

TVET AND DIGITALIZATION

TVET Academy



## Conference "Digitalization and TVET"

08 September and 19 October 2021

International Conference on  
Digitalization in Vocational Education  
and Training



On behalf of



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# International Conference on Digitalization in Vocational Education and Training on 08 September and 19 October 2021

The joint event organized by GIZ, UNESCO-UNEVOC, the ILO, the Asian Development Bank and the Swiss Federal Institute for Vocational Education and

Training provides a platform for exchange, knowledge transfer and networking. The core questions which will be addressed are: How does the digitalization of work processes affect vocational education and training and its management? What does it mean for the competence development of vocational education and training professionals?

On the basis of case descriptions, participants receive **recommendations for the up-to-date training of teachers in vocational education and training and for strategies to prepare vocational education and training institutions for the requirements of a digitized working world**

## Virtual International Conference and Workshops on

“Digitalization and TVET”

Requirements and Approaches for Competence Development of TVET Personnel in International and Development Cooperation

### Day 1 – Conference Programme

8th September 2021

08:00 – 11:30 GMT+2 (Amsterdam, Berlin, Rome)

Moderation: Ulrike Schmidt, GIZ TVET Academy

#### Setting the Scene:

#### **Digitalization and TVET Teacher Training – Requirements and Profiles**

Harry Stolte, GIZ TVET Academy

#### Opening

#### **TVET teachers in the time of digitalization: challenges and opportunities**

Soo-Hyang Choi, Director UNESCO-UNEVOC

#### **Digitalization and labor market developments: What are the needs of industry?**

Brajesh Panth, Chief of Education Sector Group, Asian Development Bank

## **Adaption of TVET pedagogies to digitalization: How to be acquired in pre- and in-service training of TVET teachers?**

Srinivas Baki Reddy, Chief Skills and Employability Branch, ILO

### **Keynotes**

#### **Changes in industrial sectors due to digitalization and the disruption of traditional vertical organizations - consequences for “white and blue collar” workers**

Thomas Leubner, Head of Siemens Professional Education, Siemens AG

#### **Digital developments and changes in the competencies of skilled workers in selected economic sectors**

Guru Mallikarjuna, Managing Director, Bosch Vietnam Co. Ltd.

#### **Requirements for teachers in vocational education due to digitalization in selected industries and their need for "digital competences"**

Francesca Amenduni, Senior Researcher and Mrs. Chiara Antonietti, Junior Researcher,  
Swiss Federal University for Vocational Education and Training

### **Panel Discussion**

Moderation: Guido Lotz

#### **The following questions will be discussed based on the overall discussion on the impact of a changing world of work and labor market:**

- How should TVET teachers be trained in the digital age?
- Is there a need to adapt curricula and training contents – which processes would support that?
- Are didactical concepts and training methods available which respond to the changing competence requirements caused by digitalization?
- Which role do digital resources play in the process of modernizing TVET?
- Do new cooperation mechanisms in terms of learning and training venues become more relevant because of digitalization?

#### **Panelists:**

- Ralph Hippe, Learning and Employability Expert, CEDEFOP
- Wahid Razzali, Vice-Chancellor, University Tun Hussein Onn Malaysia (UTHM) Malaysia
- Lars Fiechel, Cluster Coordinator Skills Development, Ethiopia, GIZ
- Lisa Marie Kreibich, Social Sector Specialist, ADB
- Karine Sonigo, Skills Digitalization Specialist, Skills and Employability Branch, ILO

#### ➤ **Questions & Answers**

### **Summary and invitation to the workshops**

Guido Lotz

Harry Stolte

## Day 2: Workshop

19<sup>th</sup> of October 2021

### Workshop 1

#### **Occupational structures, training contents**

This session addresses the core issue of how to structure occupational profiles and standards considering the massive changes in the world of work as well as changes in production and business processes by digitalization. Selected examples will reveal the processes and mechanisms behind the adaptation of curricula.

### Workshop 2

#### **Digital resources, media, tools, platforms**

Digitalization and the discussion about digital resources, media, tools and platforms belong closely together. Chances are that the challenge posed by digitalization can partly be solved by creating those digital resources media, tools, platforms and making them available. This session will provide with insights into good practices of e-learning up to the use of virtual reality in training processes.

### Workshop 3

#### **Training processes, didactical concepts, methods, cooperation mechanisms, multiple learning venues**

How to shape didactical concepts and training processes, methods of learning cooperation and other approaches to learning and training in TVET addressing competence requirements resulting from digitalization is a deeply discussed issue without clear answers. The shaping of learning processes depends on the didactical concepts and methods of learning. This session seeks to find answers on how to shape TVET teaching and learning processes addressing competence requirements that result from digitalization.

## Background Paper

# “Digitalization and TVET”: Requirements and Ap- proaches for Competence Development of TVET per- sonnel (Managing Staff and Teaching Staff) in Interna- tional and Development Co- operation

Digitalization transforms economies and societies and triggers new policy challenges. Information and Communication Technologies (ICT), Artificial Intelligence (AI) and robotics are profoundly changing the world of work and the way people work and interact with one another.

The preparedness of countries to seize the benefits of digital transformation is largely dependent on the acceptance and on the skills of their workforce and the range of appropriate policies put in place, along with skills-related policies as a cornerstone (OECD, Skills Outlook 2019).

Digitalization is reshaping millions of jobs globally, with digital technologies widely used in the workplace. Changing ways of work organizations are supporting the transformation process.

