examined.

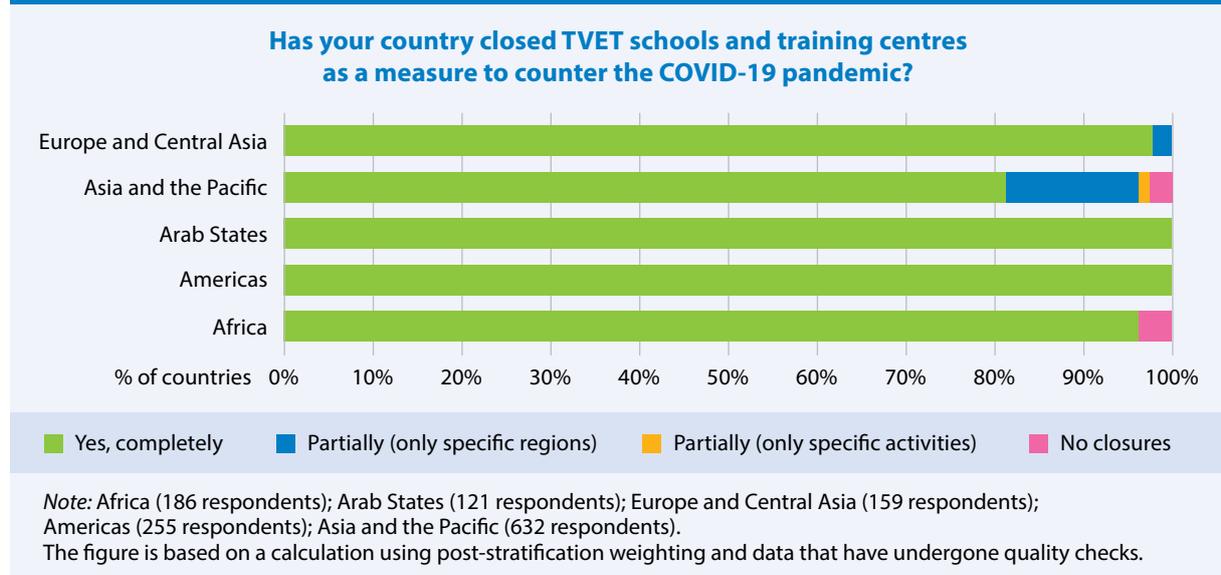
Before turning to these three areas, consideration is given to the impact of COVID-19 on TVET provision at the outset of the pandemic.

The COVID-19 pandemic has revealed countries' different levels of preparedness for a transition to fully remote training environments.

Government containment measures to stop the spread of COVID-19 resulted in the complete or partial closure of nearly all TVET schools and training centres globally (see Figure 5). Yet while the majority (75%, according to the 2020 ILO-UNESCO-World Bank online

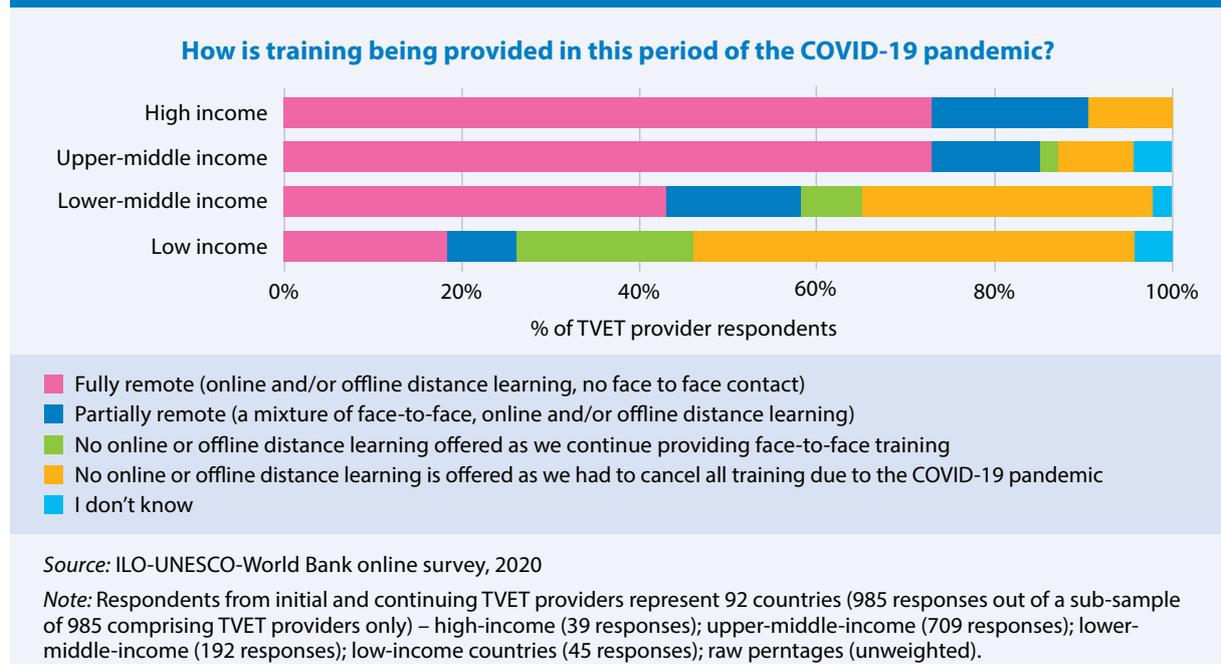
survey) of TVET providers in high- and upper-middle-income countries were able to ensure continuity of training by offering fully remote online and/or offline distance learning, only 18% of TVET providers in low-income countries were able to do so (see Figure 6). 51% of TVET providers across Africa reported being unable to provide any form of online or offline distance learning during school closures (ILO et al., 2021, p. 19).

Figure 5. Closure of TVET centres, by region, during the early COVID-19 pandemic period



Source: ILO et al. (2021, p. 8)

Figure 6. Mode of TVET training during early COVID-19 pandemic period, by national income level



Source: ILO et al. (2021, p. 19)

Access to training

TVET teachers'/trainers' access to training and support in the use of digital tools to deliver TVET remotely varied by national income level.

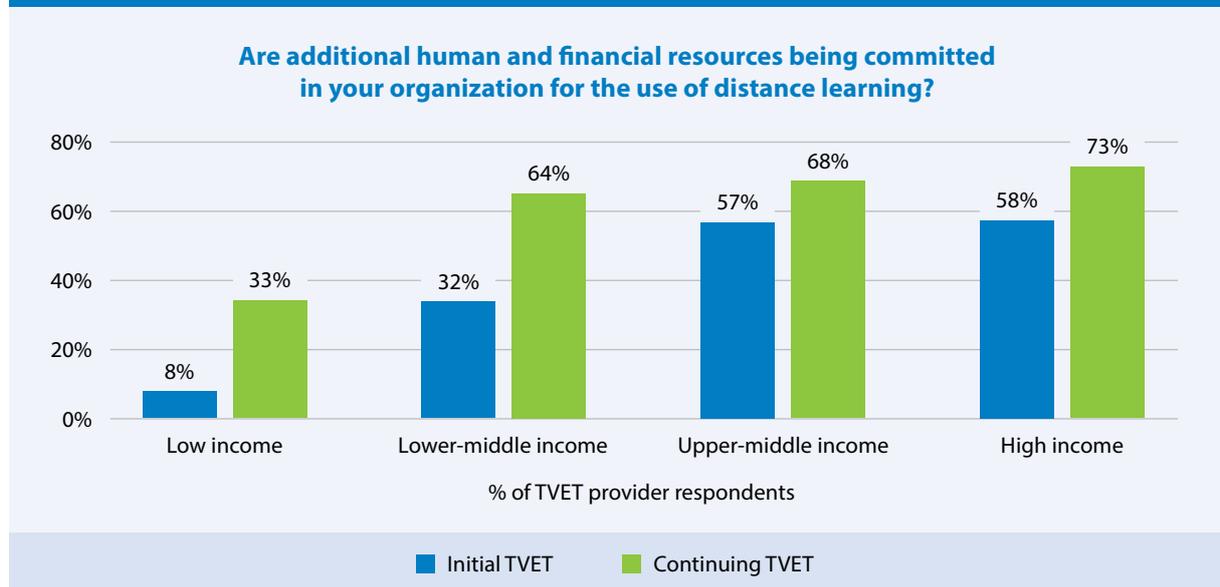
While most countries put in place measures to support TVET teachers and trainers to deliver remote training (most frequently by providing them with digital resources and online training, sometimes complemented by technical support and help desks), the level and type of support available to TVET teachers/trainers differed between low-income and high-income countries (ILO et al., 2021, p. 37).

The main challenges faced by TVET teachers/trainers in **low-income countries** in accessing training and support in distance learning modalities have included:

- **Lack of adequate human and financial resources:** While most countries in Europe and North America committed 5% or more of their 2020 gross domestic product (GDP) to fund emergency measures, governments in some parts of Africa, Asia and Latin America were able to mobilize less than 2.5% of their already low GDP

(IMF, 2021). Likewise, while almost 50% of TVET providers responding to the 2020 ILO-UNESCO-World Bank survey reported having committed additional human and financial resources to support TVET teachers/trainers in delivering distance learning, a far larger proportion of TVET providers in high- and upper-middle-income countries were able to mobilize these additional resources than those in low-income countries (see Figure 7). Resources available to low-income countries to support TVET have been affected by a reduction in donor funding owing to the economic crisis expected in the aftermath of the pandemic and, in some cases, shifting priorities (Langthaler and Bazafkan, 2020, p. 6). A survey of 1,649 educators and technology specialists from 52 African countries found that 75% did not receive any additional material or financial support to help them weather the crisis (eLearning Africa and EdTech Hub, 2020). Furthermore, while governments across Africa urged teachers/trainers to put course content online so that students could access it flexibly from anywhere, they often did not provide training or support to facilitate the shift to online learning.

