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# Promoting quality in TVET using technology

A practical guide

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# Glossary

**E-portfolios** track individual student development and they check curricula learning outcomes. E-portfolios enable communication and collaboration across learning arenas in technical and vocational education and training, and may include all actors involved in skills development (Nore, 2015).

**ICT Competency Framework for Teachers** is a tool published by UNESCO to guide pre- and in-service teacher training on the use of information and communication technologies (ICT) across the education system. The tool, which is a response to technological and pedagogical developments in the field of ICT, presents a framework that can support policy development and capacity-building (UNESCO, 2018).

**Digital skills** are a wide range of skills and other features related to behaviour, expertise, know-how and life skills that enable individuals to process and evaluate information critically, allowing them to use information fully when solving complex problems and use precise techniques to produce or access internet content (UNESCO, 2018).

**Digital citizens** or **digital citizenship** refers to the norms of appropriate and responsible behaviour in the use of technology. The term can encompass digital access, digital commerce, digital communication, digital literacy, digital etiquette, digital law, digital rights and responsibilities, digital health and wellness, and digital security.

**Massive open online courses (MOOCs)** are online courses that are designed for large numbers of participants and can be accessed by anyone anywhere as long as they have an internet connection. MOOCs are open to everyone without entry qualifications and they offer a complete course experience online for free (Mulder and Jansen, 2015).

**Mobile learning** is the exploitation of ubiquitous handheld hardware, wireless networking and mobile telephony to facilitate, support, enhance and extend the reach of teaching and learning.

**Mobile technology** refers to electronic equipment such as mobile phones and small computers that can be used in different places, as well as the technology connected with such equipment.

**Technological Pedagogical Content Knowledge (TPACK)** is a framework that seeks to identify the kinds of knowledge needed by teachers to integrate technology into their teaching. The framework focuses on the interplay between three main areas of knowledge – content, pedagogy and technology – and highlights the kinds of knowledge that lie at the intersections of the three areas.

**Open educational resources (OERs)** are teaching, learning and research materials in any medium, digital or otherwise, that are in the public domain or have been released under an open licence that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. Open licensing is built into the existing framework of intellectual property rights as defined by relevant international conventions and it respects the authorship of the work (UNESCO, 2012).

# About this practical guide

Technology has altered almost every aspect of life, including education and training. Because of technological developments, education and training have become more accessible to students who would otherwise struggle to be physically present at learning sites. The quality of education and training has improved too. Teachers and trainers can use digital tools to manage their tasks effectively and engage learners in digital-rich environments, improving learning outcomes. Learners can also use technology as tools to learn new skills and to collaborate and interact with teachers and trainers.

In the face of the COVID-19 pandemic, learning disruptions have occurred. School closures have become inevitable and the delivery of learning in the ordinary way has become impossible. This has forced school systems and institutions to undertake a rapid assessment of the capacity and readiness of the system as a whole, but also to review the technology infrastructure, pedagogy and organization needed to offer technology-enabled and distance learning solutions. In addition, the pandemic has magnified inequalities in the provision of learning that uses technologies as tools, since connectivity, technology infrastructure and devices for learning are not accessible to everyone. Teachers are not well prepared to shift their delivery online and students have yet to adopt new modes of learning.

Indeed, the adoption of technology in education and training poses a number of challenges. There are important questions to raise and consider when planning to use information and communication technologies (ICTs) in education and training:

- 1 Teachers and trainers who possess digital literacy skills and knowledge have the potential to use and apply technology in the planning and delivery of content and curricula and in the assessment of learning objectives. The continuous use of digital technologies can help to enrich teaching practices and improve pedagogical techniques.

## Checklist

√	Do teachers in your school/institution possess the necessary digital literacy?
√	Do they have the relevant skills required to apply ICTs in the classroom, or do they need further professional training?

- 2 The use of technology in the classroom can support teachers effectively in managing the required tasks. To be successful in using ICTs in the classroom, teachers must ensure that the right technology is put to use to enhance students' learning experiences and they must effectively support students' learning needs.

## Checklist

√	Is there an adequate provision of ICTs for teachers to use?
√	Do teachers know how to use them?
√	Can the use of ICTs meet the objectives and outcomes of the curriculum?

- 3 The use of technology in the classroom can support learning to the extent that learners have the necessary digital literacy skills. Learners need to be familiar with the specific digital tools that are used in the learning process. Efforts to create a technology-enabled learning environment will not work as planned if there are barriers to the use of ICTs in the learning process.

## Checklist

√	Do learners have the necessary digital literacy skills?
√	Can the use of ICTs meet individual learning needs?

- 4 Institutions can provide the tools and platforms needed to establish an ICT-enabled learning environment. In this environment, teachers receive support to apply their pedagogical approaches and to continue improving their own digital technology competences. This is possible when relevant ICT solutions are available in the classroom or other learning sites where teachers and learners can use technology to enhance the learning experience. ICTs can therefore improve the quality of teaching, which is a crucial factor in the success of high-performing education systems (UNESCO, 2011).

## Checklist

√	Does the institution provide technology-enabled environments?
√	Do ICTs enable the provision of quality education and training?

# Skills and competencies required to adopt technology in TVET

Before addressing the various challenges of adopting technology in education and training, it is important to define the types of skills that teachers need to have in order to use ICTs effectively in TVET.

UNESCO and the Broadband Commission (2017) list three types of skills that are required for effective participation in the digital society and economy:

- 1 Basic functional digital skills** enable an individual to access and engage with digital technologies (including foundational skills to operate and connect, visual literacy and psychomotor skills).
- 2 Generic digital skills** enable an individual to use digital technologies in meaningful and beneficial ways (including information and data literacy, communication and collaboration, and skills for digital content creation).
- 3 Higher-level skills** enable an individual to use digital technologies to empower and transform (including the advanced skills needed in specialist ICT occupations and professions).

## ESSENTIAL TEACHERS COMPETENCIES

The terms 'ICTs' and 'digital technologies' are used interchangeably and sometimes differently in TVET environments. The adoption and use of these technologies in the classroom are influenced by teachers' competencies.

While 'chalk and talk' approaches are the most pervasive form of teaching in TVET, students' learning is also affected by the abilities of teachers and trainers to manage, innovate and execute effective learning processes. The selected methodology is informed by:

- A teacher's understanding of how knowledge can be constructed and how technology-oriented competencies can be developed using a variety of available tools
- A teacher's ability to adapt new emerging technologies to learning processes

The Australian curriculum provides a good illustration of the difference between 'ICTs' and 'digital technologies':

**ICT knowledge and competencies** are capabilities to manage and operate ICTs for the purpose of investigating, creating and communicating. They also involve the application of protocols and practices of a social and ethical nature that contribute to individuals becoming effective users of technology.

### Examples of ICT tools

Presentation instruments

Searching for information

Digital publishing

Managing files

Online communication tools

Digital music/multimedia

Mapping tools

### Examples of ICT tools application in classroom

- Using digital concept mapping tools to plan and select research tasks
- Using video to analyse a trend or performance
- Using a search engine as a research tool
- Using a computer simulation
- Using spreadsheets to create tables and to record, sort, calculate and present data

**Digital technology competencies** are capabilities to address the underlying concepts of information systems, data and computer science. They help to extend ICT capabilities in order to support the design and creation of digital solutions.

Examples of digital technology tools

Coding and programming

Practicing user-interface design

Storing and transmitting data

Applying pattern recognition

Algorithms

Collecting data

Programming board

Examples of the application of digital tools in the classroom

- Comparing a transport and computer network to explore ideas
- Creating an interactive story with user input using programming language
- Creating a simulation using a visual or text-based programming language

The use of ICTs and digital technology in the classroom can lead to the development of twenty-first-century skills for teachers seeking to develop their ICT or digital competencies to improve the quality of their pedagogy, and for learners seeking to acquire competencies to become digital citizens. These skills include collaboration, critical thinking, problem solving, innovation and creativity (UNESCO-IBE, 2013).

## DIGITALIZATION

Digitalization at work refers to the trend of using automation technologies in the workplace, often to replace routine tasks. This development is influenced by (and influences) the changing nature of work and occupations in particular sectors and areas, demanding new sets of knowledge and competencies that cannot be acquired through traditional modes of learning. Such changes call for the reskilling or upgrading of low-skilled workers in occupations with a high risk of job automation. The observed changes include (Bughin, Lund and Remes, 2016; OECD, 2017):

- Reclassification of tasks that rely on digital technologies
- Demand for a new mix of skills (a broader interdisciplinary skills set and job-specific capabilities)
- Demand of companies for digital culture and training

- Workforce's increasing use of digital systems and a rising demand for ICT professionals
- Workforce equipped to work in a technology-rich environment
- Shift to greater autonomy and skill-based self-employment
- Shift from academic credentials to big data as measures of ability
- Expansion of digital jobs ecosystem
- Greater collaboration between and across system

A recent report published by ILO (2020) suggests that 'digital technologies are particularly effective when used as blended learning tools that can be operationalized in social practices (such as teamwork, peer-based learning and collaborative problem solving), particularly when they are linked with real problems or project-based learning. They can also bridge the perception gaps between the key stakeholder groups of government, TVET institutions, learners and the labour market.'

#### *Good to know*

Digital literacy – 'the skills required to achieve digital competence, the confident and critical use of ICT for work, leisure, learning and communication' (European Commission, 2017)

In this setting, increasing the capacities of teachers through professional training can help them to develop their understanding of the trends and navigate the increasing digitalization of work and society in order to grasp what it means for learners to develop skills so as to become better prepared for the digital future of jobs. What the future of work looks like can influence the demand for modern TVET pedagogies and digital technologies.

## Opportunities and challenges for teachers when adopting technology in TVET

Having covered the types of skills required to adopt technology in education and training, this practical guide now presents an overview of some of the challenges and opportunities for teachers when they seek to adopt ICTs in TVET.

### CHALLENGES

#### **Teacher competencies**

The ability of teachers to use ICTs and digital technologies is crucial for their successful integration in the learning process. This starts with the design of a clear instructional plan to enhance TVET delivery with the use of technologies, and it results ultimately in the creation of an environment that is conducive to achieving the intended learning outcomes (Dwayi, 2017). However, teachers who lack the necessary competencies often fail to realize what can be achieved in the curriculum with ICTs in comparison to what is achieved without ICTs.

Shortcomings in teachers' competencies and motivation can be barriers to integrating ICTs and digital technologies. However, the development of teachers' competencies and motivation is not always easy because of issues related to accessibility; some teachers have access to technology and infrastructure, but others do not. Moreover, teachers' pedagogical or didactic competencies can also have an impact on their integration of ICTs and digital technologies. Teachers with lower pedagogical skills, for example, are at a higher risk of not using ICTs effectively.