Preparing learners for the rapidly changing digital world requires regular updates of curricula and training regulations to cover new skills and competences, as well as adjustments in the way these are taught. Accordingly, TVET teaching staff must be aware of new and evolving digital trends and tools and must also be able to effectively teach them to students, as they are preparing to enter the workforce of the future (UNESCO-UNEVOC).

Many teachers do not have the appropriate level of digital knowledge and digital skills. This has a direct impact on the potential of digitalized equipment in TVET to take root in curricula and classrooms.

Teachers’ digital knowledge and skills are a key limiting factor in the development of digitalization in TVET. Digitalizing TVET requires a broad range of professionals to be involved in its creation and shaping provision. It is necessary to overcome the domain of lone (even isolated) professionals attempting to provide high-quality digital TVET on their own because their efforts are unlikely to be effective or sustainable.

When implementing the national training programs offered to teachers, facilitators or supervisors, coordination and collaboration between the professionals working in the TVET sector must be ensured.

Didactical training on delivery, assessment, certification and work-process-based curriculum and continuous improvement of trainers needs to be established. Industry experience of teachers and trainers would help to develop vocational competences that are required by the industry. To ensure this, the training of TVET teachers and trainers must include the opportunity to gain experience in the industry.

The Covid pandemic created a global awareness of the need for digitalization and caused some upsurge in distance education approaches. At the same time, it became clear that due to the limitations of teachers in vocational education and related fields, there is a need to develop subject-related competences and implement appropriate approaches in the education and training of teachers.

Questions such as “What does it take to build high-quality TVET systems for an increasingly digitalized world of work?” were discussed in a GIZ Webinar in February 2021.

In one of the sessions aspects of demands of competence development of TVET personnel related to digitalization were intensively discussed.

A key outcome from this session was that unless there will be significant investments in the improvement of teacher quality, there will be no big payoff from integrating digital technology in TVET programs. A holistic approach that encompasses subject specific, vocational pedagogical, digital as well as transversal competences was seen as crucial.

In terms of the planned series of conferences/experts meetings and workshops, a holistic approach should encompass the “Change of Work” and

“Future Expectations”, the “Chances of Shaping of Work” and “Future Requirements for TVET” with a focus on the development of subject specific and broad competences. The broad competences cover vocational and transversal competences and competences in operating with digital media by taking existing diverse pre- and frame conditions in national and regional dimensions into account. These plans must not only consider economic developments but also make them the central object of competence development.

A special role is given to representatives and "practitioners" of the industry. Thereby it is ensured that recommendations for TVET teacher training are developed that will also find acceptance among those who employ skilled workers who are trained in TVET. Nevertheless, the theoretical requirements for TVET teacher training are not neglected.

It is a common understanding that further deepening of investigations and exchange of experiences seems to be relevant for identifying strategies and implementation approaches for learning and teaching to develop appropriate competences of TVET personnel as a key enabling factor for transformation of TVET towards digitalization of work, production, economy and society. Based on findings as described in expected outcomes below projects, clients and partners in international TVET cooperation can be served in defining and implementing appropriate approaches for capacity and competence development as well as in initiating peer networks, etc.

Against that background the GIZ TVET Academy, the Sector Programme TVET, and the Competence Center Education, Vocational Education and Labour Markets agreed to take the initiative to continue further activities together with partners of the international development cooperation and TVET community for an exchange of demands and consequences of digitalization on the development of competences of TVET personnel.

Asian Development Bank (ADB), International Labour Organization (ILO) and the Swiss Federal University for Vocational Education and Training (SFUVET) agreed to join this initiative and contribute as co-organizers in preparation and implementation of related events.

## Objectives

- Derivation of impacts in competence requirements of workforce in economy, production, work and business processes from digitalization
- Derivation of consequences in TVET teaching and management processes because of the changes in work and work organization caused by digitalization
- Clarification of competence requirements of teachers and trainers due to the changes in industry driven by digitalization
- Development of ideas and proposals for competence and capacity development for TVET personnel towards (pre- and in-service) education and training
- Initiation of exchange on existing approaches, developments and solutions regarding adjusting pre- and in-service training of TVET personnel with focus on digitalization

## Audience / Target Group

- Representatives / Staff of Development Agencies, Development Banks
- Stakeholder of TVET institutions, related organizations and authorities of partner countries
- Representatives of TVET projects
- Representatives of TVET teacher institutions
- Representatives of business sector
- Representatives from international organizations, e.g. UNESCO-UNEVOC, ADB, ILO

## Format / Structure

- Online Conference (Kick Off)
- Parallel online workshops
- Concluding session



## Expected Outcomes

- Recommendations for development of TVET teacher training in a digitalized world of work, appropriate to the demand of the business sector
- Distribution of collected didactical concepts of TVET teaching in a digitalized world of work
- Collection of materials for training and training concepts for the implementation of digitalization in TVET
- Case descriptions for best practice approaches and models of pre- and in-service TVET teacher training by consideration of digitalization
- Recommendations for pre- and in-service training approaches for TVET teachers
- Tool Box(es), Materials
- Recommendations for strategies for the support of lower developed countries in integration of digitalization in TVET and skills development

## Timeline

- Kick off: begin of September 2021 (September 8, 2021)
- Parallel Workshops: mid October 2021 (October 19, 2021)
- Session on Final Conclusion / Presentation of Recommendations (mid November / tentative)

## Kick-off Conference

Digitalization is a „software-driven technology“ with an impact on all business areas as well as on private and individual communication and collaboration. One of the main consequences for the industry is the change of work-processes and business-processes leading areas such as production processes towards completely changed work requirements. The consequences for the labor market and for education and training have not yet conclusively been clarified and are still under deep discussion. The focus on the different argumentations is at a higher level with the main interest to make relevant labor market trends visible. Answers for TVET are not yet considered in these discussions. Efforts have

to be initiated to identify the impact and the changes relevant for TVET-approaches in order to prepare the workers-to-be for the new framework of work in changing work environments.