Figure 7. Additional resources committed for the use of distance learning by TVET providers



Source: ILO-UNESCO-World Bank online survey, 2020

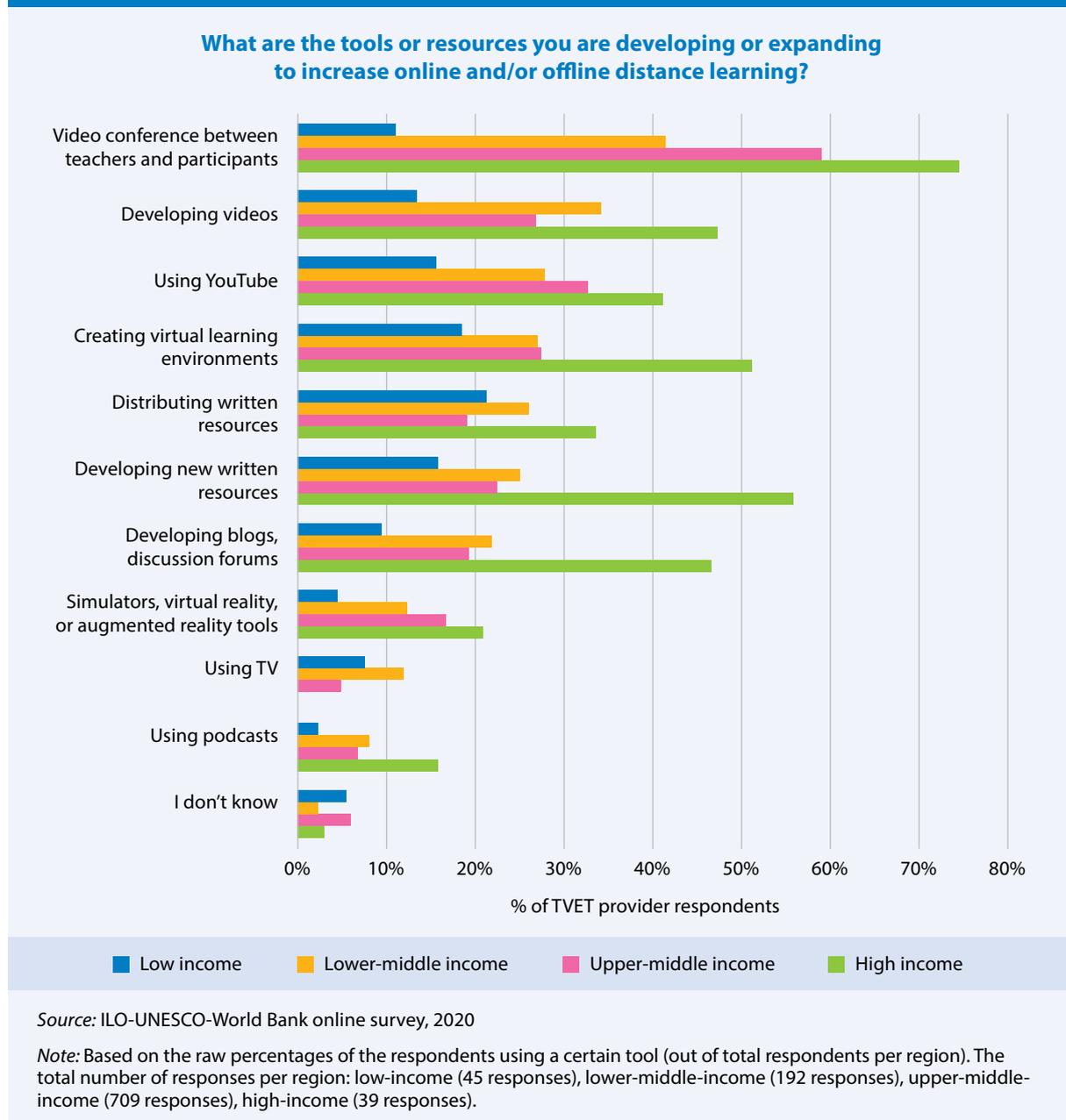
Note: The share of countries where the majority of respondents representing TVET providers reported that their TVET organizations had committed additional human and finance resources to ensure the continuity of distance learning. Respondents from initial TVET providers represent 71 countries (635 responses out of a sub-sample of 985 comprising TVET providers only) (low-income – 13; lower-middle-income – 25; upper-middle-income – 21; high income – 12). Respondents from continuing TVET providers (349 responses out of a sub-sample of 985 comprising TVET providers only) represent 67 countries (low-income – 12; lower-middle-income – 25; upper-middle-income – 19; high income – 11).

Source: ILO et al. (2021, p. 22).

- Inadequate infrastructure and limited access to digital resources:** Responses to the ILO-UNESCO-World Bank survey suggest that in 20% of the (mainly low- and lower-middle-income) countries represented in the survey, TVET teaching staff continued to lack access to computers, tablets and phones, while in over 5% of the countries they lacked reliable access to electricity (ILO et al., 2021, p. 41). Prior to the pandemic in 2019, only 10% of rural households and 25% of urban households in 47 UN-designated least developed countries had computer and/or internet access

compared with 81% of rural households and 87% of urban households in developed countries (ITU, 2020). Lack of teacher/trainer access to digital resources and infrastructure explain why TVET providers in low-income countries have had to resort to offline tools (such as written resources and television) to provide training to students during the pandemic, in contrast to the predominantly online tools and resources (e.g. video conferencing tools and virtual learning platforms) implemented in high- and middle-income countries (see Figure 8).

Figure 8. Use of new tools and resources during the early COVID-19 pandemic period, by income group



Source: ILO et al. (2021, p. 24)

- Lack of suitably skilled staff to train TVET teachers/trainers in distance learning approaches:** A lack of staff with the pedagogical and digital skills needed to train TVET teaching staff in distance learning approaches was cited by many respondents to the ILO-UNESCO-World Bank survey (ILO et al., 2021, p. 30). For example, skills shortages led authorities in Egypt to recommend that TVET providers develop partnerships with the private sector to build teachers'/trainers' skills and competencies or to recruit online and distance learning experts and advisers via short-term contracts.

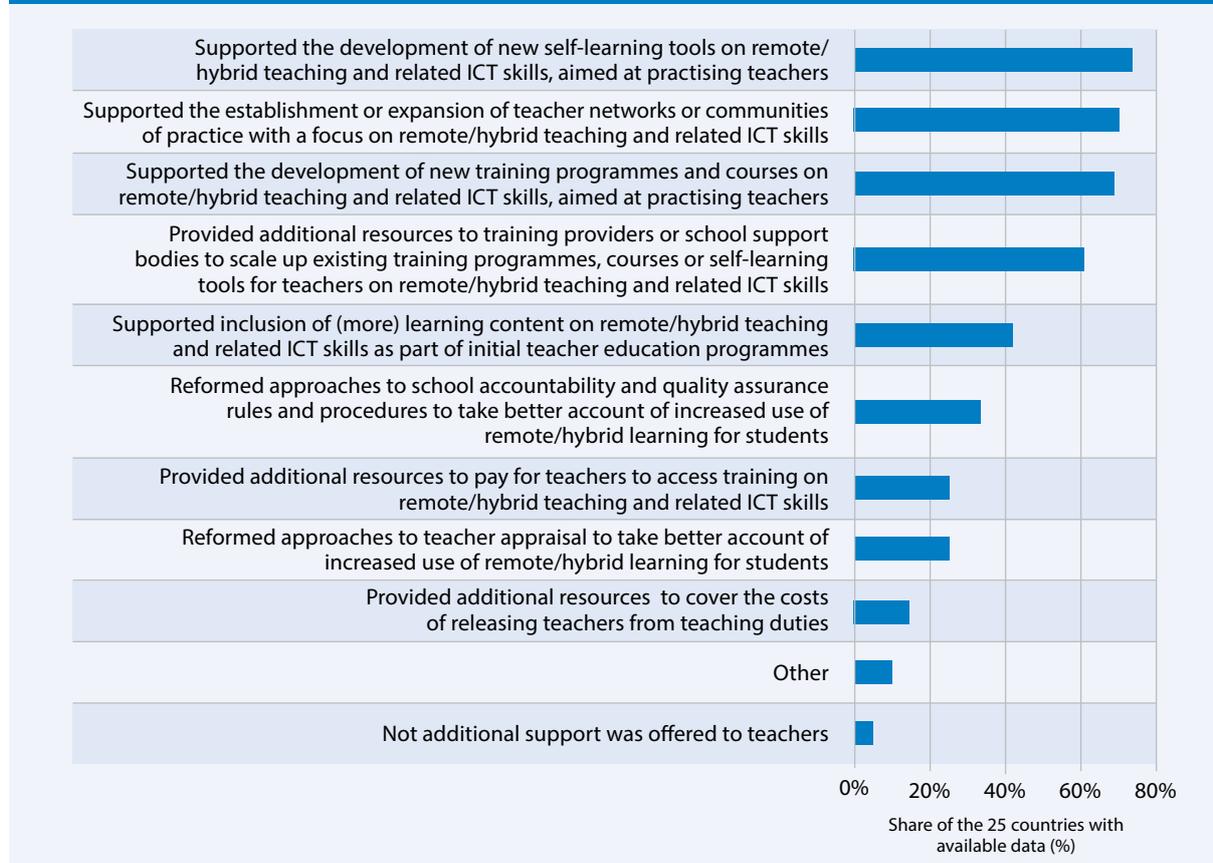
In some African countries, TVET institutions have cooperated with NGOs or private companies to provide training in distance/e-learning to teachers and trainers (eLearning Africa and EdTech Hub, 2020, p. 30). However, since such interventions are not part of a coordinated national programme of teacher training, they have not benefited all TVET teachers/trainers. Furthermore, most training-of-trainer initiatives in African countries cover offline distance training approaches, not the use of online learning environments (ILO, 2021). Respondents to the 2020 eLearning Africa and EdTech Hub survey cited a lack of appropriate training in designing and

managing distance learning programmes as the main obstacle that teaching staff in Africa have faced in providing training to learners during school and training centre closures (eLearning Africa and EdTech Hub, 2020, p. 4).

In upper-middle and high-income countries, the quality of training and support received by TVET teachers/trainers has been more of an issue than access to training.

In 96% of the 38 OECD and partner countries participating in the 2021 OECD/UIS/UNESCO/UNICEF/World Bank Special Survey, TVET teaching staff received training and support to develop their remote/hybrid teaching and related ICT skills (OECD, 2021a, p. 19–21). In most countries, this was done by supporting (a) the development of new (and scaling up of existing) self-learning tools; (b) the establishment or expansion of teacher networks or communities of practice; and/or (c) the development of new in-service training programmes and courses (see Figure 9). The new focus on online teacher training is notable, since prior to the pandemic only 34% of CPD activities for OECD VET teachers took place online (OECD, 2021b, p. 99).