### **Teacher qualifications**

The profile of TVET teachers, lecturers and instructors differs from country to country, and so too does the scope of their tasks. This can be the result of structural and organizational factors. For example, TVET teacher education is largely university-based, except in some countries where there are colleges dedicated to the preparation of TVET teachers and trainers. Also, there is often no clear distinction between the pedagogical requirements for teaching TVET and non-TVET subjects. This blurs the line between TVET and its approaches, and the approaches adopted in other educational fields, and it obscures the specific advantage of having a mastery of vocational pedagogy. In some countries, there is no one single training system or entry programme for TVET teachers. This results in a pool of TVET teachers with heterogeneous backgrounds, with some possessing a strong industry background but lacking adequate teaching skills. Weak or non-existent qualifications and standards for TVET teacher education are a challenge for TVET teachers who are inadequately prepared to use technology to enhance their instruction, affecting their ability to introduce innovations in pedagogy and use effective tools to improve the learning experience.

### **Access to learning resources**

The increasing demand for equitable access to quality learning resources is also a challenge for TVET systems. Compared to other post-secondary academic streams, the TVET sector's image and reputation is usually poor. This has a major effect on enrolment rates and on the learning resources that are available for TVET learners, especially in developing countries. In India, limited access to learning resources has been seen as one of the main causes for the poor quality of TVET programmes and courses (Ray, 2014). Also, the learning resources that are available become rapidly obsolete owing to ever-evolving technologies. For example, without access to up-to-date examples of occupational contexts, it is difficult for TVET learners to relate theory to practice.

A UNESCO-UNEVOC study on open educational resources (OERs) highlights that TVET has thus far lagged behind in seizing the new opportunities that come from the development of OERs, massive open online courses and open education. One of the problems that TVET teachers and trainers face is that the material is not applicable to their context or that the material does not really target

### **Challenge to using OERs in TVET**

Challenges and barriers to the creation and use of OERs in TVET are numerous. Because of the complexities and the different arrangements available to develop and acquire vocational skills, some barriers are even more pronounced in the field of TVET.

Other barriers and challenges are not specific to TVET and occur in other educational sectors too. Some have been discussed in a UNESCO-UNEVOC study on OER and are highlighted below:

- Much of the TVET content must comply with professional rules and standards, which differ between sectors and often between countries. This hampers large-scale international reuse of OERs.
- Access to the internet is problematic in large parts of the world.
- TVET teachers and trainers are not aware of the existence of OERs and their potential. Many are unaware of the difference between OERs and free access and they likely breach copyright when they reproduce and repurpose materials.
- The expiration date of knowledge in TVET is short (shorter than in fields like languages, mathematics or history), especially in IT-driven areas. This puts an extra burden on updating learning materials.
- TVET at ISCED levels 2 and 3 predominantly takes place in local/national languages. The skills needed to read and comprehend learning resources in languages other than the local one are in many cases not present.

Other perceived challenges in TVET include insufficient skills or knowledge to find/locate OERs, insufficient technical/administrative support to locate and/or adapt OERs, lack of capabilities (e.g. necessary technical skills), and a lack of motivation to create, share or use OERs.

*Source: Schuwer and Janssen, 2017*

the learning outcomes that they have set for their students. Teachers and trainers need to be able to repurpose or rewrite OERs completely to be able to use them (Schuwer and Janssen, 2017).

### **Level of ICT use**

ICTs are applied sparingly in TVET when it comes to enhancing teaching and learning (Latchem, 2017). For example, while it is widely-used in higher education in some countries, the level of ICT use in TVET courses is low, unless there is a demand to connect school-based and workplace learning experiences and assess learning. The use of technology-based tools and platforms where data can be stored, shared and analysed between sites of learning is often useful. In other parts, it is assumed that ICT skills are developed within workplace settings as learners learn to use productivity tools and machineries providing real-life work experience.

## **OPPORTUNITIES**

While there are clear challenges, ICTs also offer many opportunities. The use of ICTs in TVET has additional advantages for vulnerable groups including girls and women, as well as those with no formal education. Access to education and training that use multimedia and online resources is now possible, allowing learners to acquire additional skills. Moreover, young adults outside of formal school systems can engage in self-directed learning through the use of media technologies.

A case in Sri Lanka gives an example of building the blocks needed to increase access to learning opportunities and career guidance through distance education. The initiative, led by the Sri Lankan Ministry of Youth Affairs and Skills and Development, helps to bridge the gap between supply and demand through an ICT-enabled career guidance and job-matching system. As part of the Distance Education Modernization Project, an online portal ensures equal access for vulnerable groups, including girls and women, and it enables employers to find skilled employees free of charge (ADB, 2016).

# Enhancing pedagogy with ICTs

Having established the types of skills and competencies needed by teachers to adopt technology in TVET, and identified their challenges and opportunities when doing so, the following section suggests ways to use ICTs in pedagogy and offers examples from around the world.

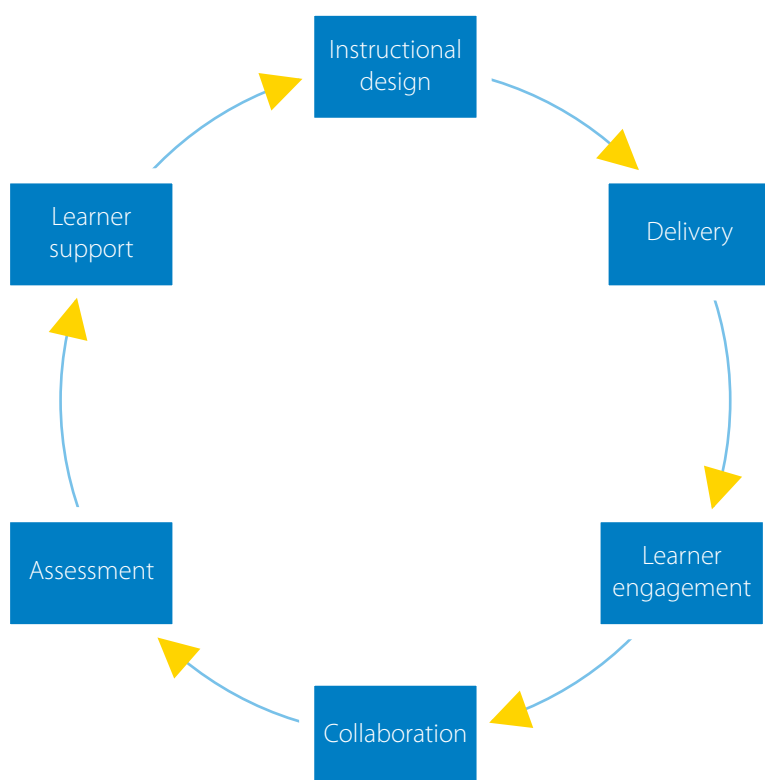
## ENHANCING PEDAGOGY WITH ICTs USING AN INTEGRATED INSTRUCTIONAL SYSTEM

The potential of technology can be maximized when it is applied in the context of an integrated instructional system (Guthrie et al., 2009). Learning in TVET is valued for the practical orientation of its processes and tasks. Learning can also occur at different learning sites: schools provide theoretical lessons and students can then take what they

learn in theory and put it into practice outside of school. Such hybrid-learning sites enable students to cross boundaries between schools, workplaces and courses offered by specialized course providers, helping them to acquire work-related and learning-related competencies. However, there are challenges in using learning sites when the provision and standards of digital infrastructure are different. The level of pedagogy provided by teachers and trainers is vital to maximizing the learning outcomes across different sites (Ajithkumar, 2016).

To harness the use of ICTs and digital technologies in TVET teaching and learning, it is important for teachers to plan and organize activities within an integrated instructional system that can be supported (an example is provided in Figure 1).

Figure 1 – Illustrative example of an integrated instruction system



*'The use of digital technologies in formal education and vocational training has the potential to improve learning, although the outcomes depend on the capacity to link these tools to effective pedagogy.'*

OECD, 2018

## Instructional design

Teachers are also instructional designers, facilitators of learning and didactic planners. They design the context in which learning resources will be used in the classroom or other learning sites and they stimulate learning through an interplay of activities. Dillenbourg (2013) associates this role to 'classroom orchestration', in which teachers manage multi-layered activities in the context of several possible constraints related to the curriculum, time, workload and assessment. Teachers plan and organize activities and identify specific technological tools that can help to adapt to specific scenarios that occur at the learning site or manage what is produced on the spot. Moreover, new information and ideas are produced while learning takes place.

The integration of ICTs offers a variety of opportunities to create student-centred learning environments. It is important for teachers to reflect on how previous ICT-enhanced learning activities have been designed to consider whether they can still be used in any current or future delivery of learning content.

Just as TVET graduates have to work and live in rapidly changing societies and economies that demand a mix of skill sets, teachers have to consider and adapt activities to make sure that the course content and delivery mode are conducive to the development of twenty-first-century skills. In short, teachers as designers and planners have to create an enabling environment. [Table 1](#) shows an example of activities and possible tools.

### Student-centred learning in TVET



A student-centred approach can:

- Make teaching and learning processes more responsive to learner interests and needs
- Increase the control that individuals or groups of learners exercise over learning processes, for example by emphasizing the teacher's role as a facilitator or coach
- Give greater attention to learner outcomes or competencies, for example by focusing on a learner's communication skills or capability for learning
- Use a range of innovative methods to enhance learning, particularly in project work, group work and active learning (otherwise known as inductive or experiential learning)

ICTs are creating new opportunities for teachers and learners to address eight dimensions of learner-centred teaching and learning in TVET:

- Formation of vocational identity
- Authenticity of tasks
- Reconciliation of subject-oriented and thematic material
- Construction
- Adaptive instruction and modelling
- Coaching
- Development of self-regulation skills
- Development of reflection

*Source: Cedefop, 2015*

**Table 1** – Example of activities and possible tools

Activities	Purpose	Examples of online tools
<b>Reflection activities</b>	Track learning; demonstrate progress	WordPress, Google Docs, REALTO
<b>Peer review activities</b>	Demonstrate communication skills through feedback	Canvas, TEAMMATES
<b>Discussion forums</b>	Demonstrate communication with peers; answer questions showcasing multilevel critical thinking skills	Tricider
<b>Small-group activities</b>	Solve problems together and collaborate showcasing multilevel critical thinking skills	GoReact, Tricider
<b>Digital storytelling activities</b>	Tell stories to inform and instruct; evaluate, reflect and analyse information or content	Various multimedia such as PowerPoint, videos

Source: Mansbach, 2015

## Delivery

The European Training Foundation (2009) suggests two possible orientations for pedagogical models to deliver e-learning:

### Content-oriented delivery

Emphasis is on individual learning and access to resources.

### Process-oriented delivery

Emphasis is on the interaction between individuals involved in the learning process (e.g. student-student, student-tutor and student-teacher).