## Core Questions

Based on the overall discussion of changes of work and labor market movements which have focused on TVET since several years, thoughts are now developed based on the following questions:

- How should TVET teachers be trained in the digital age?
- Is there a need to adapt curricula and training contents – which processes would support that?
- Are didactical concepts and training methods available which respond to the changing competence requirements caused by digitalization?
- Which role do digital resources play in the process of modernizing TVET?
- Do new cooperation mechanisms in terms of learning and training venues become more relevant of digitalization?

These questions underpin the need for fundamental work on different levels such as research, curriculum work, political units, media, companies, teacher training, management training in order to find convincing and sustainable answers for the direction of future TVET activities. The requirement to focus on a holistic concept of competence development needs to be specified to ensure the transfer to the working day routines of TVET staff in TVET institutions and companies. This leads to the question of how to develop appropriate competences of TVET teaching and management personnel.

# Setting the Scene

## “Megatrends to be addressed in TVET Teacher Training: Sustainability and Digitalization”

**Digitalization and TVET Teacher Training – Requirements and Profiles**  
Harry Stolte, GIZ TVET Academy

**Teachers are core actors in the support of quality in TVET**

**Digitalization and TVET Teacher Training – Requirements and Profiles**

Based on the megatrends

- sustainability and
- digitalization

It is stressed that the Congress is focusing on digitalization as it currently has an important impact on the societal and economic development and is particularly favorable to support sustainability. Teachers and in-company trainers are playing an important role as they must fulfill a multi-functional job:

- support of competence development
- they must support the development of technical and practical skills and competences of trainees.

The requirements for TVET staff can be summarized as follows:

- education, training, and development of TVET teachers and trainers has received too little attention (UNESCO)
- There are often no career paths encouraging people to become TVET teachers or trainers, either through pre- or in-service programmes (ILO).

Internationally mandated guidelines or standards specifically created for TVET training personnel do not exist. In general, there is a big variety for existing models, approaches, and trends in TVET teacher education worldwide.

In other words: Digitalization meets the TVET systems and their staff in an unprepared situation. This requires initiatives for pre- and in-service teacher training programs and management training oriented to internationally recognized standards. The starting point is the identification of teachers' quality based on the occupational structure of industry and the movement of the society.

Establishment of pre- and in-service training

Competences for a digitalized world

Internationally comparable and recognizable standards

All teachers have to be up-skilled

### TVET

- ❖ is crucial for fostering an economically productive labour force – but also for employment and social cohesion
- ❖ has the potential to support progress and transform societies
- ❖ is the engine of economic development and international competitiveness (EU)

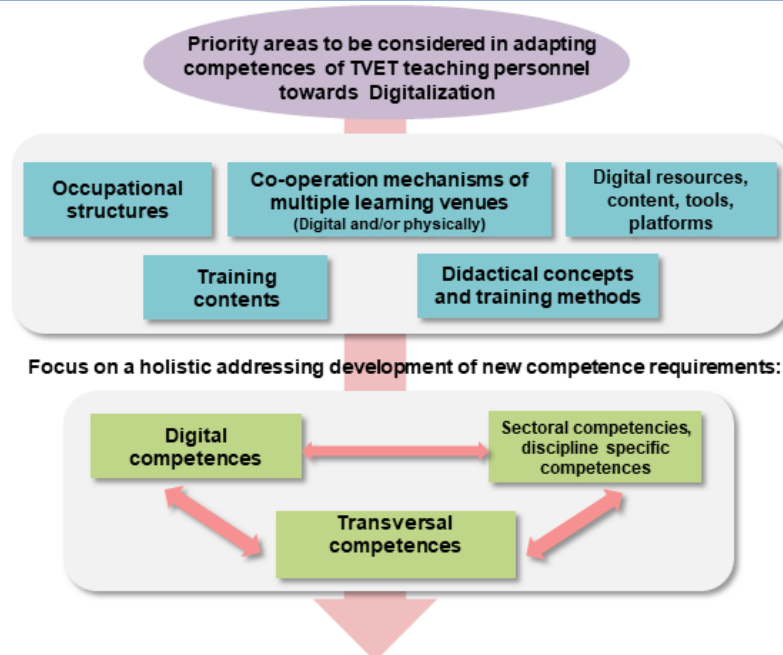
### TVET Teachers & In-Company Trainers

- ❖ have a multi-faced role requiring combined (vocational) pedagogical, technical and practical skills and competences
- ❖ are central elements for performance, effectiveness and quality of TVET for generating qualified and skilled workers

### CHALLENGES

- ❖ is worldwide facing rapid changes – in particular because of
  - increasing complexity of work processes
  - rapid technological changes
- both closely linked with and resulting from Digitalization