Figure 9. Training and support provided to TVET teaching staff at national level (% of OECD countries)



Source: OECD/UIS/UNESCO/UNICEF/WB Special Survey on COVID, March 2021, as reported in OECD (2021a, p. 21)

Challenges faced by TVET teaching staff in **high- and upper-middle-income** countries in accessing quality training and support in distance learning modalities have included:

- **Lack of TVET-specific crisis response policies/strategies:** Policy responses for TVET have tended to be part of general education policies, so have paid little attention to TVET-specific features such as work-based learning (ILO et al., 2021, pp. 33–35).
- **Lack of TVET-specific digital tools and resources:** Despite 75% of the countries represented in the OECD/UIS/UNESCO/UNICEF/World Bank Special Survey citing self-learning tools as the main form of training in remote/hybrid teaching available to TVET teaching staff (see Figure 9), the vast majority of digital tools and resources provided by public and private stakeholders in European countries to aid TVET teacher/trainer self-learning are not TVET-specific and focus on theoretical knowledge (European Union, 2020). Few resources contain video demonstrations or step-by-step instructions relating to practical skills linked to specific TVET professions. The need for more TVET-specific digital content is reflected in the call, by a majority of the 262 (mainly VET provider) respondents from 26 countries participating in a European Commission survey from 18 March to 11 May 2020, for the Commission and national public authorities to support the creation of a database of ready-made material with TVET-specific content to be shared for free around Europe, as well as the development of virtual simulation environments to assist TVET teachers/trainers to support work-based learning in specific sectors (European Commission, 2020a).
- **Lack of pedagogical training on how to apply digital technologies to deliver student-centred distance learning:** The main focus of governments and TVET providers during the early pandemic period was on securing access to digital technologies and getting teaching and learning resources online **quickly**, rather than on ensuring that TVET teachers/trainers had the pedagogical skills required to **effectively** apply digital tools and resources to deliver student-centred distance learning (ILO, 2020a, p. 3). According to the International Monetary Fund (IMF), the bulk of additional TVET funds have been used to deploy online and distance teaching technologies, with far less spent on training teaching staff how to use these technologies (Das et al., 2021). Some countries' education ministries

and TVET teacher training institutions have organized 'crash courses' for TVET teaching staff on how to deliver online content, manage virtual classrooms and use digital technologies (ILO, 2020a, p. 2). While addressing an immediate need, the training quality has been questionable.

Lack of effective training in online distance learning approaches has resulted in some TVET teachers/trainers transferring their existing course content online, without altering it or adjusting their teaching methodologies to suit virtual learning environments and meet the learning needs of students. Many have therefore delivered 'emergency remote teaching' rather than quality online learning (Hodges et al., 2020). In the longer term, this may cement perceptions of distance learning as a less effective option than face-to-face teaching. Yet if TVET teachers/trainers were able to deliver student-centred, digitally-enhanced distance learning – for example, by promoting online interactions not only between teachers and learners, but also between learners, to empower students and to support active, collaborative learning – then moving to an online environment could lead to 'transforming' results (Hamer and Smith, 2021).

Propensity to develop and apply digital skills

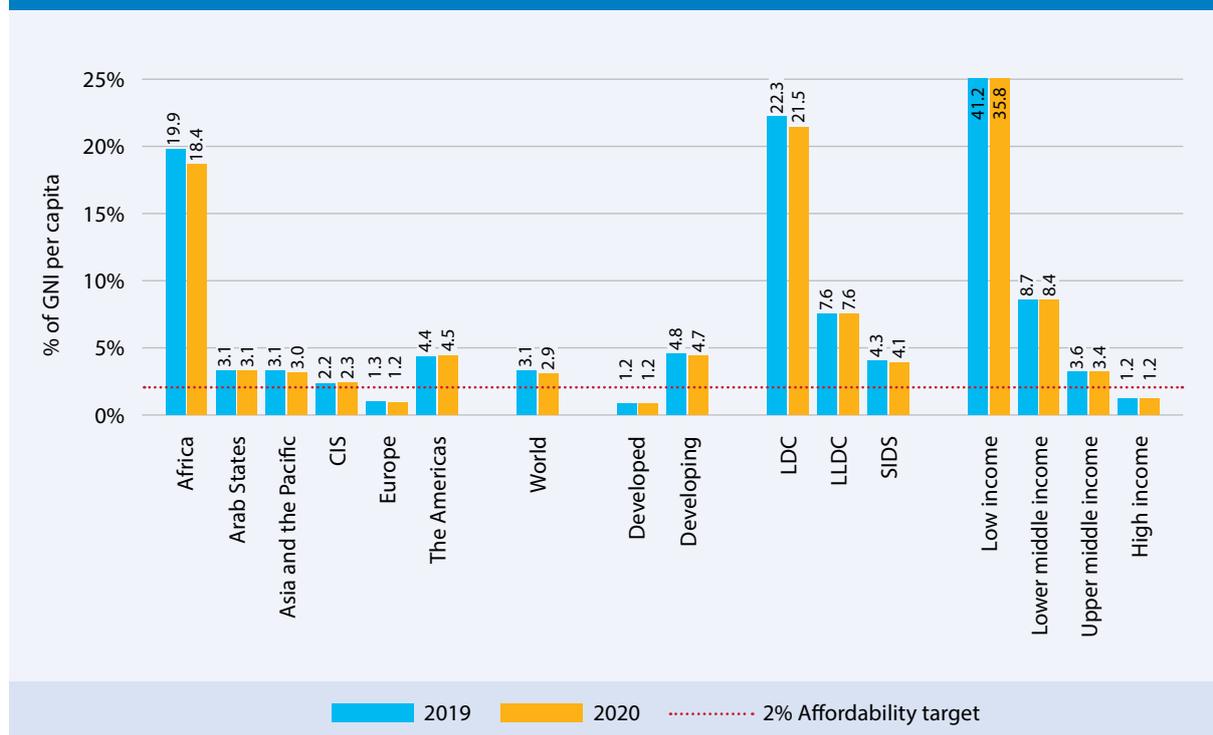
In all countries, TVET teaching staff have experienced heavier workloads and higher teaching/training costs, often with little employer support, reducing their motivation to develop their knowledge, skills and competencies to deliver high-quality technology-enhanced distance learning.

- **Less time for undergoing/integrating training:** Rushed transitions to remote working arrangements have led to heavier workloads for TVET teachers/trainers. During school closures, TVET teaching staff have been expected to learn about and apply new tools and technologies to deliver TVET, prepare lessons and learning materials in new formats, adapt new teaching methodologies, learn how to manage virtual workspaces and classes, and field student enquiries at all hours, while executing their regular teaching and assessment tasks (ILO, 2020a, p. 2; ILO et al., 2021, p. 15). Female teachers/trainers have tended to be more time-constrained than male teachers/trainers owing to the gendered division of labour in many households and the need to juggle teaching and caregiving duties, which have also increased because many children have been out of school.

- Higher costs of undergoing/delivering training:** Work-from-home arrangements amid school closures have resulted in new out-of-pocket expenses for many TVET teachers/trainers. Examples include the costs of accessing and using the internet to undergo online teacher training or to deliver distance learning to students. Such costs have been borne mainly by teachers/trainers, rather than by TVET providers (ILO et al., 2021, p. 8). Responses to the ILO-

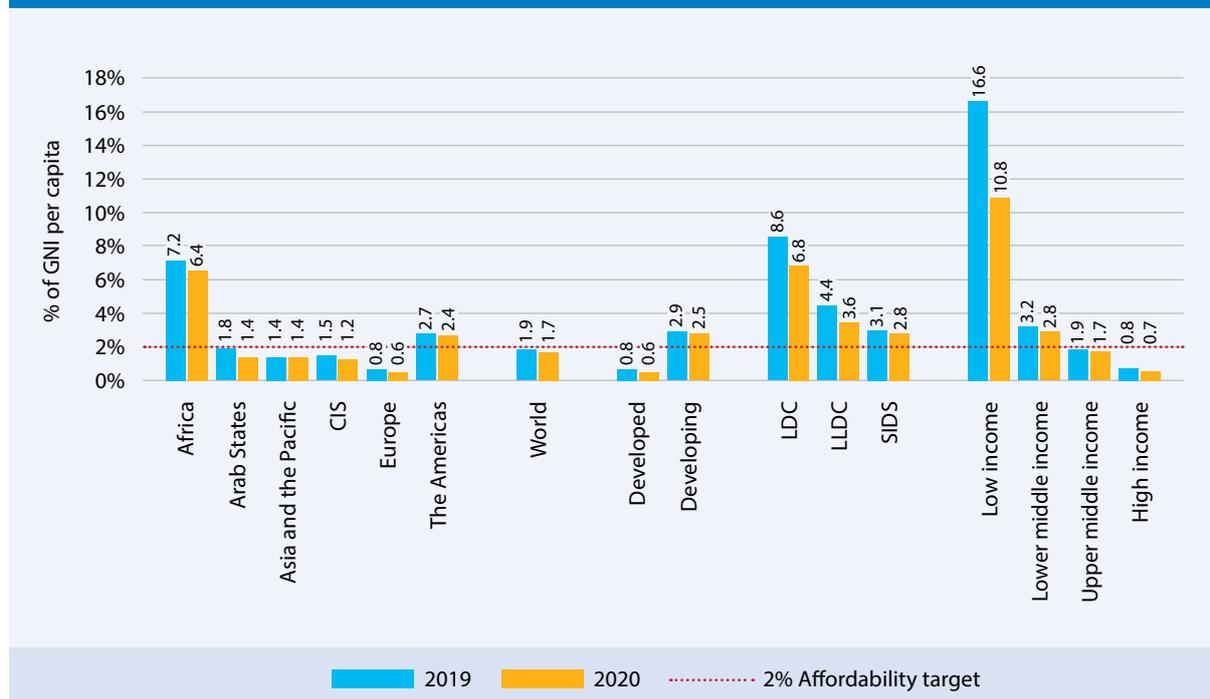
UNESCO-World Bank survey suggest that in some instances these extra costs have reduced teachers/trainers' motivation to undergo training and to deliver high-quality distance learning (ILO et al., 2021, p. 15). Costs of fixed and mobile broadband tend to be higher in low- and middle-income countries than in high-income countries (see Figures 10 and 11), so are likely to have higher impacts on teaching/training quality in those countries.