**Table 2** – Delivery tools for content- and process-oriented delivery

Technology	Pedagogical model	Recommended use
Email	Process-oriented	Asynchronous dialogue between individuals; exchange of confidential communication
Mailing list	Process-oriented	Dissemination of information to many users through email, with open discussion among group members using the push modality (the message is delivered to the recipient)
Forum	Process-oriented	Focused discussion on specific topics; asynchronous discussion that has to be stored for subsequent analysis. Dissemination of information to groups using the pull modality (the message must be found by the reader inside the forum)

Wiki	Content-oriented	Construction of hypertext pages on specific topics; sharing of information and knowledge
Chat	Process-oriented	Real-time analysis of topics
Web pages	Content-oriented	Distribution of hypertext and multimedia training material (courseware, learning objects, etc.) and also traditional material (booklets, notes, etc.); publication of information, resources and news
Shared synchronous resources	Process-oriented	Sharing of a teacher's or student's screen (for example, the teacher demonstrates how to do something) or sharing of software programs; Access to file systems and databanks; Uploading and downloading of documents (e.g. organized in folders) created by teachers or students
Simulation environment	Content-oriented; Process-oriented	Two- or three-dimensional virtual environments, simulation environments or role-playing environments, available on the web for individual use (individual interaction with the software program) and collective use
Organization tools	Process-oriented	Support systems for teaching organization (shared calendars, syllabi, frequently asked questions, information, etc.); support systems for group processes (for managing projects, monitoring, decision-making, polls, etc.)
Streaming video and broadcasting	Content-oriented	Distribution of lessons, seminars, conferences, etc.
Audio conferencing	Process-oriented	Real-time interaction among people to explore interesting topics
Audio/video conferencing	Process-oriented	Virtual class lesson or seminar discussions; these tools usually integrate the possibility of sharing material (e.g. PowerPoint slides) and managing the class through requests to speak (raising a hand and passing the microphone)

Teachers need to understand the characteristics of these tools to be able to choose the right ones for use in technology-supported pedagogical models. The integration of technologies in TVET can support learning processes because they reflect scenarios similar to the ones faced by learners in real-work settings. This is particularly important in contexts where dual training systems are implemented. However, technology-enhanced teaching as part of the delivery in school-based initial TVET is only one piece of the story. The ways to bridge practical experiences across different learning sites is another.

Some professions with high-risk performance environments have adopted simulation technology in their training and assessment programmes. For

example, flight simulators have been incorporated into the curriculum for pilot training. Similar simulation-based programmes have also been incorporated into clinical or medical-oriented fields. These technologies help trainees to acquire skills by placing them in lifelike situations and providing immediate feedback on their decisions and actions. The development of skills, including transversal skills such as collaboration and occupational safety, are enhanced by technology (Scalese, Obeso and Issenberg, 2008).

Using these models in training in medical fields such as critical care and emergency medicine have led the way in adopting simulations, especially to teach and test the skills needed to manage rare and/or critical incidents.

## Stimulating student-centred engagement and outcomes

In addition to learning at schools and training institutions, TVET is unique in providing an opportunity for students to learn in workplace settings. This learning may be a course or part of a course within a TVET programme (offered by the students' institution itself or by a company or trade organization that acts as the accreditation body). Linking theory with practice and performing practical tasks to learn about an occupation in the actual workplace makes TVET learning uniquely practice-based. Internships and courses that offer supervised field experience are examples of how TVET learning can occur. Examples of learning arrangements where ICTs can be used to stimulate learning include:

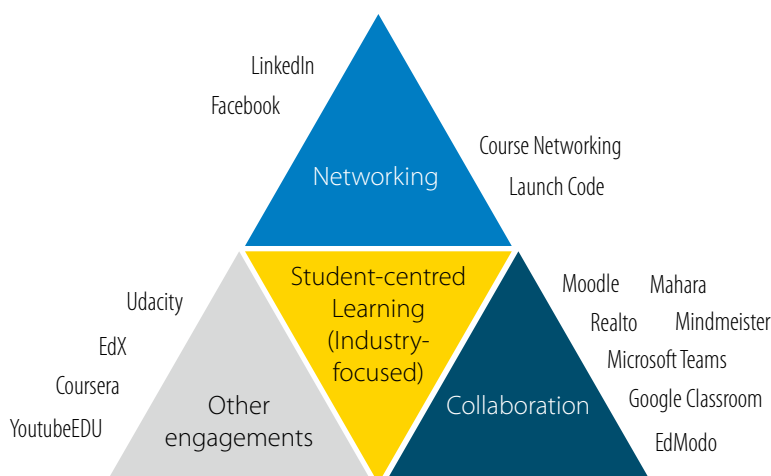
- Use of synchronous and asynchronous platforms to communicate and provide feedback between learners, supervisors and mentors – ICTs allow learners to document and reflect on their learning process and outcomes. Digital artefacts may be collected and compiled in a system, such as e-portfolios, that show what learners have learned and what competencies they have developed in the workplace as part of a course or programme.
- Use of pedagogy with technology-enhanced learning processes to develop specific skills – learning is stimulated with the help of the right combination of pedagogy and tools. A study of students in a textile and fashion retail programme in the United States (Bennur, 2014) showed how students' critical thinking was stimulated through a structured approach and the use of digital assets to conduct their research, develop data visuals and make a trend analysis of retail practices in two locations. Pedagogy with a technology-enhanced approach was shown to improve student productivity and learning outcomes (e.g. better depth of analysis) when compared to pedagogical approaches that did not use technologies.
- Use of ICTs and digital technologies for learning-based networking, collaboration and interaction in the workplace – social media and other platforms are increasingly used to connect teachers, students and industry practitioners. The approach combines student-centred and strong industry-focused learning.

### Learner engagement

Effectively engaging learners can help to meet or exceed course and programme learning outcomes. Engagement entails mindfulness, intrinsic motivation, cognitive effort and attention. TVET learners are more likely to be engaged in a course when they perceive that the teaching and learning activities are practical and close to real-life practice.

The use of ICTs in these activities allows learners to conduct inquiry-based learning through ICT-enabled simulation tools and internet resources, to experience real-world practice through a multimedia-based showcase of cases or tasks, to communicate and collaborate with their peers, teachers and experts, and to learn at their own pace.

**Figure 2** – Examples of ICT tools for student-centred learning approaches with focus on industry



In summary, the strategic use of ICTs can help to create conducive learning environments that put learners at the centre, not technology. Technology can support the execution of more personalized and better teacher-learner and learner-learner interactions. This ensures that individual learning needs and the expected learning outcomes of TVET programmes are met without distraction from technology (Summak and Samancioğlu, 2011).

### **Student collaboration**

Martens et al. (2014), in a publication on learning in Web 2.0, demonstrate a number of promising practices for integrating Web 2.0 tools to enhance learner-learner interactions. For example, the India Web 2.0 project – supported by the University of Rostock, the Institute of Computer Science, and ANOVA Information Technology, in collaboration with the IT College Putbus – aimed to develop innovative instructional resources for TVET teachers and support them to integrate ICTs in their teaching. Web 2.0 tools are open-source

applications that are subscription-free and easily accessible via the internet. Such tools empower teachers to enhance their teaching. The flexibility of the tools also allows teachers to choose how and when to employ them, based on their expected learning outcomes. Wiki was one of the Web 2.0 tools implemented in the project because it provided opportunities for learners to collaborate among themselves (in the course and institution, and across institutions locally and internationally), co-construct theoretical and practical knowledge, and communicate with peers, teachers and experts. For example, a teacher would ask a small group of students to use wiki to work together to create a handbook of computer science terms. Wiki enabled the students to discuss and communicate with peers online. The interactions among learners enhanced their understanding of the concepts. More importantly, teachers highlighted that the use of wiki allowed learners to understand the importance of team communication, a key component in any future workplace.

### **Box 1 – Shared learning space for VET students and teachers, Switzerland**

REALTO was developed by the École polytechnique fédérale de Lausanne, based on the pedagogical model 'Erfahrraum', which describes the processes involved in bridging shared digital spaces with physical contexts. REALTO aims to bridge the gap between school and workplace learning contexts in two ways. From school to workplace contexts, theoretical knowledge can become more understandable and relevant if it is connected to specific examples of workplace experience. From workplace to school contexts, workplace experiences can help students to reflect and build connections to knowledge learned in the classroom. As a digital learning space and platform, learners use mobile applications to capture learning experiences through photos, videos, audio and texts in the workplace. Selected experiences can then be shared with peers, teachers and supervisors.

Learn more at [epfl.ch/labs/chili/dualt/current-projects/realto/](http://epfl.ch/labs/chili/dualt/current-projects/realto/).

### **Assessment**

Assessment drives teaching and learning practices, and it is therefore an integral part of the learning process. Assessment processes ensure that students are supported as they determine their skills and knowledge proficiencies through a series of tasks and receive feedback from their peers, teachers and experts. Digitalizing assessment processes potentially enables learners to carry out assessment tasks anywhere at any time. Digital technologies can also allow students to document

their outputs and enable professional learning communities to give asynchronous or synchronous feedback to help students reflect on their learning processes online. In addition, digital portfolios have been increasingly used in TVET learning environments to help students to consolidate and reflect on their learning outcomes, outputs and processes within a course or across courses in a programme. Digital portfolios allow learners to monitor and manage their own learning with the support of their peers, teachers and experts.

### Learner support

Besides getting support from mentors in the workplace, digital platforms (learning management systems or social media) offer virtual support to part-time TVET students, either from their supervisors in the institution and/or from their fellow learners in another workplace. Examples include the use of video-recording so that students can provide evidence of their practices and share videos. Digital platforms also allow students to receive virtual feedback from their supervisors and peers and hold face-to-face meetings. To improve both the link between theory and practice and the partnership between TVET institutions and the workplace, students can use such platforms to hold videoconferences with supervisors and mentors at the same time. Feedback and communication with peers ensure that learners do not feel isolated in the workplace, but instead feel a sense of comradeship with peers who are having similar experiences in other workplaces.

Even if TVET programmes are entirely workplace-based, ICTs enable learners to remain in contact with teachers at TVET institutions or TVET experts at universities. In such cases, teachers and experts may be able to help learners make sense of their workplace practices by introducing them to theoretical models or concepts. More importantly, ICTs can help learners to link their practices to a set of principles that can be applied across contexts. ICTs also provide learners with access to digital resources that allow them to do research on aspects of their practices in the workplace. Similar to the previous type of workplace learning, e-portfolios can be constructed by learners as they monitor and manage their own learning through reflection and the planning of their own learning trajectories. At the same time, e-portfolios showcase learners' learning processes and outcomes to different programme stakeholders.