- ❖ Education, training & development of TVET Teachers and Trainers has frequently received too little attention (UNESCO)
- ❖ often, there are no career paths for becoming a TVET teacher or trainer, either through pre- or in-service programs (ILO)
- ❖ internationally mandated guidelines specifically created for TVET teaching personnel do not exist



# „Transfer into pre- and in-service programmes of TVET teacher education and training oriented on international recognized standards“

DIGITALIZATION and TVET  
Requirements and Approaches for TVET Personnel in International and Development Cooperation



## Megatrends

to be addressed in TVET Teacher Training:

- ❖ Sustainability
- ❖ Digitalization



**There is no correlation between investment in technology and student achievement**  
(OECD, Schleicher 2015)



**We won't see a big payoff from technology - unless we make big investments in teacher quality**  
(Tucker, 2016)

## “...to combine a holistic and humanistic approach by integrating the voices of TVET staff”

### **TVET teachers in the time of digitalization: challenges and opportunities**

Soo-Hyang Choi, Director of UNESCO-UNEVOC, International Centre for TVET

First of all, allow me to thank the GIZ TVET Academy and its partners for organizing this virtual conference on digitalization and TVET, especially devoted to the issues of TVET staff; and thank you for inviting UNESCO-UNEVOC to participate in this event.

Digitalization is speeding up labour market change, requiring young people to have digital skills and intelligence. They must understand digital risks as well as opportunities and TVET staff are expected to adjust quickly. TVET responsiveness to labour market demand is partly what makes it so valuable.

Digitalization is both challenging TVET provision while also emphasizing why it is so important. The digital challenges facing TVET staff, in particular teachers and trainers are plentiful. Delivering remotely is a challenge for all teachers, but it is particularly daunting for TVET teachers, who will have to rely more and more on a digital means to deliver an education of which the core process lies in practice, or hands-on experience.

According to a report by ILO, in order to provide high-quality digital TVET, we need an *instructional designer*, who lays out the overall learning pathways combining school- and work-based learning and also incorporating distance and simulation-based learning experiences for the students.

There also has to be a teacher who will facilitate the student’s interpretation of information that will be available freely and obtained through multiple sources.

Future TVET institutions also need their staff to deal with special technologies such as AI, VR, and

AR, to name a few, both as a means of delivery and as content. Last but not least, anyone teaching TVET must know how to translate the students’ overall hybrid learning plans and processes into corresponding assessment tools, which is always challenging. The list of roles expected of TVET staff in a digital age can go on to include other roles. Students learning remotely need more emotional and social support.

Many TVET teachers are used to providing vocational counselling. They now have to go one-step further to address the students’ emotional and social wellbeing as well. In the best circumstances, a TVET institution may have the resources to recruit and retain different categories of professionals catering to these various aspects of a digitalized teaching environment. In places with less resources, the division of work will be out of the question and one teacher will struggle, in vain, with all these different roles.

The mounting challenges will eventually contribute to a widened digital gap. More importantly, with digitalization, some professions in the labour market will eventually be phased out, as we all know. TVET teachers specialized in the skills on the declining path are at risk of losing their own jobs. The job security issue of TVET teaching staff is not new. Even in many OECD countries, a large portion of TVET teachers do not have a permanent job status. This situation will be exasperated by digitalization. TVET teachers remain as vulnerable to the evolving job market as their students are.

When we talk about teachers, we are, first and foremost, talking about human beings, not some sort of a mechanism generating an educational process. Nor are teachers a system that can be maintained and upgraded externally for better operation. TVET teachers, facing multiple challenges, need time to digest the swirling environment of their profession and support to rise above them. Are we providing them with enough support and guidance? The answer seems to be “not quite,” or “not yet” at best. According to a survey conducted by Education International, teachers are reporting an increased workload and technological stress. They may not be consulted about the technologies to be introduced, let alone trained for the use of them; and policy

documents often do not address issues of staff well-being.

UNESCO recommends that to support teachers in a crisis, there has to be a collection of precise data on their needs. Without data, no serious policy and systemic support can be devised. Second, teachers need a platform to share their needs and experiences as well as resources. Third, the absolute need to care for their professional development and support should not be ignored.

UNESCO-UNEVOC provides a platform for exchange across TVET providers and practitioners globally. We actively support TVET staff through our Leadership programme. We facilitate practitioners' discussion through our Bridging Innovation and Learning in TVET project. We support collaboration and peer learning through our global UNEVOC Network. In all of our work at UNESCO-UNEVOC we try to combine a holistic and humanistic approach by integrating the voices of TVET staff.

Thank you and I wish you a successful conference.

to combine a holistic and humanistic approach by integrating the voices of TVET staff

Need of a platform for access to exchange of knowledge and experience

Capacity development towards change demands resulting from Digitalization

Collection of precise data on the needs of TVET Teachers

“Instructional Designer Needed”



Source: <https://unevoc.unesco.org/home/>

# Opening

## „... Holistic picture of TVET“

### Digitalization and labor market developments: What are the needs of industry?

Brajesh Panth, Chief of Education Sector Group,  
Asian Development Bank

TVET was presented as a “holistic unity” with numerous elements leading to the fact that TVET-trained persons have a considerable impact on the productivity of industry. And not only that: TVET exerts a considerable impact on

- skill and
- socio-economic development

and is a major catalyst of digitalization.

The target of TVET must be the development from low-skill to high-skill equilibrium. This ensures a lifecycle approach and skills pathways with different entry and exit options.