Figure 10. Fixed broadband prices as a percentage of monthly gross national income (GNI) per capita, 2019–2020



Source: ITU and A4AI (2021, p. 7)

Figure 11. Data-only mobile broadband prices as a percentage of monthly gross national income (GNI) per capita, 2019–2020



Source: ITU and A4AI (2021, p. 3)

- Lack of employer support:** During the pandemic, TVET teaching staff have been offered few financial or other incentives to boost their motivation to develop and apply their knowledge and skills in online or offline distance learning approaches. In only 25% of the 38 OECD and partner countries represented in the OECD/UIS/UNESCO/UNICEF/World Bank Special Survey were TVET teaching staff paid to engage in training on remote/hybrid teaching and related ICT skills or were teacher appraisals reformed to reward use of remote/hybrid learning approaches (see Figure 9). In only 15% of countries were additional resources provided to release teachers/trainers from their teaching duties to give them time to participate in training. In most countries across the world, the emergency funds mobilized for education in response to the pandemic were not used to increase teacher wages (ILO, 2020a, p. 5). Moreover, in some instances TVET teaching staff suffered reduced pay ‘as their employers tried to balance budgets whilst retaining personnel’ (British Council, 2021, p. 39).
- Negative attitudes/resistance to change:** TVET providers from a range of countries responding to the ILO-UNESCO-World Bank survey reported resistance among TVET teaching staff to the sudden change in teaching methods and a reluctance to embrace online learning in the field of TVET (ILO et al., 2021, p. 9). These issues stemmed from both lack of training and lack of support (see Figure 4).
- Mental health issues:** Pandemic pressures have resulted in a steep rise in TVET teaching staff needing mental health support (Agyapong et al., 2020). Of the nearly 4,000 teachers from across England responding to the NASUWT Teaching Union’s Big Question Survey, which took place from 21 February to 29 March 2021, 79% indicated that ‘unmanageable workloads and adverse management practices during the Covid pandemic’ had adversely affected their mental health (Speck, 2021). A mixed-method study of 394 teachers in Ecuador found that teachers who had had previous training and experience in online teaching displayed lower-than-average levels of psychological distress and perceived stress during the pandemic (Hidalgo-Andrade et al., 2021). Teachers’/trainers’ mental health can impact on their capacity to optimize the training they receive in digital skills and distance learning modalities.

Partnerships for advancing digitalization

New partnerships have been forged with the private sector to support the use and integration of digital tools in TVET teaching accompanied by training support.

New partnerships have emerged between telecommunications operators, technology providers, TVET institutions and governments, with private sector firms providing teachers/trainers with free digital equipment (e.g. tablets, internet access and additional bandwidth), as well as free access to communications tools, platforms, software and apps. In some cases, this has been accompanied by training on how to use these tools to create digital learning content and deliver online and offline distance learning (ILO et al., 2021, pp. 25–26). Governments in many countries have deployed these tools and technologies as part of their pandemic response strategies (ILO, 2020a, p. 5). Some companies have also worked directly with TVET institutions to develop dedicated distance learning platforms and conduct related user training. Prior to the pandemic, 47% of TVET practitioners responding to the 2019 UNESCO-UNEVOC trends mapping survey reported having had no interactions with the private sector (UNESCO-UNEVOC, 2020b, p. 36).

Whether, in the longer term, such partnerships will prove sustainable and will promote access to high-quality learner-centred course provision remains an open question. The rush by governments and TVET institutions to provide online and distance learning solutions to ensure training continuity has required emergency measures. In some cases, private sector firms have been able to circumvent public procurement procedures and gain influence in the global education industry without having their products passed through government quality controls (ILO, 2020a, p. 5). As one study put it, 'the

pandemic has acted as a catalyst for private investments seeking profit from new disruptive models of public education' (Langthaler and Bazafkan, 2020, p. 6). There are risks that publicly funded training systems become 'captured' by private sector firms without due diligence to standards (including over data control) and that training provision becomes overstandardized and fails to meet individual learner needs (Langthaler and Bazafkan, 2020, p. 14).

Equality of access to digital tools, technologies and resources by TVET providers is also at risk if, as some agencies believe, 'companies are counting on a greater presence in the educational field after the crisis' (ILO et al., 2021, p. 26). The example of massive open online courses (MOOCs) is often given. Initially conceived as being available free of charge, in recent years commercial MOOCs have gained ground (Langthaler and Bazafkan, 2020, p. 14).

In the longer term, greater government oversight and regulation of TVET teacher education is needed

to assure the quality of training received by teaching staff and to ensure that private sector involvement in TVET teacher training is not only driven by business objectives, but also serves the needs of TVET institutions, teachers/trainers and learners while advancing broader national goals.

A stronger government role is also needed to coordinate TVET teacher training efforts and ensure the recognition and portability of digital skills acquired by teachers/trainers.

While many educational technology products targeting TVET teaching staff make use of e-badges to motivate and reward TVET teachers/trainers for participating in digital skills training, these badges have limited value unless they are integrated into recognized digital competency frameworks, such as the European Framework for the Digital Competence of Educators (DigCompEdu).

Tackling digitalization challenges: promising concepts and practices

To advance digitalization in TVET by improving the digital capabilities of teaching staff, the challenges blocking teachers'/trainers' access to and uptake of digital skills development opportunities need to be overcome, and teachers'/trainers' confidence and motivation to incorporate digital tools, technologies and e-learning into their practices need to be boosted.

The specific challenges faced by TVET teachers/trainers in low- and lower-middle-income countries, and especially in rural areas, also need to be addressed to reduce the digital divide between countries, which has been widening before and since the start of the pandemic. Likewise, steps need to be taken to ensure the quality and relevance of the training that TVET teachers/trainers receive. Such training must focus on pedagogy as well as on the use of digital tools and resources to 'transform' TVET by building learners' digital skills and competencies, as well as their capacities to create, innovate and collaborate through independent as well as guided learning.

These are hard 'asks', which require thought and multiple decisions, plans and strategies to support TVET teacher/trainer digital skills development. They also require TVET stakeholders to assess what is necessary, realistic and achievable in raising the digital competencies of TVET teachers/trainers to the level required for them to 'apply' new technologies in a way that is appropriate to the training courses and learners that they teach and train. Lastly, the fate of online and distance learning in TVET remains uncertain.

With these caveats in mind, this section outlines several promising concepts that may help to overcome some of the challenges that prevent countries from advancing digitalization in TVET through TVET teacher and trainer training. It also presents details of innovative TVET teacher training efforts from Europe, Asia and Africa that have proven successful in tackling specific digitalization challenges. Details of these practices were collected through interviews held with key personnel in the selected TVET teacher training institutions.

Promising concepts

Innovative concepts that could serve to tackle digitalization challenges in low- and lower-middle-income countries include the following:

Off-grid infrastructure upgrading: Off-grid electricity and internet supply provided by private sector firms could serve to overcome infrastructural barriers that hinder digitalization in TVET in many low- and lower-middle-income countries.

- **Electricity access:** New energy start-ups, such as Bboxx, d.light and Niwa, have begun to supply energy in many developing countries in the form of distributed renewable solar-plus-battery systems, which bypass traditional government-run or regulated fixed-grid systems (Coren, 2018). Consumers, including those in rural areas with little or no infrastructure, can purchase electrification packages for a few US dollars per month, which allows them to lease solar panels, batteries and high-efficiency appliances that fit their individual needs and budgets. Telecommunications companies, such as Orange Energie, have also entered the energy market and now supply mobile electrical mini-grids in the form of solar kits to customers across Africa (Burns, 2020). Cumulative disclosed corporate investment in the off-grid energy market was estimated to be \$2.1 billion between 2010 and 2019, and an estimated 420 million people worldwide are now using standalone off-grid solar systems, with a further 47 million relying on mini-grids for electricity access (Wood Mackenzie, 2020). The cost of producing solar-plus-battery systems has fallen 70% since 2010, making off-grid systems competitive with, or cheaper than, on-grid electricity while offering a more reliable service (Coren, 2018). Some governments have begun to shift their rural

electrification efforts from public to private infrastructure, while others have outfitted schools with solar panels to ensure they have access to reliable electricity when the national grid goes down (Burns, 2020). Innovative tools using artificial intelligence (AI) and machine learning to estimate least-cost electrification scenarios are now available to assist governments in providing electrical access to all areas, but public–private partnerships are needed to make the most of on-grid and off-grid electricity (Wood Mackenzie, 2020).

- **Internet access:** According to the African Union’s first African Space Policy and Strategy, ‘satellite-based wireless systems are the most cost-effective way to develop or upgrade telecommunications networks in areas where user density is lower than 200 subscribers per square kilometre. Such wireless systems can be installed five to 10 times faster and at a 50% lower cost than landline networks. Technologies for education and training, in particular distance learning and multimedia technologies, may be instrumental in meeting the needs of African countries that have to train and integrate a large number of workers in widely dispersed and underserved areas’ (African Union Commission, 2016). Out of 54 countries in Africa, 21 have already set up a space programme or are in the process of creating one, but partnerships between governments, the private sector and development partners are needed to make progress in improving internet access using satellite technology (Onyango, 2021). Some of the firms that have invested in satellite internet and are targeting developing countries include SpaceX, SES and Viasat (Erwin, 2021). In addition, firms such as Wikipedia and Facebook have ‘zero-rated’ their services to allow customers using approved versions of their apps to pay no network charges for data (Burns, 2020).

Mobile learning: Given their fast growth and low utilization of electricity, mobile phones could offer a solution to TVET teachers/trainers’ lack of access to digital resources and to digital skills training in low- and lower-middle-income countries. As a study on digitalization in education in sub-Saharan Africa noted, ‘low cost and proliferation of mobile technologies in the region have enormous potential to improve ICT use in education. In many countries, mobiles are the only channel for effectively distributing reading material, given the high cost of books and their distribution, especially in rural areas. In addition, mobiles offer interactivity, connectivity, and personalized content’ (Tilya, 2018). In sub-Saharan

Africa, mobile phone subscriptions now outnumber electrical grid connections (Coren, 2018). The costs of mobile broadband have also fallen in recent years (see Figure 11), making mobile learning (including by teachers) more affordable than fixed broadband (see Figure 10). MTN, which is Africa’s largest phone network, has recently launched a ‘smart feature’ phone that is as multifunctional as a smartphone yet as affordable as a feature phone (Chutel, 2018). To maximize the benefits of mobile learning in TVET teacher training, teachers/trainers should be taught not only how to use the tools, services and apps available on mobile devices for teaching, but also how to adapt their pedagogy to make best use of the devices in their teaching/training practices (Godwin-Jones, 2018).