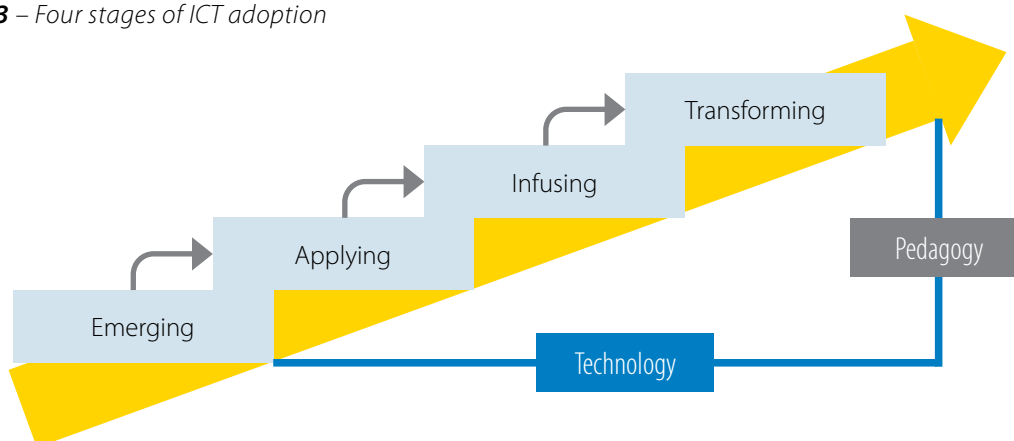
Collaboration and information sharing between institutions and training sites are critical to support apprentices. In a dual-training setting in Germany, Gessler (2017) ranks important areas for collaboration, some of which are listed below. Collaboration requires simple and complex systems (digital platforms, online databases, etc.) that enable both parties to access information and work together as follows:

- Exchange information on apprentice's social behaviour and professional performance
- Exchange information on apprentice's personal engagement
- Exchange information on apprentice's discipline and punctuality
- Coordinate company training plans and school curricula
- Jointly develop training and teaching materials
- Share contact information of focal points, their availability, and schedules of joint activities and events

### STAGES OF ICT ADOPTION IN TVET

A four-stage model can help teachers to integrate ICTs into learning environments, because it enables them to distinguish the extent to which ICTs are currently integrated (Majumdar, 2005). The four stages of ICT adoption are emerging, applying, infusing and transforming (Anderson, 2010). In addition, there are two dimensions: technology and pedagogy (Figure 3). By becoming aware of their own stage of ICT adoption, teachers can better plan their own professional learning trajectories and enhance the quality of their teaching in ICT-enabled learning environments.

Figure 3 – Four stages of ICT adoption



Source: Anderson, 2010

The four stages are not hierarchical. Rather, they provide guidance for teachers and curriculum leaders in TVET programmes to assess the existing level of ICT adoption by teachers in TVET institutions. Below is an overview of the four stages.

### **Emerging**

At this stage, teachers use the available ICT tools (often limited ICT infrastructure and hardware) for administrative purposes rather than for teaching and learning. For example, teachers may use a spreadsheet application to enter and calculate assessment marks and grades. Work schemes and lesson plans may be prepared on work documents and shared among teachers. Also, institutional announcements to teachers may be communicated via email, and colleagues may use email to communicate with one another. At this stage, teachers may be aware of the opportunities of ICTs to enhance TVET teaching and learning, but they have yet not taken up these opportunities in their courses or programmes. It is important for teachers to understand how to use ICT tools and to become aware of the potential of ICTs to enhance TVET learning and teaching in order to move on to the next stage: applying.

### **Applying**

At the applying stage, TVET teachers and trainers tend to have a better understanding of how to use ICT tools for teaching and learning. However, while TVET institutions have better ICT infrastructure and hardware on campus and teachers can gradually build their capacity to use ICT tools, there is still little or no change in the pedagogical approaches adopted for teaching and learning, and teachers still tend to dominate the learning activities in class. At this stage, teachers are aware of the opportunities offered by ICT for TVET teaching and learning and they have taken up some of the opportunities, but with little or no change in the roles of teachers and students.

For example, teachers can use ICT-enabled presentations and multimedia elements to support students to observe new procedures or experiments, and engage with students about their observations or ask them to complete a worksheet to document their observations. Although ICT tools can help students to visualize and animate procedures or experiments, the teacher is still the presenter and main driver of learning in this environment. There is no change in teachers' pedagogical strategies in the ICT-enabled learning environment.

### **Box 2 – LinkNet Information Technology Academy**

LinkNet Information Technology Academy provided short computer literacy courses in rural Zambia for learners who were not familiar with computers owing to the shortage of local ICT infrastructure (Mudenda and van Dam, 2012). The short courses allowed learners to familiarize themselves with computers and learn basic computer knowledge and skills. As a result, some of the trainees were able to obtain internationally recognized certificates of computer literacy and to give further support for local ICT adoption. Moreover, teachers were made aware of the potential of ICTs to enhance students' learning experiences.

### **Box 3 – Applying a computerized dynamic assessment system**

A study in the People's Republic of China showed Shih, Ku and Hung (2013) applying a computerized dynamic assessment system in an 'accounting entry' unit for second-year accounting students in a vocational high school. The teachers used the system as an additional tool to enhance students' learning experiences. In the system, teachers included a number of adaptive quiz questions to evaluate students' understanding of the concepts. The system therefore reinforced students' learning and encouraged them to review using the adaptive function. That is, based on the quiz results, the system provided diagnostic feedback for the students to review the related concepts that they had misunderstood. Students could then retake the quiz before moving on to the next-level quiz. In this case, teachers were able to use ICTs to teach and monitor students' learning progress.

### **Infusing**

In order to achieve the expected learning outcomes, TVET teachers at the infusing stage are able to integrate ICT tools to accommodate students' learning needs. Teachers have access to the necessary infrastructure and hardware to support ICT-enabled learning environments. For example, teachers can organize students in groups to conduct virtual experiments on their digital mobile devices, analyse and discuss the data from the experiment as a group, present key findings, and reflect as a group on the feedback given by peers and teachers. At the infusing stage, teachers are still the main organizers of teaching and learning activities, and they are only just beginning to use ICTs to support and empower students to monitor and manage their own learning.

### **Transforming**

At the transforming stage, TVET teachers support and empower students to monitor and manage their own learning. Teachers become facilitators and support student learning rather than organize teaching and learning activities. Teachers provide scaffolding or initial assistance to students until students are able to reflect on their own learning processes and outcomes with limited support. Teachers guide students in planning their own learning trajectories and enhance both the quality and external efficiency of teaching and learning. Teachers use a number of ICT tools with different pedagogies to create an engaging and meaningful learning environment. Many of the ICT tools are internet-enabled applications such as learning management systems and e-portfolio systems. TVET institutions at the transforming stage have robust ICT infrastructure, hardware and resources, and they have a transformed curriculum that takes up the opportunities of ICTs for teaching and learning.

For example, TVET teachers at this stage are able to use e-portfolios as a form of assessment for student internships. Students are supposed to reflect on their working experiences, discuss their learning processes and outcomes, identify their learning gaps, and plan how to address their gaps in order to meet the expected learning outcomes. The e-portfolios may be situated in a learning

### **Box 4 – Problem-based online learning environments for learning languages**

Gündüz et al. (2016) designed and adopted a problem-based online learning environment to improve TVET students' knowledge and skills to use the Turkish language effectively in written form. In a lesson entitled 'What Do We Know about Petitions?', an example of a rejected petition was presented on an online platform; the example was meant to represent an authentic situation related to a real-life experience. The platform also provided guiding questions, which encouraged students to understand better how to write correctly in Turkish. Moreover, multimedia resources (e.g. cartoons, videos, etc.) and a discussion forum gave additional support to students. In the forum, students were able to discuss and reflect with their peers, while the teacher could monitor their learning progress and give suggestions. It was reported that the use of the online learning environment enhanced student engagement in the course. More importantly, students applied the knowledge to solve their own real-life problems.

Clearly, the teacher in the course had the capacity to select specific ICT tools to align with the learning tasks and to create a learner-centred environment to promote students' problem-solving skills.

management system of the TVET institution. Such a system might allow students to identify courses or topics in the learning management system that address their own learning gaps. Similarly, in a hybrid learning context, e-portfolios can promote autonomy and transformative learning outcomes and serve as an effective tool to establish communication and cooperation across different learning sites (Nore, 2015).

A summary of teachers adopting ICT at the different stages is presented in [Table 3](#).

**Box 5 – Victorian TAFE Virtual Campus, Australia**

The Victorian TAFE Virtual Campus, which uses WebCT for its online learning management system, has been implemented to cover e-learning for all campuses of the South West Institute of TAFE (Victoria) in Australia (Carter and Ellis-Gulli, 2014). This undertaking provided an opportunity to create a Diploma of Business Administration programme to transform teaching practices. With the virtual campus, teachers were able to collect various types of information about students before the start of the programme in order to gain a fuller understanding of their prior knowledge and experience and then to create a personalized, authentic learning experience for their students. Teachers integrated workplace or case-study activities with courses led by other teachers or with other online learning resources in the web-enriched virtual classroom in order to inspire students' thinking. More importantly, the system allowed students to learn at their own pace. The learner-centred approach increased student motivation and provided a meaningful learning experience.

It was crucial that teachers built up their understanding and capability to integrate the appropriate ICT tools with diverse learner-centred pedagogical approaches to maximize the learning achievement of students. The teacher becomes an instructional designer to create an authentic, learner-centred environment and a facilitator to support students' self-directed learning.

**Table 3 – An overview of ICT adoption indicators**

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 (and often limited ICT infrastructure and hardware)	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 the 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 TVET teaching and 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 on campus in place	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 organizers 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 engaging and 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

# Teacher development and institutional support

As noted earlier, teachers need certain skills and competencies in order to adopt ICTs in education and training. Appropriate teacher development mechanisms and institutional support are key. The following section gives an overview of important considerations.

## TEACHER DEVELOPMENT

TVET teachers and trainers play a critical role in supporting the learning of students in technology-enabled environments (Mumcu and Usluel, 2013). In order to do so, however, TVET teachers must themselves be lifelong learners and monitor and manage the development of their own professional learning (Rogers, 2003). All TVET teachers should be expected to have metacognitive competencies to enable lifelong learning and specific competencies to integrate ICTs in their day-to-day practice.

Teachers can do a great deal with technologies to create constructive learning environments. For example, TVET teachers in South Africa took part in a professional excellence programme to develop their competencies in creating engaging, ICT-enabled learning environments. Afterwards, institutions reported that the introduction of ICTs transformed teaching practices and increased students' motivation (Dwayi, 2015). Moreover, teachers who were able to integrate ICTs in their pedagogical approaches were more likely to create effective and meaningful learning environments (Khan, 2015).

ICTs also support TVET teachers' professional education and they enable learning to become more personalized. This is especially important because of teachers' and trainers' diverse learning needs and the time that they need to commit to professional learning. One approach is to form online communities. Duncan-Howell (2010) studied three online communities in Australia and found that teachers who took part in the communities collaborated with other teachers in different teaching areas via communication channels that were asynchronous (e.g. online discussion forums) and/or synchronous (e.g. chatrooms). The study also found that the online communities offered rich, meaningful experiences that were likely to support TVET teachers' continuing professional development.

### **Box 6** – *Teacher continuing professional development, Ireland*

SmartVET is an innovation transfer project funded under the Lifelong Learning Programme of the European Union. The project supports the continuing professional development of vocational teachers in the use of interactive technologies for teaching and learning. The project aims to transfer good practices in the delivery of training on Interactive White Boards (IWBs) to the VET sector in Ireland, providing VET teachers with the competencies needed to design educational resources suitable for use on IWBs and to integrate their use into everyday teaching activities.

### **Box 7** – *Professional learning network for teachers, Australia*

The Scootle Community is a free online professional learning network available to all Australian educators, including pre-service teachers. As a social media platform, it allows educators to collaborate, ask questions and connect with networks of like-minded professionals who share similar educational interests and curriculum areas. Within the Scootle Community, networks allow members to connect with peers, start discussions and collaborate on wikis and blogs with other teachers across Australia.

Learn more at <https://www.scootle.edu.au/ec/p/home>.