A smaller share of the workforce is well-qualified and has a lower risk for employment and income. To move up to high-skill equilibrium, education and skill development must be rethought. A “Two Pronged Strategy” will be followed:

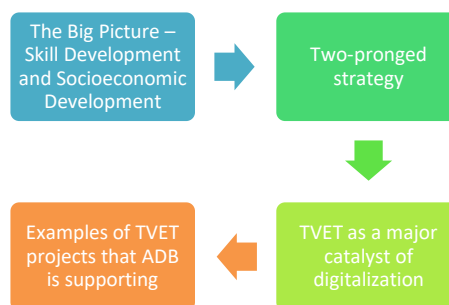
- ensuring a very good quality of school education as a fundament for skill development and life-long-learning,
- moving from low-skill equilibrium to high-skill equilibrium.



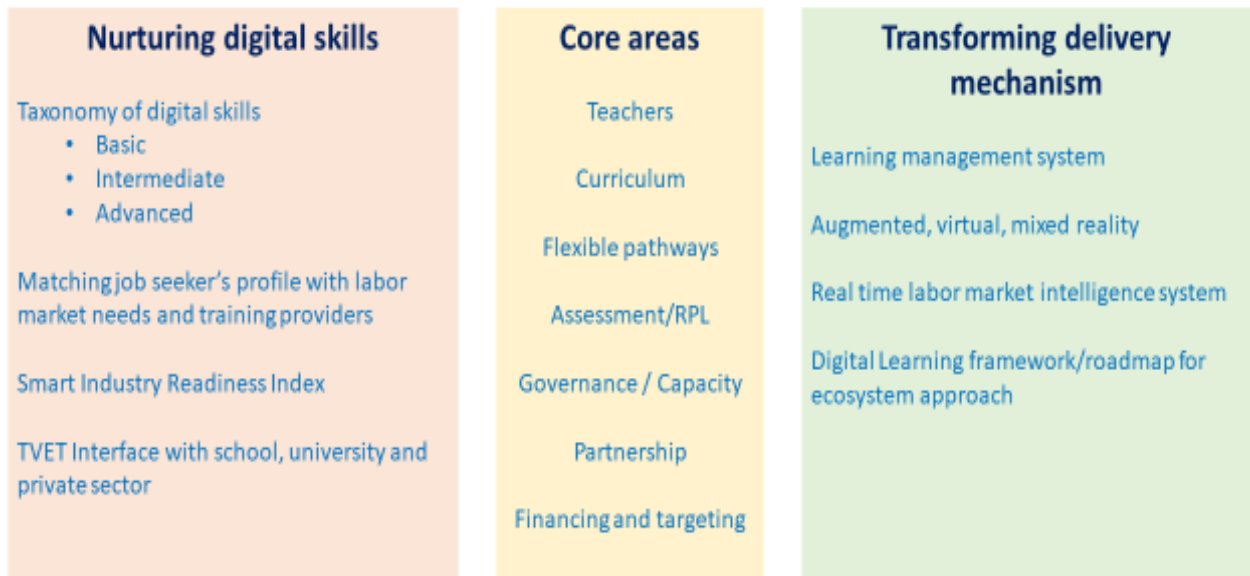
A high quality of school education is an important foundation for successful competence development processes in TVET. In the TVET system, qualified teachers, curricula, flexible pathways, assessment, financing and partnership with industry are important parameters for quality-oriented development of competences. To support 21<sup>st</sup>-century skills including digital skills makes it necessary to work with cross-sectoral approaches, adaptive learning technology, home learning and support by research. This includes learning management systems, augmented, virtual and mixed reality and real time systems. A roadmap for an ecosystem approach which includes digitalization and digital learning is needed.

### Rethinking capacity development,

- Digital learning framework/ roadmap,
- strengthening in-company training,
- ecosystem approach and multisectoral activities.



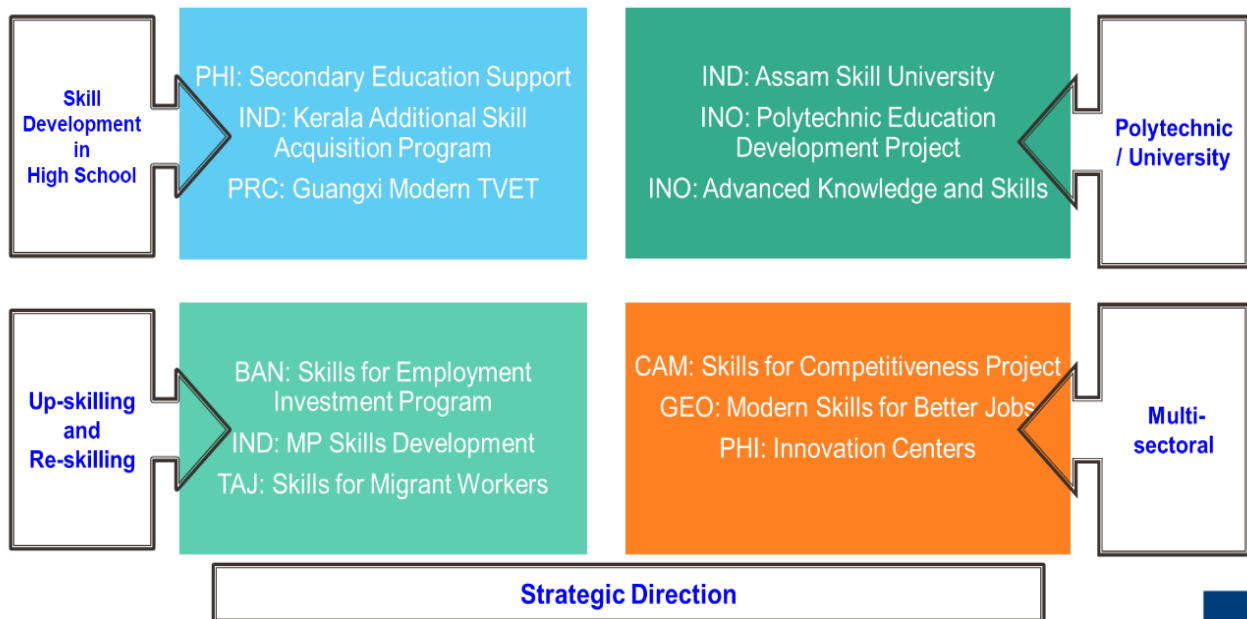
## TVET as a Major Catalyst of Digitalization