Examples of innovative VET-oriented practices using mobile technology to improve teachers/trainers’ digital and pedagogical skills can be found in the materials presented at a 2018 UNESCO-UNEVOC symposium (UNESCO-UNEVOC, 2018a). EdTech Hub also offers inspiration on how messaging apps, SMS and social media tools can be used for teacher/trainer pre-service and in-service professional development (Jordan and Mitchell, 2020). One of the promising practices detailed in this section (**Velocity Academy gamified upskilling platform**) combines mobile learning with gamification to equip TVET teachers with the digital and pedagogical skills required in a rapidly changing world.

Offline teacher training: In contexts where the technological infrastructure is underdeveloped, offline solutions incorporating asynchronous methods could overcome issues such as drop-offs owing to low bandwidth. Offline solutions help to limit data costs, which often make accessing online tools and resources prohibitive in low-income countries (see Figures 10 and 11). However, offline solutions also need to be developed for contexts where the internet is not yet available and where teachers/trainers as well as learners lack access to digital devices. According to the World Bank, ‘many of the available and popular tools for mobile app development rely in some way on connectivity, whether to something in the cloud or even only to applications running a local web server in the same room’ (Trucano, 2014).

UNESCO’s COVID-19 Education Response website lists several distance learning systems with strong offline functionality.² One of the promising practices included in this section (**Ideas Cube offline server and digital learning kit by Bibliothèques Sans Frontières**) offers offline TVET teacher/trainer digital and pedagogical skills training, while overcoming digital resource and internet access issues.

² See <https://en.unesco.org/covid19/educationresponse/solutions>

Open educational resources/OER-enabled pedagogy: Advancing digitalization in TVET and in TVET teacher training requires teachers/trainers to have access to a range of digital tools, technologies and resources that are continuously upgraded in response to changes taking place in the world of work. Yet given the fast pace of change and the complexity of skills increasingly required in the workplace, individual teachers/trainers working on their own are unlikely to be able to develop such resources in a sustainable or effective way. Instead, a team of specialists – encompassing instructional designers, media creators, and assessment and skills experts, working together with teaching staff – is needed to design and deliver high-quality, relevant digital content that develops learners’ practical and soft skills in line with evolving labour market needs (ILO, 2020c). Close collaboration between employers, government, TVET providers and others (e.g. universities/research centres) is also needed to keep abreast of changes taking place in the world of work. The costs of creating and maintaining sophisticated digital tools and technologies are beyond the reach of most TVET institutions, especially in low- and lower-middle-income countries. Yet if they are licensed as open educational resources (OERs), they can be shared and repurposed for different training environments at low cost, enabling smaller or less well-resourced TVET providers to access well-developed, validated training tools (Commonwealth of Learning, 2020).

Use of OERs and open educational practices is not yet widespread in TVET. A 2018 UNESCO-UNEVOC study found that TVET stakeholders had little knowledge or awareness of issues relating to OERs and open licensing in the run-up to the COVID-19 pandemic (UNESCO-UNEVOC, 2018b). The *UNESCO 2019 Recommendation on OERs*³ lists five objectives for realizing the full benefits of OERs: (a) build capacity among key education stakeholders to create, access, use, adapt and redistribute OERs; (b) develop supportive policy; (c) ensure inclusive and equitable access to quality OERs; (d) nurture the creation of sustainability models for OERs; and (e) facilitate international cooperation to develop high-quality, relevant, gender-sensitive and accessible OERs in multiple languages and formats. In line with the Recommendation, TVET teacher training programmes should build teachers’/trainers’ awareness of OERs as well as their capabilities to retain, reuse, revise, remix and redistribute OERs to fit specific teaching and learning needs.

Artificial intelligence: The use of AI in TVET is viewed as a promising solution to difficulties encountered in delivering work-based training components remotely, especially in TVET fields that require substantial hands-on experience. As the OECD (2020b, p. 12) observed in a recent policy brief, ‘AI can help develop simulations and virtual reality experiences that allow for a “learning by doing” experience’. Yet use of virtual reality, augmented reality and simulators for learning is often not possible in low-income countries owing to the high costs involved as well as countries’ limited digital infrastructures and capacities.

However, a recent UNESCO-UNEVOC study posits that ‘[t]his is likely to change: for example, there is a pilot programme using virtual reality in non-formal TVET in Uganda’ (UNESCO-UNEVOC, 2021, p. 31). The ILO (2020b, p. 3) likewise reports that the new generation of e-learning programmes currently being developed in Latin America are likely to use gamification, augmented reality, virtual learning environments and simulators. Making advanced technologies available as OERs through open licensing could widen access to these tools by TVET teachers/trainers and as part of TVET teacher training, especially if the simulations and experiences are designed for use in low-bandwidth areas and can be accessed and run on low-end digital devices.

Networks/communities of practice: TVET professional networks and communities of practice are a promising solution for overcoming challenges such as a lack of skilled personnel to train TVET teachers and trainers. They allow for easy sharing of information on the latest labour market trends, as well as of research, resources and promising practices in technology-enabled teaching and training. Networks and communities can facilitate TVET teachers’/trainers’ acquisition of advanced digital and pedagogical skills, especially if their members come from a range of contexts and experience levels. They can also serve as informal sources of technical support to help teaching staff tackle issues relating to the use of digital tools and resources. They can thus boost teachers’/trainers’ confidence in integrating digital technologies into their teaching practices, while overcoming negative attitudes by raising awareness of the benefits of technology-enhanced teaching and learning.

Examples of active TVET professional networks and communities include:

- The UNESCO-UNEVOC TVET Forum, which brings together over 6,000 members from more than 180 countries through an online discussion board,

³ See <https://unesdoc.unesco.org/ark:/48223/pf0000373755/PDF/373755eng.pdf.multi.page=3>

where an average of more than 100 messages are shared each month.⁴ At the time of writing, member contributions to the forum have included new research on technological advances in the automobile industry and information on an OER platform for linguistics and education that offers access to free online certified course material.

- The CEDEFOP Community of Practice of VET Providers on Technology-Enhanced Environments and Working Group on technology-enhanced learning, which were established to encourage and support VET teachers' acquisition of digital and pedagogical skills (CEDEFOP, 2019).

TVET teacher training institutions should consider building networks and communities of practice into teacher/trainer professional development programmes to encourage peer-learning and exchange of good practices. One of the promising practices detailed in this section (**Enhance Digital Teaching Platform by the UK Education and Training Foundation**) supports the development of an online community of practice and promotes the sharing of peer-reviewed good practices through its certified digital badge scheme.

⁴See <https://unevoc.unesco.org/home/About+the+TVET+Forum>

Promising practices

Enhance Digital Teaching Platform (UK)

Implementing agency: Education and Training Foundation (ETF), the teacher workforce development body for the Further Education and Training sector in England.

Funding source: UK Department for Education.

Digitalization focus: Use of digital technologies for teaching and for digitally delivering TVET (fully online/blended).

Target group(s): Teachers, trainers and assessors within the Further Education and Training sector.

Brief description: The Enhance Digital Teaching Platform is designed to help develop teaching and training practice using technology. The platform supports innovation in teaching and training to improve student outcomes and equip learners with the skills needed for the changing world of work, where technology use is becoming increasingly important.

Key features of the initiative include:

- Free, bite-sized, certified online self-learning training modules mapped to the Digital Teaching Professional Framework (DTPF), a set of professional standards for supporting learning through technology that links to DigCompEdu (the European Framework).
- An achievements badge system to reward participation in and application of training.
- A user-centred, mobile-first design accessible anywhere and anytime on any device.
- Facilities to build a community of practice by awarding special badges to teachers/trainers who comment on at least ten different practices or who review at least ten different shared reflections.
- Management dashboard enabling TVET institutions to utilize the modules to support staff development.

Context/motivation for initiative: The Enhance platform stemmed from the ETF's realization that training for teachers on educational technologies (EdTech) and digital skills was needed. The findings of the National Training Needs Analysis, carried out in 2017, had shown that 59% of training providers urgently needed training on how to use digital and other new technologies for teaching and learning (Education and Training Foundation, 2018). Thus, in January 2018 the ETF hired a project manager to lead on EdTech and digital skills.

Key digitalization challenges addressed: Prior to launching Enhance in January 2019, the ETF undertook a positioning review to understand the barriers to and the enabling factors for the use of technology in teaching and training, by compiling case studies on colleges that had scored low grades in digital skills during school inspections. These case studies informed the design of Enhance.

- **Time** was found to be a major barrier to teachers'/trainers' uptake of professional development opportunities, so the ETF adopted micro-learning (5-minute modules).
- **Signing-on** was also a barrier, viewed as intimidating by many teachers/trainers (e.g. if their names are displayed during a meeting). Therefore, no sign-on is required to use the platform.
- **Technophobia/negative attitudes towards new technologies** was another barrier identified, so the ETF described the training purpose from a pedagogical viewpoint. The training module highlight the benefits of new technologies for communicating course content and improving students' level of engagement and learning outcomes. If teachers understand the pedagogical aims, it would be possible to overcome their resistance to change.
- Written transcripts are available for each training module, enabling those with **poor technological infrastructure and low bandwidth** to read transcripts instead of watching the animated videos.
- The ETF built gamification into the platform as an enabler, to motivate teachers/trainers to participate in professional development by **rewarding their commitment to self-development**.

Stage(s) of ICT adoption covered: All stages are included. The Digital Teaching Professional Framework (DTPF) consists of seven competencies covering different teaching contexts and activities, which are mapped onto three stages/levels (Exploring, Adopting and Leading) of personal development (see Figure 12). The three DTPF stages align with the four stages of ICT adoption outlined in Table 3. Stage 1 (Exploring) is similar to the 'emerging' stage of ICT adoption: practitioners assimilate new information and develop basic digital practices. Stage 2 (Adopting) overlaps with the 'applying' and 'infusing' stages: practitioners apply their digital practices and expand them further. Stage 3 (Leading) links to the 'transforming' stage: practitioners pass on their knowledge, critique existing practice and develop new practices. Earning

digital badges at each stage past Exploring requires not only participation in training but also application. To earn 2-star and 3-star badges, practitioners must submit reflections on the impacts of their practices on student learning, which are then peer-reviewed according to standards set by the ETF to contribute to further learning. Good practices are published on the ETF's website to provide guidance and inspiration to others.