**Box 8** – *e-Mentoring, United Kingdom*

In the UK, synchronous coaching using an e-mentoring system was used as part of a vocational teacher training course. The approach provided immediate feedback and more personalized learning experiences. By using an e-mentoring system that has a wide database of TVET teachers across the country, teacher trainees could pick mentors that they thought could best support them. The trainees were paired with peers or experts as mentors to help them with their diverse teaching contexts. In addition to the e-mentoring system, e-coaching technology allowed mentors/coaches to provide instant feedback during the training process.

*Source: Lord and Coninx, 2011*

**Box 9** – *eTutor and eStudent systems, Singapore*

The eTutor and eStudent systems that are integrated into Singapore's TVET programmes allow teachers to enhance their interactions with students and create a collaborative online learning community for all TVET learners in Singapore. The eTutor system is an interactive online learning environment that contains multimedia learning resources for TVET learners that they can access anytime and anywhere. Most of the theory-oriented lessons are delivered online. This enables students to learn at their own pace, ask teachers questions when problems arise, and take more time to master practical skills. The eStudent system enables students to manage their learning tasks and to access services available to them during their studies.

In all, ICTs give students in Singapore more opportunities to communicate with their teachers and peers, and they enable students to establish online learning communities with students in other campuses.

*Source: Law, 2008*

**Box 10** – *TVET online community forum*

UNESCO-UNEVOC's TVeT Forum, an online platform for TVET stakeholders, enables TVET teachers to engage in open and dynamic exchanges with other experts and educators on TVET-related matters, including pedagogical approaches.

Learn more at <http://www.unevoc.unesco.org>.

## INSTITUTIONAL SUPPORT

Through institutional and inter-institutional support, TVET teachers now have better access to quality professional learning opportunities and digital resources. Support at the institutional level is pivotal to ensure that conditions are conducive for teachers to develop themselves professionally and that they are able to integrate ICTs in their educational setting. In 2010, the Commonwealth of Learning (COL) implemented the Innovation in Vocational Education and Skills Training (INVEST) Africa capacity-building model to support flexible skills development using ICTs. The implementation of the model had an impact on the policies and implementation strategies of institutions, their organizational structures, their technology infrastructure, and their learning and teaching practices. As part of the Flexible Skills Development project, a community learning network was established to develop and support a community of practice among partner institutions working towards flexible and blended approaches. The community was built on a social media platform that allowed teachers, institutional leaders and policy-makers to take part in discussions, upload documents and photographs, post blogs, and advertise events. Key institutions also had their own group spaces where they shared documents (e.g. policies and course plans). Some even used

the platform as their main internal communication tool. The key discussion topics included:

- ICT infrastructure and system design
- Equity and gender issues
- Moodle learning management system
- National and institutional policy issues
- Entrepreneurship

In Ghana, the government supports the integration of ICTs in TVET by applying the Devotra Smart Classroom concept. In addition to enhancing teaching and learning, the project aims to improve access, quality and relevance. To this end, the project introduces state-of-the-art technologies, software, simulations and hands-on practical education in TVET classrooms (COTVET, 2018).

When teacher development is well supported by TVET institutions and government policies, the access to quality TVET programmes is more likely to be enhanced and students are more likely to achieve better learning outcomes. The European Centre for the Development of Vocational Education (Cedefop) has conducted a series of studies that demonstrate that the quality of teachers is pivotal to the quality of TVET teaching and learning, and has a positive impact on learning outcomes (Cedefop, 2015).

*'School systems need to find more effective ways to integrate technology into teaching and learning to provide educators with learning environments that support twenty-first-century pedagogies and provide children with the twenty-first-century skills they need to succeed in tomorrow's world.'*

OECD, 2018

## Limitations of ICTs

ICTs exist in almost every aspect of our daily life. However, in order for teachers to understand how ICTs can be beneficial to learning, they will have to adopt them in their teaching. On one hand, ICTs allow teachers to explore and adopt a range of learning resources to enhance their abilities to teach. Even more importantly, ICTs enable teachers to create student-centred learning environments with real-life problems, thus supporting the development of skills and competencies for future employment opportunities.

On the other hand, teachers must also pay attention to the limitations of ICTs. ICTs are not omnipotent. Each ICT tool has its advantages and disadvantages, so it may not be applicable to all learning activities. ICT tools can help teachers to align their instructional designs with learning objectives and students' learning styles, thereby leading to enhanced learning outcomes. Without adequate pedagogy, however, ICTs cannot provide much support for learning and teaching. It is therefore crucial for teachers not only to see that ICT has the potential to enhance teaching, but also to understand that it is not an isolated tool, but an integral part of TVET teaching and learning.

# Learning from examples

Whereas the previous sections have shown how technology can enhance pedagogy and how teachers can be supported in the adoption of technology, the following section offers some examples that TVET teachers and institutions can use as inspiration.

## ICT FOR LIFELONG LEARNING

Massive open online courses (MOOCs) provide learning opportunities for TVET learners from diverse geographic, economic and cultural backgrounds, and they encourage lifelong learning. One promising example of MOOCs is the learning offered by the Alison platform, which provides free, quality, certified online courses for TVET learners. The platform not only provides individuals with learning opportunities, but also supports the development of a more equitable global learning community. With the support of Alison, TVET learners all over the world have shared their experiences.

According to learner testimonies, the MOOCs on the Alison platform provide students with more learning opportunities and richer learning experiences. However, it should also be noted that the platform's MOOCs require learners to have internet access and the capacity to learn independently.

Find out more about the Alison platform at <https://alison.com/>.

## ICT FOR BLENDED LEARNING

There are various definitions of blended learning across institutions and countries. However, the two definitions most commonly adopted by institutions are:

- The use of both online and face-to-face teaching and learning
- The replacement of face-to-face instructional time with online instructional time

Blended learning allows teachers to design courses that seize the opportunities offered by both face-to-face as well as online teaching and learning. By integrating online components into courses, TVET learners are able to learn anywhere, anytime and at their own pace, beyond the physical boundaries of the institution or classroom or the time boundaries of scheduled lessons.

For example, teachers who design a blended learning course have more teaching and learning options; they can assign learners to work through the required multimedia resources at their own pace before scheduling a face-to-face lesson where the focus is on group and/or class discussion. Teachers can then ask their students to share their reflections of the face-to-face discussions on an online discussion forum or blog in the learning management system.

### **Box 11** – *Digital and online learning in VET, Serbia*

The European Training Foundation (ETF), working in collaboration with Srdjan Verbić, Serbia's Minister for Education, Science and Technological Development, implemented the Digital and Online Learning in Vocational Education and Training project in order to support ICT adoption in TVET in Serbia.

#### **Who are the learners?**

Teachers in eight vocational schools

#### **How ICTs are used?**

The use of ICTs, including digital and online learning and assistive technologies, has augmented conventional teaching practices in eight vocational schools in Serbia. Repositories of various learning resources and forums are used predominantly to exchange ideas between students and teachers. This has provided students with a more engaging environment where they can ask questions, upload their homework and download course presentations at their own pace. When students need help from their teachers, they can choose either to have face-to-face meetings or to communicate via emails.

### Why it is important?

- It provides opportunities for students to learn and develop their ICT literacy skills in non-ICT and general subjects (e.g. mathematics, biology, history, languages).
- It provides a personalized learning experience for students.
- It motivates teachers to use open-source repositories to work on their lesson plans and create personalized learning environments.
- It increases student engagement.

### Evidence of impact and quality

From the students' point of view, the school gave them opportunities to develop their own ICT literacy skills in subjects taught in school. This included students not only from vocationally oriented subjects such as ICT, programming and multimedia, but also students in general subjects such as mathematics, biology, history and languages. Students appreciated the efforts made by the school and favoured the use of ICTs in the classroom as they felt that it gave them a more personalized learning experience. This finding reflects an improvement in student engagement as well as an enhancement of the quality of TVET programmes. Additionally, over the years more and more teachers have changed their attitude towards ICTs and now apply digital and online learning in their teaching. This results in increased student satisfaction with TVET programmes.

### Other benefits

ICT development and digital and online learning are integral parts of the schools' strategic plans, which also represent and showcase Serbia's institutional reputation.

## LEARNING MANAGEMENT SYSTEM

To support online teaching and learning, TVET institutions have been adopting different learning management systems (LMS). An LMS is an online platform that allows institutions to manage their online teaching and learning activities within a course, and between courses in a programme. Teachers can upload digital resources and design learning tasks and activities for their learners (e.g. discussion forums, peer assessment, blog entries, quizzes, polls and surveys, and group project collaboration). Teachers can also manage their courses by sending individual or class messages, monitoring learners' online access to course activities, and grading and providing feedback on learners' assessment tasks. The three most common types of LMSs adopted by TVET institutions are:

- Open source LMS such as Moodle
- Subscription-based LMS such as Blackboard
- National or institution developed LMS

Moodle is probably the LMS that is most commonly used by TVET institutions in developing and emerging countries. However, it requires the capabilities of a technical team to customize its use to the needs of the institution, including the local language and links to the course management system (such as the teacher and learner database in a course and programme).

A LMS is used not just in the context of blended learning, but also in all TVET contexts that involve online teaching and learning, such as learning in the workplace and distance learning. Learning platforms for MOOCs can also be used in blended learning contexts where TVET teachers may assign their learners to work through certain session activities or learning resources of a MOOC when they align with the learning outcomes of the TVET course.

## ICT FOR DISTANCE LEARNING

ICTs can help to ensure the quality of TVET programmes in all contexts (urban, suburban, rural and remote), and they can be adopted to bridge the absence of access to TVET in remote areas through distance learning. TVET learners in remote areas with limited access to teachers, learning resources or contexts can engage in distance learning, interacting synchronously or asynchronously with teachers and learners in their course or programme. Distance learning also allows students to learn at their own pace. In addition, learners who are already in full-time or part-time employment can use distance learning courses to upskill or develop their competencies to take up a job in another industry or trade.

## Box 12 – Online Platform REALTO, Switzerland

The École polytechnique fédérale de Lausanne (EPFL) is a leading public institution in Switzerland. Acting in partnership with industry and government, EPFL has set up the Computer-Human Interaction in Learning and Instruction (CHILI) lab, which has been conducting research on innovative technologies that support learning. EPFL-CHILI has developed an online platform called REALTO in collaboration with the Swiss research group Leading House DUAL-T, which is funded by the Swiss State Secretariat for Education, Research and Innovation.

### Who are the learners?

Apprentices learning at different sites (e.g. school and workplace settings).

### How ICTs are used?

ICTs are used to create a digital space that can serve as a mediating tool to bridge the physical gap between school and workplace settings.

REALTO (<http://www.realto.ch>) is a next-generation online platform for Swiss TVET that supports learners to reflect on their experiences in the workplace and at school. REALTO, which can be accessed through smartphone or desktop applications, allows students to record, process and share experiences through different features, such as photos, audio, videos, drawings and texts. REALTO also helps learners to capture workplace experiences in learning journals, or online guided learning documentation. REALTO creates a shared digital space that connects locations, kinds of knowledge (practical and theoretical) and stakeholders (e.g. apprentices, teachers and supervisors). Through REALTO, learners can document their work on intercompany courses. Teachers can use the multimedia resources to illustrate abstract concepts with practical examples. Supervisors can also make comments and evaluate students' learning journals.