5



## Examples of Innovative Approaches



6





## Opening

### “... Pre- and in-service training for new roles of teaching staff.”

#### **Adaption of TVET pedagogies to digitalization: How to be acquired in pre- and in-service training of TVET teachers?**

Srinivas Baki Reddy, Chief Skills and Employability Branch, ILO

Due to digitalization and the pandemic, pedagogical shifts are going on:

- ubiquitous blended learning approach
- wide range of platforms and tools (EdTech) for design, delivery, assessment and management of learning:
  - student management systems
  - learning management systems
  - digital content authoring and publication
  - communication and collaboration tools for facilitated learning
  - virtual, immersive learning environments
  - portfolios and digital evidence.

The conclusion of the presenter on the pedagogical shifts was, that it is too limited to focus on online and distance learning only. A systemic change is required to support the pre- and in-service training especially in developing countries. The key issues of this training should cover:

- support change through capability building
- core digital literacy / ICT
- new skills and attitudes
- more specialization in education structures and ecosystems
- clarify work processes involved and who does what

As the difference between developed and less developed countries on the mentioned topics is very large, an identification of the new roles of teaching

staff and related skills and attitudes should be initiated. It has also to be investigated whether teachers/ trainers (trainers for capacities) are able to cope with these new tasks. The new roles and responsibilities require:

- describe clearly the changed tasks and clarify roles
- develop capability for all roles, not just teaching/training
- use projects for capability development
- use new EdTech and workplace learning technology.

More specialization in education structures and ecosystems,  
Variable use of learning approaches,  
Investment in teaching staff.

Instructional design/ media production/ content creation/ online facilitation/ learning architecture design.

Clarification of work processes of teachers

The new tasks cannot be coped with without a bigger investment. The investment must concentrate on:

- Investment in robust pre-service and in-service dedicated training plans,
- Integrated approach to instructional design and architecture,
- Capacity to evaluate the local e-readiness ecosystem (infrastructure, equipment, TVET institutions and students),
- Identifying and prioritizing curricula to be transformed,
- New competence standards,
- Defining blended learning strategy.

The main challenge which must to be addressed is the professional development of teachers and trainers. They are the key to building willingness, confidence and maintaining or enhancing training quality.

Key pedagogical shifts towards blended learning systems

- Learning management system / student management system
- Communication tools
- Virtual learning environments
- New roles and related skills for teaching staff, as
  - ❖ Instructional design
  - ❖ Content creation
  - ❖ Online facilitation
    - ⇒ To be addressed into pre- and in-service requirements
    - ⇒ Support change through **Capacity Development** to develop capabilities for all (new) roles of teaching staff

## Some challenges addressed through Professional Development

Professional development for teachers/trainers as a key to:

- build willingness, confidence and eventually buy-in
- maintain or enhance training quality
- optimize time management & ROI
- select relevant tools
- maximize students learning experience & engagement

For successful digital transition, CPD to include effective and efficient:

- change management
- leadership
- guidance

► ilo.org



<https://www.giz.de/akademie/en/html/60706.html>

## Key Note

### „... the Future of Manufacturing will change“

#### **Changes in industrial sectors due to digitalization and the disruption of traditional vertical organizations - consequences for “white and blue collar” workers – A Siemens Example**

Thomas Leubner, Head of Siemens Professional Education, Siemens AG

Using Siemens as an example, this short paper discusses the changes in industrial sectors due to digital transformation and the disruption of traditional vertical organizations. How is the industry developing in selected sectors? Is a massive change of traditional shaping of work organization taking place? What are the consequences for occupational profiles and competences of shop-floor workers and administrative staff?

We present a strategy for a high-tech multinational enterprise that combines the real and digital worlds as foundation of a high-value growth strategy with a strong focus on sustainability in all dimensions, including employability. While HR managers need to enhance their knowledge on ecosystem management and external communities, blue-collar and white-collar workers need support to ensure their future relevance by upskilling and, sometimes, re-skilling measures: digital topics in production and technology.

#### **Introduction**

Digital transformation is imperative for every industry today. According to studies by McKinsey and BCG, 60% of manufacturing tasks can be automated whilst improving productivity, quality, and workers safety. In the infrastructure sector, 80% of lifecycle costs arise from operations with potential savings of up to 20% because of digital technology deployment. The mobility sector foresees a potential increase in transport capacity through digital

signalling technology without additional infrastructure being necessary. In healthcare, artificial intelligence and digital twin technologies help to increase processes and procedures.