Changes to initiative as a result of COVID-19: The ETF had mapped out 169 micro-learning modules in line with the DTPF, several of which covered fully online learning (see Figure 12, competency area B), but not in the depth required to assist teachers/trainers in working remotely. To support Further Education and Training colleagues during the pandemic, the ETF developed six micro-learning modules and four supporting guides under the heading of Connected and Effective⁵.

Measurable impacts:

- 50,000 users of Enhance as of 30 September 2021, of whom 26% are registered users.
- 164 awarded practices shared on Enhance as of 30 September 2021, of which 20 were resources developed by 3-star badge holders and 144 were reflections shared by 2-star badge holders.

Relevance/replicability for other contexts: Enhance can be freely accessed and used by anyone in the

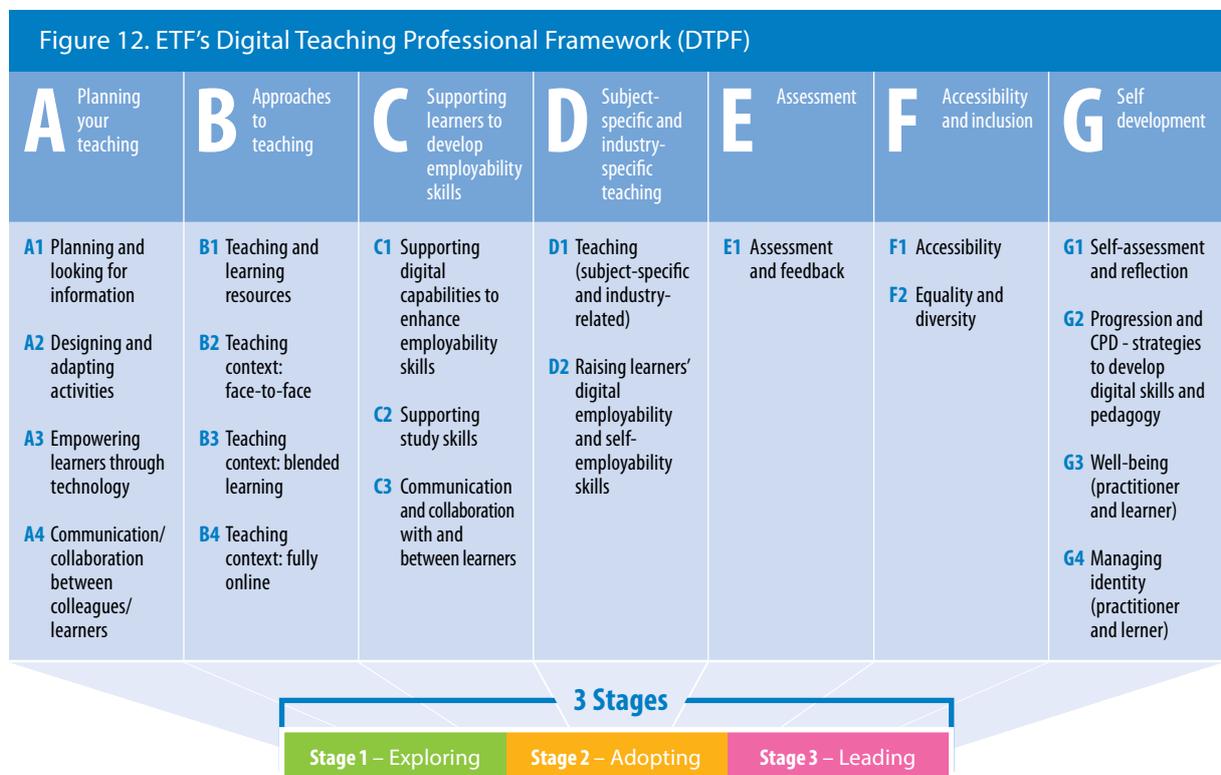
world with access to the internet. Teachers/trainers outside the UK can also earn a 1-star badge. However, owing to the expense of peer-review mechanisms, only teachers/trainers in the UK currently qualify for 2-star and 3-star badges.

Limitations of the initiative:

- Teachers/trainers need internet connectivity to access the platform and some pedagogical skills to fully engage with the training modules.
- DTPF and Enhance do not cover work-based learning and practical skills training.

Data sources:

- Interview with Vikki Liogier, the ETF's National Head of EdTech and Digital Skills
- <https://www.et-foundation.co.uk/supporting/edtech-support/enhance-digital-teaching-platform/>
- <https://www.et-foundation.co.uk/wp-content/uploads/2020/09/EnhanceDTP-Teacher-Starter-pack.pdf>
- <https://enhance.etfoundation.co.uk/category/connected-and-effective>
- Figure 12 source: <https://www.et-foundation.co.uk/wp-content/uploads/2018/11/181108-Print-DTPF-Infographic-A3.pdf>



⁵ See <https://enhance.etfoundation.co.uk/category/connected-and-effective>

Multistakeholder partnership for training Balai Latihan Kerja (BLK) instructors in online/distance learning (Indonesia)

Implementing agency: ILO Field Office in Indonesia in collaboration with Indonesia's Ministry of Manpower and Skilvul, a digital training provider with an online education technology platform.

Funding source: JP Morgan Chase Foundation.

Digitalization focus: Use of digital technologies for digitally delivering TVET (fully online/blended).

Target group(s): Instructors teaching in public TVET centres, known as BLKs.

Context/motivation for initiative: The COVID-19 pandemic disrupted the planned activities of the ILO's Women in STEM Workforce Readiness and Development Programme. The project's objective had been to increase the participation of women, especially young women, in STEM (science, technology, engineering and/or mathematics) training and education to help them gain quality employment, especially in IT fields, and to prevent them from losing their jobs as a result of automation. However, BLKs were unable to fulfil their role in training the women once the pandemic hit, since face-to-face training activities were forbidden and the BLKs had no skills or experience in delivering online training. Flexibility on the part of JP Morgan – which allowed the ILO team to use project funding towards a COVID response – and creativity on the part of the ILO team, who shifted their focus from female students/workers to BLK instructors, led to an innovative and impactful initiative that has helped to advance digitalization in both TVET teacher training and in TVET in Indonesia.

Brief description: The ILO Women in STEM project team approached the Directorate of Instructors and Training Personnel Development within the Ministry of Manpower, which is responsible for the capacity building of teachers/trainers across Indonesia, to propose collaborating on a training programme for BLK instructors on the creation and delivery of online training. The ILO team was also able to enlist the help of Skilvul, a training provider that had previously run face-to-face 'boot camps' in web programming for prospective coders and had been able to successfully shift its training model from offline to fully online when the pandemic hit. Skilvul agreed to share its knowledge/journey to help others transform their courses from offline to online and provided access to its network of contacts, some of whom played a role in delivering training on specific topics. For example, training on how to create a good video using a smartphone was provided by a professional Indonesian vlogger who was part of Skilvul's network.

A total of 180 instructors from 131 BLKs in 28 provinces of Indonesia were trained by the multistakeholder team, with training taking place in two batches, in June-July and October-December 2020. Instructors had to complete an online application using Google Forms to participate in the training, and over 2,200 applications covering every province in Indonesia were received. Participants were selected based on their motivation statement of how they planned to use the skills gained following the training, as well as their openness to change and agility (but not experience) in using digital technology. Efforts were made to ensure equity as well as geographical spread, so that instructors from smaller rural BLKs would benefit from the free training. 33% of the participants were women; this was a large percentage, given that TVET instructors in Indonesia are mainly male.

Training was conducted using Zoom, providing participants with first-hand experience of what it feels like to be a student being trained online. While the training was run using the premium Zoom package, which allows for breakout rooms, etc., training content focused on teaching instructors how to use multimedia tools available for free, since some BLKs lack the resources to pay for premium tools.

The 9-day training that was offered to instructors participating in the second batch covered:

- An introduction to the design thinking process
- Exploring learning management systems using Google Classroom
- How to design a student-centred learning journey
- Transforming an offline learning journey to an online learning journey: benchmarking, research, resources, challenges, process, and timeline (presented by Skilvul)
- How to create and manage an online learning platform using Google Classroom
- Where to find free digital resources, including a free library of augmented/virtual reality (AR/VR) tools
- How to use different digital tools to create online learning content:
 - Creating good videos using a smartphone (presented by a professional vlogger)
 - Creating an interactive presentation using Prezi (presented by a Skilvul network member)
 - Creating an infographic using Piktochart (presented by a Skilvul network member)

- Creating an interactive online learning session using Zoom, Kahoot for icebreaking and Miro collaborative online whiteboard (presented by a Skilvul network member); and
- How to speak in front of a camera (presented by professional public speaking instructors)
- Since participating in the training, the Ministry of Manpower has developed its own e-training platform to train instructors, and the project has led to a follow-on ILO project, InSIGHT, which trains BLK instructors in collaboration with the Ministry of Manpower, Skilvul and UNIQLLO.

Participants also had to apply their learning by developing online content pertaining to their subject and then presenting their work in an online simulation. Presenters received feedback from their peers as well as from the public speaking instructors, who evaluated their presentations and provided constructive criticism on their body language, voice projection, etc.

On the final day of training, participants were asked to prepare an action plan outlining the next steps for transforming their offline training to online training, including a proposed timeline.

Key digitalization challenges addressed:

- The project addressed several barriers to online distance learning in Indonesia, such as lack of access to teacher training, especially in rural areas; lack of suitably skilled trainers able to offer high-quality training in designing/managing distance learning programmes; high costs of undergoing training; and teachers' lack of time or need for flexibility to participate in training.
- By training instructors on how to deliver training using multimedia tools available for free, the project addressed an additional barrier: the high costs of digital TVET delivery for providers.

Stage(s) of ICT adoption covered: Emerging, Applying or Infusing, depending on BLKs' ICT resources and school management support for implementation.

Measurable impacts:

- The ILO project team conducted an impact survey in December 2020 and March 2021 to assess how far instructors had been able to implement their action plans. They found that 38% had been able to transform their training partially or fully from offline to online. For example, a food processing instructor in South Kalimantan province now provides training material to students using Google Classroom, uses the Quizizz gamified student engagement platform to administer summative tests, and plans to use AR tools to explain food safety to students.
- Some instructors reported going back to their BLK and passing on their learning to peers, thereby acting as 'champions' for online training and producing multiplier effects.

Relevance/replicability for other contexts: With the right partnerships, the online and distance learning course pioneered by the Women in STEM project should be replicable in other contexts.