The REALTO platform is based on the pedagogical framework 'Erfahrraum', a German term that means 'experience space'. The term highlights the fact that (unprocessed) experiences alone do not lead to knowledge. Knowledge cannot be directly experienced, but needs to be constructed through processes of reflection. As there is often no time to reflect in the midst of work processes (reflection-in-action), the 'Erfahrraum' model encourages learners to capture and share workplace experiences through digital artefacts (e.g. pictures, texts, videos, drawings, etc.) that can be used for later reflection. For example, this can happen during a meeting with a mentor or teacher (reflection-on-action).

### Why it is important?

- It provides a platform to process experiences, which could lead to knowledge.
- It promotes student-centred learning.
- It provides a space for sharing digital artefacts with other learners, contributing to a deeper understanding of work processes and the formation of adaptive expertise.
- It allows teachers to make connections between theoretical and practical knowledge, and support learning needs and processes.

### Evidence of impact and quality

ICTs make it possible to develop new teaching and learning techniques that can enhance approaches to TVET delivery, teaching and learning. Through access to learners' digital artefacts, teachers gain new opportunities to support them, make connections between theoretical and practical knowledge, and encourage reflective thinking. For instance, teachers can use existing artefacts or assign tasks to learners that will enrich their learning experiences and allow for further reflection (for example, taking photos of tools, documenting a specific step in the workflow, or making notes of a critical experience).

REALTO helped to increase student engagement, since teachers made connections to real-life experiences that were relevant to students. When teachers used students' digital artefacts, it allowed for a more vivid illustration of abstract principles using real examples from the students' workplaces. This in turn encouraged students to document their workplace experiences and reflect more systematically in their learning journals, mentoring sessions and classroom activities. Digital artefacts can help learners to integrate theoretical and practical knowledge. With integrated knowledge and ongoing reflection, students are more likely to become adaptive problem-solvers and lifelong learners.

#### **Other benefits**

With the support of the REALTO platform, EPFL has been able to attract a larger group of learners from diverse industries in Switzerland.

*Source: Schwendimann and Dillenbourg*

### **Box 13 – Guri Kunna VET school, Norway**

Guri Kunna is a VET school located on the islands of Frøya and Hitra in rural parts of Norway's coastal area. The school offers apprenticeship-based education to about 500 students aged 16 to 19, and vocational education to staff from the fish farming industry in the region. The fish farming industry in Frøya and Hitra are crucial for Norway's export business, because they produce approximately 20 per cent of the country's salmon exports. Due to the rapid expansion of the fish farming industry and the limited labour market on the two islands, there is an increasing need to recruit employees from other European countries. The school has therefore started offering training in multilingual and multicultural classes.

#### **Who are the learners?**

The trainees are full-time staff working on fish farms in rural areas and students enrolled in the apprenticeship system. Trainees and students have varying levels of prior learning.

#### **How ICTs are used?**

The use of ICTs has made it possible for the school to offer quality in-class teaching and learning. Most classrooms are equipped with up-to-date digital devices, such as digital blackboards, projectors and loudspeakers. Every student has access to his or her own laptop, so teachers can apply a range of ICT tools in the courses. For example, an LMS is used in every course to support teaching and learning. The TVET courses at the school offer the same curriculum for the trainees working as full-time staff and the students engaged in the apprenticeship system. ICTs make it possible to offer a more equitable learning opportunity for the trainees regardless of geographical location.

ICTs have also supported teachers' class management and pedagogy approaches to assess the prior learning of students engaged in different industries, using a student response system (SRS) and making appropriate pedagogical adjustments on site. By asking questions via the SRS at the beginning of lessons, teachers gain a clearer understanding of the class's knowledge and can adjust their instructional approach accordingly. The SRS works flexibly by allowing teachers to initiate quizzes and voting schemes using blended teaching approaches. Since the SRS can run on mobile devices, students can engage in classes using their own devices.

#### **Why it was important?**

- It increases student engagement.
- It gives full-time trainees opportunities to learn industry skills.
- It equips teachers with tools to engage students, assess learning difficulties on site, and build confidence.

### **Evidence of impact and quality**

ICTs make it possible to reduce teaching hours. In face-to-face training sessions, teachers can use the SRS at the beginning of training to identify the most problematic areas and investigate and recognize students' prior learning. This allows the teacher to cater training to students' needs. For the remaining parts of the curriculum, students can also learn online. In this way, students can learn at their own pace.

Guri Kunna VET school managed to enhance teacher-student engagement and student-student interactions using the SRS. Students reported that it was fun to take part in TVET courses with the SRS as it enabled them to ask for feedback from their teachers and engage in discussion with their peers.

### **Other skills developed**

The school has learned from these experiences and promoted them among their apprenticeship-based education students. During the 'Friday quiz', students are asked to formulate questions with alternative answers related to the learning objectives. As a result of the quizzes, students' problem-solving skills are also enhanced.

*Source: Sannerud*

## **ICT FOR LEARNERS WITH SPECIAL NEEDS**

ICTs offer opportunities and help to address students' learning needs more effectively. For instance, students who are not competent in the language of instruction can use translating software or applications to support their learning. One example is SpeakApps, an open-source tool that provides opportunities for learners to take part orally in online tasks with other learners around the globe.

ICTs also support TVET learners with special needs. For example, SEVERI, an e-learning environment for special needs education, was developed for learners with learning difficulties and it has been implemented in three special vocational schools in Finland, Lithuania and Hungary (Starcic and Niskala, 2010). SEVERI has a basic interface and structure to provide learners with simpler, more user-friendly navigation. It includes guidance information and other supportive learning materials to visualize and facilitate students' learning. Also, teachers and parents have found that the SEVERI system is able to reduce barriers to learning, including issues related to communication and student engagement.

The Digital Inclusion Champions in Europe (DICE) project also demonstrates how the use of ICTs can help people with disabilities to build the digital literacy skills needed to transition from VET centre training to mainstream education and employment. The project has established an online community based on a peer support model. Sustained by Digiplace4all, a range of project stakeholders have received user-generated

information about disabilities, technologies and digital inclusion, along with mechanisms and guidance for accessing and providing peer support within stakeholder groups (such as people with disabilities, digital skills trainers, mainstream educators, and employers). The DICE project includes social media tools for discussion, sharing, uploading user-generated content and webinar hosting. It also addresses ad hoc peer support for students with visual impairment who are learning ICT skills, by providing a space that links people with disabilities to the information and support they need (DICE, 2014).

## **ICT FOR APPLIED LEARNING**

The IkaSlab project run by the Basque Centre for Research and Applied Innovation in VET (TKNIKA) integrates 3D printing as well as scanning and reverse-engineering technologies. The project develops knowledge in the area of 3D-printing technology, a cross-cutting technology that is widely applied in several sectors and digital workplaces. IkaSlab laboratories in vocational training centres, together with TKNIKA, have enabled the establishment of independent classrooms for all training courses at schools. The 3D-printing equipment has given students an opportunity to practise and experiment with its use in different projects. Students have acquired skills in the handling of the machines and they have developed knowledge of 3D-printing materials and their applications. They have also learned how to design parts for products using the technology and how to combine 3D printing with scanning and reverse engineering.

# Resources

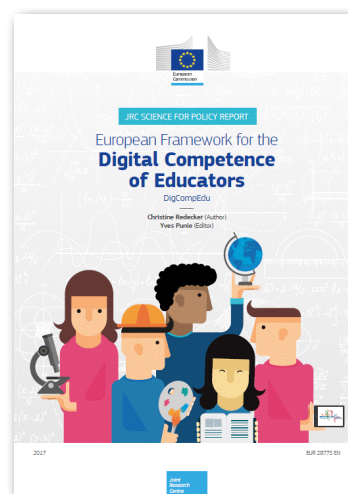
The following section offers resources to use when adopting ICT in education and training.

## SELECTED RESOURCES AND TOOLS FOR INSTITUTIONS

### European Framework for the Digital Competence of Educators (DigCompEdu) © 2017

The DigCompEdu framework is aimed at educators in all levels of education, from early childhood to higher and adult education, including general and vocational education and training, special needs education, and non-formal learning contexts. It aims to provide a general reference framework for developers of digital competence models.

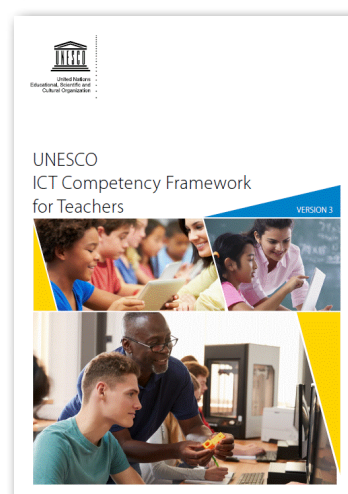
[ec.europa.eu/jrc/en/digcompedu](http://ec.europa.eu/jrc/en/digcompedu)



### UNESCO ICT Competency Framework for Teachers (Version 3) © 2018

The UNESCO ICT Competency Framework for Teachers guides pre- and in-service teacher training on the use of ICTs across the education system. The framework is intended to be adapted to support national and institutional goals by providing an up-to-date framework for policy development and capacity-building in this dynamic area.

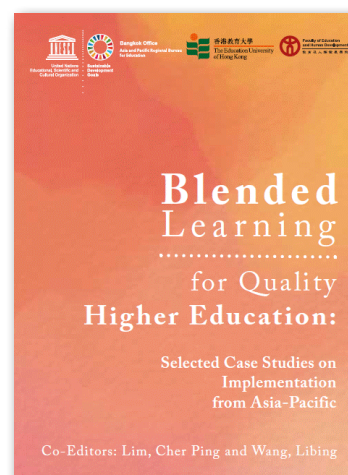
[unesdoc.unesco.org/ark:/48223/pf0000265721](http://unesdoc.unesco.org/ark:/48223/pf0000265721)



### UNESCO-SFIT Institutional Self-assessment © 2017

The online self-assessment tool is targeted at higher education institutions and aims to enhance their understanding and approaches for blended learning and to promote the quality of higher education. The tool, which is currently designed for use in Asia-Pacific, is adapted to higher education contexts, but it can still be useful for institutions that offer higher TVET.

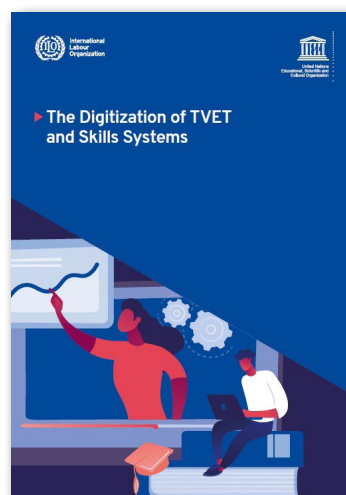
[unesdoc.unesco.org/ark:/48223/pf0000246851\\_eng](http://unesdoc.unesco.org/ark:/48223/pf0000246851_eng)



## ILO Digitization of TVET and Skills Systems 2020

The resource provides a global, high-level snapshot of the digitalization of TVET and skills systems in a set of countries and international organizations. It provides insights into TVET and skills systems several countries of the world as well as the views of the labour market and representatives from global organizations.