Furthermore, the strategy of Siemens today sets clear priorities for sustainability in order to meet customers' and society's needs for green products, solutions and skills. Within its new **DEGREE** program introduced during the 2021 Capital Markets Day, Siemens announced clear goals for decarbonization and resource efficiency to its stakeholders, while reinforcing its standards for ethics, governance, resource efficiency, equity and employability.

We will focus hereafter on employability. Enabling Siemens employees to stay resilient and relevant in a permanently changing environment is a people and organizational strategy as an answer to the massive change of traditional shaping of work organization taking place today in times of digital transformation.

#### **Employability: Shaping the Work organization to unlock new growth potentials**

An organization that is preparing itself for new growth potentials in times of digitalization must fundamentally change its focus to capitalize on network effects: The focus shifts from internal employees to external communities (HR), from experts and specialized departments to crowdsourcing and open innovation (R&D), from shareholder value to stakeholder value (Finance), from push to pull and outbound to inbound (Marketing), just to give a few examples. While HR managers need to enhance their knowledge about ecosystem management and external communities, blue-collar and white-collar workers need support to ensure their future relevance by upskilling and, sometimes, reskilling measures: digital skills in production and technology.

### Consequences for skills development of the future

Demographic change and a lack of digital competences in the existing workforce require a better understanding of the competences of the future. According to OECD Data, 6 out of 10 employees lack digital basic skills and an ageing population (average age of workforce 47 years (2030) vs. 39 years (2020)) reduces the supply in the labour market in selected countries.

We use a specific methodology to determine future skills and competences requirements in the existing workforce. This framework systematically analyses the status quo and identifies relevant trends and effects, such that the future state of the workforce can be defined. Via the identification of future competences, the required job profiles will be described and consequently paths and actions for relevant and resilient employees can be developed.

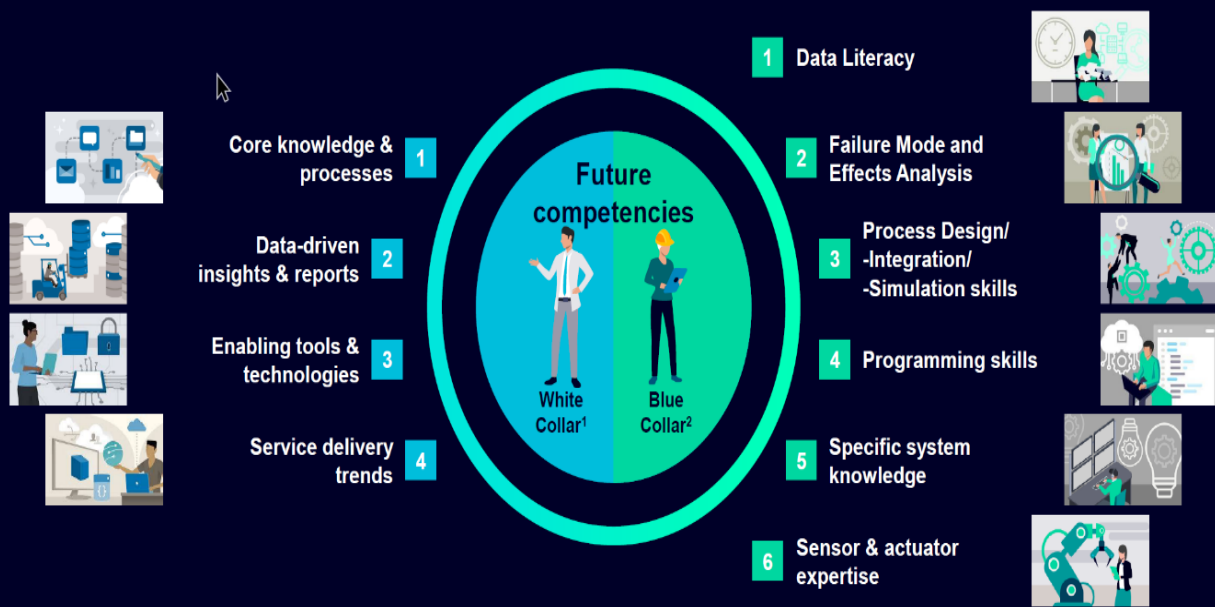
Online learning has priority

Trends towards platforms and ecosystem

Change of occupational profiles

During the #NextWork pilots several future competencies for white and blue-collar were identified – Competencies can be clustered into different capability areas

3



1 White-collar competencies derived from GBS pilot & "Master Data Service" role | 2 Blue-collar competencies derived from SI-DS & DI-MC pilots

In Technical Vocational Education and Training (TVET), the process for future skills identification was similar, albeit distinct. Based on 25 use cases, role-based gaps in competence fields relevant for Industry 4.0 environments were identified. Throughout a process lasting three years between 2015-2018, the required curricula were amended via suitable contents, either in-house or via external sources. It is noteworthy that such future competence discussions were carried out not only within a TVET department, but with various stakeholders across the company and beyond. This is necessary to avoid false assumptions, to link results strongly to the everyday reality of shop-floor representatives and to ensure high practical relevance of such skills. Besides the technical curricula, the development of six soft skills is not to be neglected, such as self-managed learning, project management, and media expertise. An example for TVET competence profiles is illustrated. New topics in TVET since then include sustainability and dematerialization, cyber security, internet of things and edge computing, simulation and digital twin as well as low-coding.