Limitations of the initiative:

- Instructors had to have basic digital skills, digital devices and internet connectivity to be able to apply for and participate in the training.
- The initiative did not include measures for overcoming infrastructural or other constraints faced by BLKs, so may have resulted in a negative return on training for some instructors.

Data sources:

- Interview with Navitri Putri Guillaume, ILO Project Officer for Women in STEM project
- https://www.ilo.org/jakarta/info/public/pr/WCMS_754427/lang--en/index.htm
- https://www.ilo.org/jakarta/info/public/fs/WCMS_774905/lang--en/index.htm
- https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-jakarta/documents/publication/wcms_809227.pdf

Velocity Academy gamified upskilling platform (Cambodia)

Implementing agency: Velocity Academy, a new EdTech start-up operating in Cambodia.

Funding source: Self-funded. Velocity Academy initially pitched to investors, but then decided not to seek external funding in order to maintain control of its business. However, in the near future it is hoping to leverage partnerships to build an ecosystem for teacher capacity building.

Digitalization focus: Use of digital technologies for teaching and for digitally delivering TVET (fully online/ blended).

Target group(s): TVET and general education teachers from public and private schools and higher education institutions, and trainers from large companies in Cambodia.

Brief description: Velocity Academy was co-founded by Phasokvina Sar, a learning support officer at Khmer Business School, and Pichpisey Sovann, an educational researcher with a background in educational technology, pedagogical development, blended learning, online learning environments and lean teaching. Their start-up aims to transform Cambodian teachers/trainers into digital educators by equipping them with the up-to-date digital and pedagogical skills and competencies required in a rapidly changing knowledge-based society. In addition to running a range of workshops and training programmes, from June to July 2021 Velocity Academy ran a two-week training programme, Innovative Teacher, to provide pedagogical support and digital skills to 50 teachers and trainers from various provinces across Cambodia, which included lessons on how to use the platform.

Context/motivation for initiative: While working as a consultant helping companies with instructional design and providing training solutions to companies, Velocity Academy co-founder Pichpisey Sovann noticed a gap in the market: a need for digital skills training that combines pedagogical skills with digital skills and content knowledge to teach teachers/trainers how to deliver flexible, student-centred training as well as to promote the development of interdisciplinary fields, which she believes will become increasingly important in the future.

Prior to launching its upskilling platform in 2020, Velocity Academy spoke to several TVET providers who were seeking digital skills training for their teachers/trainers to help them to deliver education and training remotely. While the providers understood

the need for digitalization to expand access to their programmes, they did not understand the importance of linking digital skills to pedagogical skills to introduce new and more engaging teaching techniques into their classrooms.

Key digitalization challenges addressed:

- Velocity Academy's remote training approach overcomes several constraints faced by teachers/trainers in Cambodia, such as **lack of time, lack of access to training and lack of funds**.
- Its upskilling platform is usable in **low-bandwidth internet areas** and is available in Khmer and in English to overcome **linguistic barriers to training**.
- Velocity Academy utilizes the power of **mobile learning**, since its research has shown that 90% of teachers/trainers participating in its programmes prefer using mobile phones over laptops.
- The platform's gamification features make training fun, which encourages teachers/trainers to continually improve their skills, while its system of digital badges – which are awarded to teachers/trainers who complete training modules – are designed to **motivate participation in professional development**, since CPD is not mandatory or prescribed in Cambodia.
- Velocity Academy's training focuses on problem-solving, thus providing TVET teachers/trainers with **21st-century skills** and demonstrating how they can challenge their own students to foster self-learning and applied skills.
- Teachers/trainers learn how to use **open-source, free-trial or freely available tools and resources** to deliver engaging training, including in practical skills areas (e.g. by showing relevant YouTube videos in a motorcycle maintenance course), at low cost.

Stage(s) of ICT adoption covered: Emerging or Applying. Velocity Academy offers frequent (monthly or bi-monthly) follow-up support to encourage participants to apply what they have learned in their teaching practices. However, teachers'/trainers' propensity to do so varies by training provider and individual teacher/trainer.

Changes to initiative as a result of COVID-19:

No substantive changes were made to Velocity Academy's upskilling platform as a result of the pandemic. The main impact of the pandemic has been increased interest in Velocity Academy's services from education and training institutions.

Measurable impacts:

- Improved teacher/trainer practices following participation in Velocity Arcademy's workshops and training programmes have resulted in increased student engagement and attendance. One former participant reported that student attendance in her classes had risen from 45% before the training to around 80–90% following training.
- 80% of teachers/trainers who completed Velocity Arcademy's Innovative Teacher programme in June/July 2021 have continued to use its upskilling platform post-training.

Relevance/replicability for other contexts: Velocity Arcademy is currently focused on the Cambodian market but is considering expanding outside Cambodia in future.

Limitations of the initiative:

- Teachers/trainers need internet connectivity, basic digital skills, a smartphone, and knowledge of how to download apps to access Velocity Arcademy's training and use its upskilling platform.
- Velocity Arcademy's digital badges are not tied to a national or regional competency framework, so are not widely recognized.

Data sources:

- Interview with Pichpisey Sovann, Co-founder of Velocity Arcademy
- <https://www.velocityacademy.com>
- <https://sea-vet.net/news/925-50-teachers-empowered-to-become-digital-educators>

Ideas Cube offline server and digital learning kit (Burundi and Democratic Republic of the Congo (DRC))

Implementing agency: Bibliothèques Sans Frontières (BSF), an international NGO founded in 2007.

Funding source: Enabel (Belgian Development Agency).

Digitalization focus: Use of digital technologies for teaching TVET

Target group(s): Teachers/trainers in public TVET centres.

Brief description: BSF's mission is to build bridges between the information society and those who are excluded from it. One of BSF's main activities is to provide tailor-made support to educators in areas of the world where a large part of the population is not connected to the internet, using innovative technologies and teaching methods. Since 2019, BSF has been implementing offline digitalization projects to support quality improvements in TVET in Burundi and the DRC. It has installed Ideas Cube kits in 13 vocational training centres across Burundi and in 15 technical education centres across the DRC. The Ideas Cube is a portable nano-server that creates a local offline Wi-Fi hotspot to which users can connect using any device to access thousands of specially curated digital resources with no need for an internet connection. When connected to the internet, the Ideas Cube updates and shares locally created content to the cloud. New resources can also be downloaded from an online catalogue. Ideas Cube kits contain the Ideas Cube server, 20 tablets, a laptop, a projector, a camera and (if needed) solar panels, which are all packaged neatly together in a small backpack or hardware box to optimize storage and protection from dust, heat and humidity, while allowing easy recharging.

The educational and training content hosted on the server is specially selected by BSF following a needs assessment involving consultations with all relevant local stakeholders. The resources chosen complement centres' existing courses and programmes and come in a range of formats, including MOOCs, videos, audio files, infographics and ebooks. Teachers/trainers using these digital tools and content receive training from BSF staff on how to use them effectively, as well as how to apply modern teaching methodologies to facilitate student learning. BSF staff visit regularly after the initial set-up period to coach the facilitators, offer refresher training and update the contents on the server.

Context/motivation for initiative: Teachers in Burundi and the DRC often lack access to teacher training and learning resources. Although TVET centres may have the right textbooks for each course, the lack of additional resources – including videos, tutorials and other content – can limit their ability to provide good-quality, comprehensive training.

Key digitalization challenges addressed:

- Half of the world's population lacks access to the internet owing to a **lack of digital infrastructure or equipment** or the **high costs of data**. BSF addresses this challenge by providing offline digital tools and strengthening populations' digital skills.
- BSF provides **access to information and content** that is targeted to its beneficiary groups' specific learning needs, language and digital skills level.
- The support that BSF offers to TVET teachers/trainers covers not only how to use its digital tools and contents, but also how to organize and facilitate learning activities to engage students and create an active learning environment. Pedagogy, together with digital tools and curated content, is central to BSF's operations.
- BSF's products, software and contents are available under free licence to allow others to reuse them on the condition that they do not make them exclusive. In this way, BSF's products benefit everyone and promote innovation.
- One of BSF's targets is to provide students graduating from the TVET centres with skills that differentiate them from others in the labour market, such as being able to use industry-specific software or to communicate in French.

Stage(s) of ICT adoption covered: Applying or Infusing.

Limitations of the initiative: BSF's tools and contents must be used near to the Ideas Cube server, which has a range of 20–50 metres, so its digital learning kit cannot be used to deliver distance learning.

Changes to initiative as a result of COVID-19:

- Pandemic-related travel restrictions caused delays to BSF's project timeline and forced BSF to develop its capabilities in distance training. This was done by delivering online training, where viable, or by producing and sending training videos to partner institutions followed by phone calls.

- BSF created and owns a social enterprise, Kajou, through which it offers digital solutions for ensuring learning continuity during TVET centre shutdowns. The Kajou card is an SD card, which when inserted into a smartphone, provides users with access to an offline library containing MOOCs, videos, audio files, ebooks and other content. The card can be customized so that it contains the same learning materials as the Ideas Cube, allowing students to learn on the move or at home. The Kajou app, which can be installed on a smartphone, allows users to interact across SMS data technology, even when not connected to the internet.

Measurable impacts: An assessment of the impacts of BSF's TVET projects in Burundi and the DRC is not yet available. However, a 2015 internal evaluation found that BSF's offline internet solutions increased the academic performance of students in Congolese refugee camps by 23% compared with those in traditional settings.

Relevance/replicability for other contexts: The Ideas Cube initiative is transferrable to other settings, and BSF has extensive experience in implementing offline learning solutions in over 50 countries across the world. BSF is currently in discussions with Enabel to extend its Ideas Cube intervention to other TVET centres in Burundi and the DRC.

Data sources:

- Interview with Frederic Murat, Head of International Operations at BSF
- https://www.bibliosansfrontieres.org/wp-content/uploads/2021/02/RA-2019-20_EN-1202.pdf
- <https://slidetodoc.com/innovation-to-improve-access-to-education-information-libraries/>

Conclusion and recommendations

With this study, UNESCO-UNEVOC wanted to gain an understanding of recent trends and specific challenges in the digital skills development of TVET teachers and trainers before and during the COVID-19 pandemic. As the study has shown, TVET teachers'/trainers' access to digital skills development opportunities, and consequently their capacities to integrate digital technologies in teaching TVET and/or for delivering TVET through online or offline distance learning, has pivoted on countries' income levels. While access to digital skills training has expanded globally, it has grown most rapidly in upper-middle-income and high-income countries, with 96% of OECD countries able to offer TVET teachers/trainers training and support in remote/hybrid teaching methods by January/February 2021 (see Table 5). The digital divide between low-income and high-income countries in terms of teachers'/trainers' capacities to deliver TVET using online and/or offline distance learning approaches has more than doubled since the pandemic began, with the gap widening from around 25% prior to the pandemic to 57% by April/May 2020 (see Table 5).