[ilo.org/wcmsp5/groups/public/---ed\\_emp/---emp\\_ent/documents/publication/wcms\\_752213.pdf](https://ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_752213.pdf)



## SELECTED DIGITAL RESOURCES AND REFERENCES FOR TEACHERS

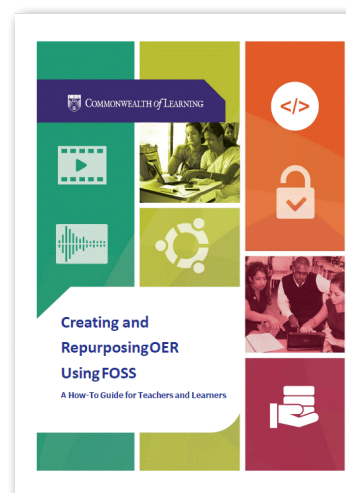
### Title: Creating and Repurposing OER Using FOSS

#### Description

The toolkit has been developed by IT for Change, an organization working with teachers and school systems to support the use of free and open-source software (FOSS) for the creation of open education resources (OERs). It aims to promote the creation, revision, publishing and adoption of OERs around the world. One way to do this is to make more digital tools available for people to use, create, revise and publish OERs.

**Published/Created by:** Commonwealth of Learning (2017)  
Available at [oasis.col.org](https://oasis.col.org)

**Format:** PDF (creative commons)



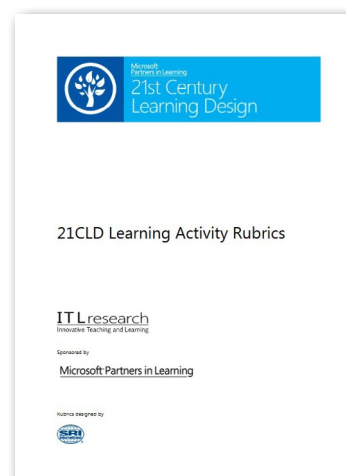
### Title: 21 Century Learning Activity Rubrics

#### Description

The 21st Century Learning Design Rubrics aims to help educators to identify and understand the opportunities that learning activities can give students to build skills for the twenty-first century. The rubrics were developed and tested internationally for the Innovative Teaching and Learning Research project. The guide describes six rubrics for learning in the twenty-first century, each of which represents an important skill for students to develop.

**Published/Created by:** ITL Research by SRI, sponsored by Microsoft Partners in Learning  
Available at [fcl.eun.org/tool5p2](https://fcl.eun.org/tool5p2)

**Format:** PDF (creative commons)



**Title: Training Programme on Interactive Whiteboards for VET Teachers**

**Description**

The manual is one of the results (Deliverable 9) of the EU project 'Supporting Continuous Professional Development of VET Teachers in the Use of Interactive Whiteboards (IWBs)'. As part of the project, the document shares good practices for the delivery of training on IWBs in TVET in Ireland, the training of teachers so that they can acquire the competencies needed to design educational resources suitable for use with IWBs, and the integration of these resources into everyday teaching activities. The manual was developed based on the EU's SmartTeach project and teachers' contributions.

**Published/Created by:** European Commission Lifelong Learning Programme with collaboration from various partners  
Available at [smartvet.weebly.com/uploads/1/6/1/7/16174838/smartvet\\_training\\_programme\\_final.pdf](http://smartvet.weebly.com/uploads/1/6/1/7/16174838/smartvet_training_programme_final.pdf)  
**Format:** PDF

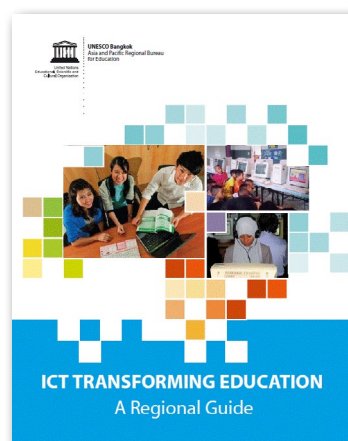


**Title: ICT Transforming Education. A Regional Guide**

**Description**

The guide provides a comprehensive overview of the types of technologies that are included in ICT, the impact of ICTs on schools, on teaching and on learning, and how ICTs have changed the world of work and life. It also explains models and frameworks that make it easier to navigate ICTs in education, and presents tools and resources that show the continuing developments in ICTs, how they are changing the learning environment, and how educators are responding in ways that transform classroom and school practices.

**Published/Created by:** UNESCO 2010  
Available at [unesdoc.unesco.org/images/0018/001892/189216e.pdf](http://unesdoc.unesco.org/images/0018/001892/189216e.pdf)  
**Format:** PDF

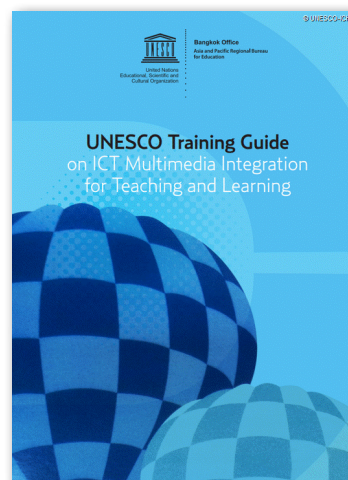


**Title: UNESCO Training Guide on ICT Multimedia Integration for Teaching and Learning**

**Description**

The guide helps educators and trainers to conduct teacher-training workshops on the application of educational resources for ICT-integrated teaching and learning. The UNESCO Training Guide on ICT Multimedia Integration also comes with free CDs.

**Published/Created by:** UNESCO 2013  
Available at [en.ichei.org/2013/12/31/unesco-training-guide-on-ict-multimedia-integration-for-teaching-and-learning/](http://en.ichei.org/2013/12/31/unesco-training-guide-on-ict-multimedia-integration-for-teaching-and-learning/)  
**Format:** PDF



## KNOWLEDGE MANAGEMENT PLATFORMS IN TVET

### Global Public-Private Knowledge Sharing Platform on Skills for Employment

Instigated by the International Labour Organization (ILO), the Global Public-Private Knowledge Sharing Platform on Skills for Employment is a collaboration between the ILO, OECD, UNESCO and the World Bank. The platform promotes information exchange focusing on evidenced-based research and documented experience on the specific issue of skills development for employment.

[www.skillsforemployment.org/](http://www.skillsforemployment.org/)

### VOCEDplus

Produced by the National Centre for Vocational Education Research (NCVER) in Australia, VOCEDplus is a free international research database for tertiary education, especially as it relates to workforce needs, skills development and social inclusion. It encompasses TVET, higher education, adult and community education, informal learning, and TVET in schools. The database is international in scope and contains over 70,000 English-language records, many with links to full text documents.

<http://www.voced.edu.au>

### Excellence Gateway: Development and Innovation in TVET

This portal brings together examples of innovative practices in the design and delivery of TVET based on the experience and insights of over 40 employer-provider partnerships. It features case studies, reports and videos demonstrating key aspects of effective and innovative employer-provider partnerships.

<http://tvet.excellencegateway.org.uk>

### SEA-VET

The database showcases good TVET practices that have been successfully implemented in Southeast Asia.

[sea-vet.net/](http://sea-vet.net/)

### Vocational Information Centre

Resources on this page include links to general information about vocational education, career and technical education, and workforce preparation. It also offers resources on the history of vocational education, current legislation, statistics, lists of associations and organizations, and vocational teacher preparation programmes.

[www.khake.com/page50.html](http://www.khake.com/page50.html)

### Creative Commons Hong Kong

Creative Commons Hong Kong works with Creative Commons International to localize and promote the use of Creative Commons licences in Hong Kong. The website provides a platform for the development, sharing and promotion of CC-licensed material. TVET teachers can share their own learning and teaching resources and they can use and adapt other materials freely, easily and legally.

[hk.creativecommons.org](http://hk.creativecommons.org)

### OER Commons

OER Commons is a free online library that allows teachers and others to search and discover OERs and other free instructional materials.

[www.oercommons.org](http://www.oercommons.org)

### JISC

JISC supports post-16 and higher education and research by providing relevant and useful advice, digital resources, and networking and technology services, while also researching and developing new technologies and ways of working.

[www.jisc.ac.uk/](http://www.jisc.ac.uk/)

### MERLOT

MERLOT (Multimedia Education Resource for Learning and Online Teaching) is an online repository and international consortium of higher education institutions (and systems), industry partners, professional organizations and individuals. It is a community of staff, volunteers and members who work to provide users of OER materials with services and functions that can enhance their instructional experience.

[www.merlot.org/](http://www.merlot.org/)

### Oasis, Commonwealth of Learning

This is an open-access repository of the Commonwealth of Learning (COL) where OER materials (including those for TVET) can be freely downloaded for reuse and adaptation under Creative Commons Licensing.

[oasis.col.org/handle/11599/2402](http://oasis.col.org/handle/11599/2402)

### GCFLearnFree

GCFLearnFree is a free online educational website focusing on technology, job training, and reading and math skills.

[www.gcflearnfree.org](http://www.gcflearnfree.org)

### **Saylor Academy**

Saylor Academy offers open online course materials at the college and professional levels. All course content in Saylor Academy is licensed under CC BY 3.0, which allows licensees to copy, distribute, display and perform the work and make derivative works and remixes based on it, provided that they give the author or licensor appropriate credit.

[learn.saylor.org](http://learn.saylor.org)

### **Art Contests for Everyone**

This is a database of art contests and exhibitions. Teacher lesson plans, assessments and free clip arts are also available.

[www.incredibleart.org](http://www.incredibleart.org)

## **PROFESSIONAL DEVELOPMENT PROGRAMMES FOR TVET TEACHERS**

### **The Foundation Online Learning**

The website is designed for educators and trainers in the United Kingdom. It gives support to educators and trainers, especially those in further and vocational education and training, to improve their organizational performance and learning delivery.

[www.foundationonline.org.uk](http://www.foundationonline.org.uk)

### **The Australian Apprenticeships Ambassadors Programme**

The programme recruits prominent figures and high-performing former apprentices as ambassadors. It organizes events and business forums where ambassadors showcase the apprenticeship system. An online platform increases the programme's outreach, sharing success stories about former apprentices and enabling the public to invite ambassadors to their local events.

[www.australianapprenticeships.gov.au/](http://www.australianapprenticeships.gov.au/)

### **Vietnamese-German Programme 'Reform of TVET in Viet Nam'**

The objective of the bilateral development cooperation between Germany and Viet Nam in the TVET sector is to increase the provision of trained, qualified workers who can meet the needs of the economy. In the programme, TVET teachers and instructors obtain competencies for practice-oriented training through capacity development measures. Advisory services are provided to the

management staff of partner TVET institutes to enable them to ensure that training programmes are demand-oriented.

[www.tvet-vietnam.org/en/topic/39.tvet-in-vietnam.html](http://www.tvet-vietnam.org/en/topic/39.tvet-in-vietnam.html)

### **SEAMEO VOCTECH Training Programmes**

The SEAMEO Regional Centre for Vocational and Technical Education and Training (SEAMEO VOCTECH) is committed to enhancing the TVET systems of SEAMEO member countries. Regional, in-country and customized training programmes are designed to meet the needs of SEAMEO member countries to upgrade the competencies of their TVET practitioners.

[www.voctech.org/Programmes/InCountry.html](http://www.voctech.org/Programmes/InCountry.html)

### **INVEST Community Learning Network**

The Commonwealth of Learning (COL) is working in partnership with the Commonwealth Association of Polytechnics in Africa (CAPA) to support CAPA member institutions who are working to integrate ICT into TVET teaching and learning through the Innovation in Vocational Education & Skills Training (INVEST) initiative.

[www.col.org/news/news/investing-tvet-africa](http://www.col.org/news/news/investing-tvet-africa)

## **MOOCs**

### **VTC MOOC**

The Vocational Training Council is the largest vocational and professional education and training provider in Hong Kong. Drawing strength from the breadth of programmes offered by the council's member institutions and the wide range of accredited qualifications, this MOOC site aims to promote flexible lifelong learning in TVET and support continuing professional development for the council's alumni.

[mooc.vtc.edu.hk](http://mooc.vtc.edu.hk)

### **China University MOOC Vocational Training Channel)**

Supported by Ministry of Education of the People's Republic of China and NetEase Inc., China University MOOC (icourse163.org) is a leading MOOC platform in China. The site features a Vocational Training Channel that offers MOOC courses specifically designed for TVET.

[www.icourse163.org/vemooc](http://www.icourse163.org/vemooc)

### **OpenLearning**

OpenLearning is a MOOC platform that allows anyone, including TVET teachers, to create, run, teach and enrol in a course (free or private).

[www.openlearning.com/courses/type/professionaldevelopment](http://www.openlearning.com/courses/type/professionaldevelopment)

### **ALISON**

The Alison platform provides free online interactive education to help people to acquire basic workplace skills. The platform offers over 400 vocational courses at the certificate level (1 to 2 hours of study) or diploma level (about 9 to 11 hours of study).

[alison.com](http://alison.com)

### **University4Industry**

University4Industry is an online education platform that offers courses on new industrial technologies. Aiming to help solve critical skill gaps for industry, the platform highlights practical knowledge and the use of real-world examples.

[www.university4industry.com](http://www.university4industry.com)

## **LEARNING MANAGEMENT SYSTEMS**

### **Mahara**

Mahara is a stand-alone system that can be integrated into a wider virtual learning framework. Mahara's architecture is inspired by the modular, extensible architecture of Moodle. It provides a file repository and other features that allow for self-management. Mahara hosts an e-portfolio system, which is a web-based application to support personalized electronic portfolio building to collect and share online reflections and digital artefacts. Mahara also offers space for collaboration and customized learning. Learners and staff can use the e-portfolio system to demonstrate their learning, skills and development, and record their achievements over time.

[mahara.org](http://mahara.org)

### **Moodle**

Moodle is a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create learner-centric tools and collaborative learning environments.

[moodle.org](http://moodle.org)

# Guidance for teacher professional development

The variance in systems to develop TVET teachers, together with the recruitment of general education teachers to deliver TVET, can influence the degree to which TVET teachers are able to develop competencies to integrate ICTs into their lesson plans. International frameworks help to guide teacher education in many countries. Many of these frameworks also contain areas to incorporate competencies that support the adoption of ICTs.

## ISTE Standards for teacher

The International Society for Technology in Education (ISTE) in the US, which is a global benchmark in the field, has identified [seven key sets of competency standards for teachers using ICT in education](#). Four of the sets focus on student learning:

- To facilitate and inspire student learning creativity
- To design and develop digital age learning experiences and assessment
- To model digital age work and learning
- Promote and model digital citizenship

The standards also focus on engagement in professional growth and leadership. Each set of standards includes detailed indicators that provide guidelines for teachers to assess their competencies in the use of ICTs in education and determine which competencies they need to improve.

## UNESCO ICT Competency Framework for Teachers

The ICT Competency Framework for Teachers (ICT CFT) Version 3 is a tool to guide pre- and in- service teacher training on the use of ICTs across the education system. It is intended to be adapted and contextualized to support national and institutional goals. The target audience is teacher-training personnel, educational experts, policy-makers, teacher support personnel and other professional development providers. The framework addresses six aspects of a teacher's professional practice:

- Understanding policy on the use of ICTs in education
- Curriculum and assessment
- Pedagogy
- Application of digital skills
- Organization and administration
- Teacher Professional Learning

The ICT CFT is organized into three successive stages or levels of a teacher's development in making pedagogical use of ICTs: knowledge acquisition, knowledge deepening and knowledge creation.

## TPACK framework

Technological Pedagogical Content Knowledge (TPACK) is a framework that is used to identify the knowledge that teachers should acquire to teach effectively with ICTs. The core components of the framework are content knowledge, pedagogy knowledge and technology knowledge. TPACK also focuses on the intersections of the three core components, which identify the four knowledge bases that teachers need in order to integrate technologies into their teaching: pedagogical content knowledge, technological content knowledge, technological pedagogical knowledge, and the intersection of all three circles: Technological Pedagogical Content Knowledge (TPACK). The framework demonstrates that the effective integration of technology requires teachers to have an understanding of the dynamic relationships between the three components in different educational contexts. Teachers are expected to have an understanding of:

- Concepts involved in the use of technologies
- Instructional approaches to construct content knowledge with technology
- How technology can help to deal with problems
- Students' prior knowledge and theories of epistemology
- Using technologies to develop new epistemologies or reinforce old ones (Mansbach, 2015)

## Digital Competency Framework for Educators at European level

A Digital Competence Framework for Educators at European level (DigCompEdu) has been developed with the aim of reinforcing national and/or regional initiatives by providing a common understanding of educators' digital competence needs. The objective of DigCompEdu is to identify and describe the key components of educators' digital competence and to provide an instrument for self-assessment, based on research and stakeholder consultation. The DigCompEdu framework is aimed at educators in all levels of education, from early childhood to higher and adult education, including general and vocational training, special needs education, and non-formal learning contexts.

# Practice worksheets

## Worksheet 1 – Understanding ICTs and digital technology

- Matching the learning approach to digital tools
- Rating the challenges and opportunities in integrating ICTs

## Worksheet 2 – Enhancing pedagogy with ICTs

- Reflections on your preferences of instructional tools to construct learning activities

## Worksheets 3a, 3b, 3c and 3d – Integrating ICTs in teaching

- Designing a learning plan, a training plan and an instructional strategy with ICTs
- Reflections on your own adoption of ICTs

### Practice worksheet 1

Using the examples, list the items that are:

#### 1 Digital tools for learning

#### 2 Digital tools for collaboration

#### 3 Digital tools for searching and managing information

- Computer
- Presentation application
- Digital camera
- Video camera
- Digital recorder
- Graphics
- Mobile phone
- Internet
- Games and simulations
- Webcam
- Virtual reality
- Projector
- Calculation software
- Blogs
- Desktop publishing
- Audio/Video
- Templates/Forms
- Web authoring
- Cloud, storage
- e-Portfolio
- Podcast
- Social media

Notes:

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### Practice worksheet 2

Design an instructional strategy to develop critical thinking skills with the aid of technology. Identify the activities, the specific purpose, and the free online tools recommended for use:

Digital literacy	Low	Moderate	High
Pedagogical readiness	Low	Moderate	High
Access to quality resources	Low	Moderate	High
Self-motivation	Low	Moderate	High
Curriculum demand	Low	Moderate	High
Prior learning of learner	Low	Moderate	High
Student engagement	Low	Moderate	High
Institutional support	Low	Moderate	High
Technical readiness	Low	Moderate	High

Notes:

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### Practice worksheet 3a

Based on your learnings from Section xx, reflect on your own practice and choices when using online tools to aid instruction. Write down the most common activities that you use in the classroom, the purpose of the activities with respect to the learning objectives, your preferred online tools and your reasons for using them.

Activities	Purpose	What are your preferred online tools and why?

### Practice worksheet 3b

Design a learning plan or teaching strategy with the following information. Try to identify the tasks where technology can be used effectively to support teaching and learning processes.

#### Lesson planning

Area/subject:

<b>Learning outcome</b> <i>At the end of the lesson, students will be able to...</i>	<b>Content</b> <i>What is the content of the lesson?</i>	<b>Activities</b> <i>Teachers/students will do the following...</i>	<b>Resources</b> <i>The following digital/electronic/technology resources will be used:</i>	<b>Assessment</b> <i>How are students going to be assessed?</i>

#### Training plan<sup>1</sup>

Qualification:

Units of competency:

<b>Purpose</b> <i>The objective of delivering the unit(s) of competency for what qualification...</i>	<b>Preparation</b> <i>The prerequisites for the training are...</i>	<b>Resources/ Materials</b> <i>The following digital/ electronic/ technology resources will be used... The following technical facility will be needed...</i>	<b>Procedure/Tasks</b> <i>How the training will proceed? What knowledge needs to be taught and what skills need to be developed...</i>	<b>Evaluation/ Assessment</b> <i>What evaluation/ assessment tools will be used?</i>

<sup>1</sup> Adapted from Northern Melbourne Institute of TAFE/Commonwealth of Australia (2005)

Notes:

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### Practice worksheet 3c

Design an instructional strategy to develop critical thinking skills with the aid of technology. Identify the activities, the specific purpose, and the free online tools recommended for use:

Instructional strategy for: \_\_\_\_\_

Activities: \_\_\_\_\_

Learning objectives: \_\_\_\_\_

Recommended tools: \_\_\_\_\_

Notes:

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### Practice worksheet 3d

Using the learnings in Section xx and the indicators for the integration of ICTs, reflect in detail on your own teaching practice to understand your current strengths, needs and potential.

Stages of ICT application	Scope of ICT use by TVET teachers	Some examples of the practical use of ICTs	Outcomes (for TVET teachers)	Resources available in the school/institution	Limitations
Emerging					
Applying					
Infusing					
Transforming					

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Technology has altered many aspects of life, including education and training. As a result of technological developments, technical and vocational education and training (TVET) has become more accessible to students, and the quality of education and training has improved too. Teachers and trainers can use digital tools to manage their tasks effectively and engage learners in digital rich environments. Learners can also use technology to learn new skills and to collaborate and interact with teachers and trainers.

The COVID-19 pandemic has however underlined the current difficulties in effectively integrating technologies in the delivery of education and training. Institutions need to make constant assessments of their capacity and readiness to provide technology-rich environment for learning. At the same time, teachers' and trainers' readiness is also of particular importance to adopt appropriate pedagogic approaches with technology.

This practical guide addresses institutions and teachers and trainers. It helps TVET institutions to understand the organizational plans to build up their capacity to stimulate digital learning. It also guides teachers that want to develop their competencies, improve their pedagogical strategies with use of technology, and learn from existing practice. By showing how technology is used in an integrated instruction model and providing helpful resources, this guide helps teachers and trainers to effectively plan their own tasks and delivery of instruction with the right technology tools.