The exigencies of the pandemic have led to an easing of the barriers to both access and uptake of digital skills training opportunities in both developing and developed countries. On the supply side, private sector involvement in TVET has led to improvements in the digital infrastructure in some countries, increased access to digital tools and resources in many countries, and in some cases expanded TVET teachers'/trainers' access to digital skills development opportunities. However, greater quantity has not necessarily translated into better quality training, and there are inherent risks associated with unregulated and uncoordinated activities by profit-seeking entities in TVET teacher training.

On the demand side, the impact of TVET centre closures has led to an expansion in the proportion of TVET teachers and trainers implementing online and/or offline distance learning. Whether this has overcome or entrenched teachers' resistance to change, lack of self-confidence and/or lack of capacities to deliver TVET using distance learning remains unanswered for the time being. Equally, only time will tell whether heavier workloads and higher stress levels have led to lower engagement in teacher training generally and in digital skills training specifically.

Based on the evidence gathered, the study suggests the following are needed to support digitalization in TVET and in TVET teacher training:

- **Strong policies and strategies on digitalization in TVET are needed to ensure that TVET teaching staff have the skills required to prepare learners for the future of work and of learning.** Well-planned and well-resourced national policies and strategies for digitalization in TVET are required to produce a critical mass of teaching staff who are well prepared for, confident in and capable of incorporating digital tools, technologies and e-learning into their practices in transformative and innovative ways. To ensure system responsiveness, governments should continuously gather and disseminate data on emerging labour market skill needs to TVET institutions and practitioners. A strong government role is also needed to coordinate and regulate teacher training activities, as well as to ensure the recognition and portability of digital skills acquired.
- **Multistakeholder partnerships and networks can increase the resources and training capacities available within TVET systems.** Such partnerships and networks can involve the private sector, NGOs and peer organizations to provide additional capacity and/or to pool resources. Teamwork involving instructional designers, media creators, assessment and skills experts, and TVET teaching staff is needed to develop high-quality digital content and learning resources. Close collaboration between employers, government, TVET providers and others (e.g. universities and research centres) can facilitate timely responses to changes taking place in the world of work.
- **A culture of inclusiveness and cooperation can reduce digital divides in TVET and in TVET teacher training.** Active participation in TVET professional networks and communities of practice can facilitate exchanges of knowledge, resources and good practices and overcome some of the challenges that low-income countries face, such as a lack of skilled personnel to train TVET teaching staff. Making digital tools and resources available as OERs through open licensing could give TVET teachers/trainers in less well-resourced contexts access to high-quality training materials.

- **Digital skills training programmes for TVET teaching staff should be designed to overcome barriers to teachers'/trainers' participation.** The promising practices included in this paper offer ideas for addressing some of the main demand-side barriers. For example, the ETF's Enhance Digital Teaching Platform initiative shows how approaching digital skills training from a pedagogical angle could counter teachers'/trainers' technophobia; use of flexible micro-learning modules could address teachers'/trainers' concerns regarding lack of time and workload pressures; and use of gamification could motivate teachers/trainers to participate in training by making it more fun. Likewise, use of digital badges to reward participation in training is a good enabler, but should be tied to a competency framework to improve skills portability and recognition.
- **Further research is required to determine the pedagogical skills and competencies needed to deliver high-quality, learner-centred, technology-enhanced distance training in TVET.** A new model of technology adoption in TVET is needed, one that ties together the two aspects of digitalization (use of digital tools and services for teaching TVET and the digital delivery of TVET through distance learning). Effective remote delivery of TVET entails teachers/trainers having competencies in both areas.

Table 5. Summary of trends and challenges in TVET teacher digital skills development

Pre-Pandemic Situation			
Trends/challenges	Low/Lower-middle income countries	Upper-middle/High income countries	All countries
Access to training on use of digital tools and services for teaching TVET	Low access to digital skills development opportunities	Limited access to quality/ relevant digital skills development opportunities	>75% of TVET teaching staff (Source: UNESCO-UNEVOC, 2020a)
Access to training on how to deliver TVET using alternative (including digital) formats	N/A	N/A	52% of TVET teaching staff (Source: UNESCO-UNEVOC, 2020a)
Main supply-side barriers to accessing digital skills development opportunities (low/lower-middle income countries) Main supply-side barriers to accessing quality/relevant digital skills development opportunities (upper-middle/ high income countries)	<ul style="list-style-type: none"> • Systematic lack of resources • Lack of digital and other infrastructure • Weak policies/strategies on digitalization in TVET • Lack of suitably skilled trainers • Lack of TVET-specific teacher training content 	<ul style="list-style-type: none"> • Weak policies/strategies on digitalization in TVET • Weak systems for ensuring relevance of TVET teacher training content • Lack of training on how to apply digital technologies to develop learners' digital and future-oriented skills 	
Main barriers to accessing training in technology-enhanced distance learning approaches	<ul style="list-style-type: none"> • Perceived lack of relevance of distance learning for TVET • Perceived lack of effectiveness of distance learning approaches • High costs of digital TVET delivery for providers • Lack of knowledge and/or information regarding the pedagogical skills needed for effective digital TVET delivery 	<ul style="list-style-type: none"> • Perceived lack of relevance of distance learning for TVET • Perceived lack of effectiveness of distance learning approaches • High costs of digital TVET delivery for providers • Lack of knowledge and/or information regarding the pedagogical skills needed for effective digital TVET delivery 	
Main demand-side barriers to uptake of digital skills development opportunities	<ul style="list-style-type: none"> • Lack of time for training • High cost of training • Negative attitudes towards new technology/resistance to change • Lack of knowledge and/or information regarding digital skills needs • Lack of incentives to counteract demand-side barriers 	<ul style="list-style-type: none"> • Lack of time for training • High cost of training • Negative attitudes towards new technology/resistance to change • Lack of knowledge and/or information regarding digital skills needs • Lack of incentives to counteract demand-side barriers 	
Extent to which digital tools and services were integrated into TVET learning environments	Most TVET teachers/trainers who received digital skills training were at 'emerging' or 'applying' stages of ICT adoption	Most TVET teachers/trainers who received digital skills training were at 'applying' or 'infusing' stages of ICT adoption	
Main barriers to integration of digital technologies in teaching/training practices	Negative attitudes/resistance to change, linked to: <ul style="list-style-type: none"> - lack of adequate pedagogical and/or digital skills - lack of experience in using digital tools and technologies 	Lack of teacher confidence, linked to: <ul style="list-style-type: none"> - lack of teacher competence - lack of personal access to digital resources - lack of technical support 	
Extent to which TVET teaching staff used online/ offline distance learning very often or regularly	5% of TVET providers in Africa (Source: ILO et al., 2021)	30% of TVET providers in Asia-Pacific, Americas and Europe (Source: ILO et al., 2021)	30% of TVET providers globally (Source: ILO et al., 2021)

Pandemic Response		
Trends/challenges	Low/Lower-middle income countries	Upper-middle/High income countries
Access to training on use of digital tools and services for teaching TVET	N/A	N/A
Access to training in remote/hybrid teaching and related digital skills	Few coordinated national programmes to develop TVET teachers/trainers' skills in designing and managing distance learning programmes. Some TVET institutions worked with NGOs or companies to train teaching staff in (mainly offline) distance learning modalities. (Source: eLearning Africa and EdTech Hub, 2020)	In 96% of OECD countries, TVET teaching staff received training and support to develop their remote/hybrid teaching and related ICT skills, often through new public-private partnerships. However, in some cases training quality was an issue. (Source: OECD, 2021a)
Main supply-side barriers to accessing training and support in distance learning modalities (low/lower-middle income countries) Main supply-side barriers to accessing quality training and support in distance learning modalities (upper-middle/high income countries)	<ul style="list-style-type: none"> • Lack of adequate human and financial resources • Inadequate infrastructure and limited access to digital resources • Lack of suitably skilled staff to train TVET teachers/trainers in distance learning modalities • Lack of training in designing/managing distance learning programmes 	<ul style="list-style-type: none"> • Lack of TVET-specific crisis response policies/strategies • Lack of TVET-specific digital tools and resources • Lack of effective training on how to apply digital tools and technologies to deliver student-centred distance learning
Main demand-side barriers to engaging in and integrating training received in technology-enhanced distance learning modalities	<ul style="list-style-type: none"> • Lack of time for undergoing and integrating training • High costs of undergoing and delivering training • Negative attitudes/resistance to change • Mental health issues • Lack of incentives to counteract demand-side barriers 	<ul style="list-style-type: none"> • Lack of time for undergoing and integrating training • High costs of undergoing and delivering training • Negative attitudes/resistance to change • Mental health issues • Lack of incentives to counteract demand-side barriers
Extent to which digital tools and services were integrated into TVET learning environments	N/A	N/A
Extent to which fully remote online and/or offline training was provided during school closures	18% of TVET providers in low-income countries were able to provide fully remote training (Source: ILO et al., 2021)	75% of TVET providers in high-income countries were able to provide fully remote training (Source: ILO et al., 2021)

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Trends mapping study

Digital skills development in TVET teacher training

Digitalization has led to extensive changes in the skills required for work and life. For technical and vocational education and training (TVET) institutions to remain relevant and attractive, they need to identify and introduce digital skills and competencies for the changing world of work and better utilize the opportunities provided by digitalization, particularly distance learning. Their success in harnessing the benefits and tackling the challenges of digitalization depends largely on the digital capabilities of TVET teachers and trainers.

This report presents the results of the UNESCO-UNEVOC trends mapping study on progress and challenges in TVET teacher and trainer digital skills development before and during the COVID-19 pandemic. The study's findings – in terms of data, policy trends and identification of good practice examples – offer guidance to governments and TVET institutions that wish to improve teachers'/trainers' acquisition of digital skills, as well as their capacities and propensities to apply digital tools, services and technologies to deliver quality, learner-centred education and training. The study will also inform UNESCO-UNEVOC's work in support of TVET teachers and trainers.

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