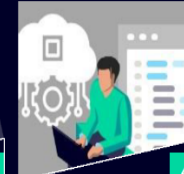


Data analytics and artificial intelligence concepts are also part of the curriculum. These topics, whilst having been initially developed for TVET, have proven their value and relevance in the up-skilling/reskilling context as well.

Besides new topics in TVET, the way of teaching has also experienced a transformation. The new VET philosophy fosters learners' individual competences, the trainers' holistic responsibility as coaches and development partners for learning programs and apprentices is a key for success. This leads to an approach called **CO**mpetence and **P**roject oriented **E**Ducation (COPED).

„... Digital transformation is imperative for every industry“

COPED – COmpetence and Project Ori-  
ented Education

### Deep dive blue-collar – Future blue-collar competencies are increasingly related to data-driven use cases and processes

 <p><b>1</b></p> <p><b>Data Literacy</b></p> <p>Ability to analyze data &amp; processes</p> <p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• Visualization of Data</li> <li>• BDE &amp; MDE know-how</li> <li>• Interpretation of data &amp; derivation of implications or action fields</li> <li>• Ability to analyze processes</li> <li>• Understanding data structures</li> <li>• Track &amp; trace data</li> <li>• Ensure cyber security</li> </ul>	 <p><b>2</b></p> <p><b>Failure Mode and Effects Analysis</b></p> <p>Identify failures and effects</p> <p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• Definition of possible failures</li> <li>• Identification of influence factors for failures</li> <li>• Analysis of impacts of failures</li> <li>• Definition of test scenarios &amp; implementation</li> </ul>	 <p><b>3</b></p> <p><b>Process Design/Integration/Simulation skills</b></p> <p>End-to-End process understanding</p> <p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• Understand E2E process and interfaces</li> <li>• Simulation of processes</li> <li>• Create digital working instructions</li> <li>• Competency for manufacturing planning tool</li> <li>• Presentation of manufacturing progress</li> <li>• Ensure transparency &amp; digital consistency</li> </ul>	 <p><b>4</b></p> <p><b>Programming skills</b></p> <p>Ability to program low code systems</p> <p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• Master low-coding</li> <li>• Connection of machines to different SAP systems</li> <li>• Build up user interface</li> <li>• Control of digital measure machines, incl. interpretation of results</li> <li>• Knowledge in Cloud &amp; Edge computing</li> <li>• Implement autonomous planning &amp; scheduling</li> <li>• Merging of reality &amp; Virtuality</li> </ul>	 <p><b>5</b></p> <p><b>Specific system knowledge</b></p> <p>Competencies for different systems</p> <p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• MES (Manufacturing Execution System) Poweruser</li> <li>• ERP-Systems</li> <li>• MRP (Material Requirement Planning)</li> <li>• Connection &amp; interfaces of different systems</li> <li>• Deal with Advanced Manufacturing, Digital Twin &amp; Robotics</li> </ul>	 <p><b>6</b></p> <p><b>Sensor &amp; actuator expertise</b></p> <p>Service delivery &amp; process improvement</p> <p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• Definition &amp; implementation of sensors</li> <li>• Connection of sensors to systems</li> <li>• Evaluation of techn. characteristics (e.g., welding robot)</li> <li>• Interpretat. of 3D data</li> <li>• Develop KI welding technic</li> <li>• Consideration of FTS</li> </ul>
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Remark: Competencies derived from SI-DS & DI-MC pilots

## Key Note

„... the only way is to educate our people”

**Digital developments and changes in the competencies of skilled workers in selected economic sectors**

Guru Mallikarjuna, Managing Director, Bosch Vietnam Co.Ltd.

“We need to increase and expand our expertise and skills. It is the only way that we will be able to help shaping the fundamental change in which we find ourselves and use it for Bosch.” (Volkmar Denner)

The presentation ends with this statement. It is very important because

- it assigns an important and great role to TVET and
- enhances education as the central path for further development.

The numerous training activities reveal that the company is already intensively implementing the above-mentioned targets. It is, for example, already running a great number of upskilling activities for their own employees in terms of use of IT, software, operations in manufacturing and other key issues. The company is currently working on training concepts aiming into the future, based on the fact that technology and innovations are the central drivers of changing processes. The changes resulting thereof have an impact on virtually all workplaces.

The guiding principle for all conceptual planning work is the overarching corporate philosophy:

“TVET has a large role to play”

Integration of Industry 4.0 in TVET

**VUCA** stands for:

- V = Volatility (Vision of Bosch)
- U = Uncertainty (Understanding)
- C = Complexity (Clarity)
- A = Ambiguity (Agility).

**“Agile is the vehicle for the VUA journey.”**

This cross-company philosophy is at the same time the basis for the design of training programs with the claim to offer "countless possibilities".

The company sees itself as a “Learning Company” and follows the concept of

**“Enabling for Digital Transformation” (EDT).**

EDT includes

- digital training information for all
- basic/ advanced qualification
- export qualification
- one day training for managers
- shop-floor enabling
- experience learning
- agile learning methods
- self-check control.

Training for Industry 4.0 has already been integrated into the training concept and is done with real i4.0 machines/ applications. “Upgrading of workforce skills” and “retraining of mid-career workers” to improve labor mobility is a permanent requirement.

Digitalization: transformation via technology

Vision – Understanding – Clarity – Agility  
(VUCA)

Industry is looking for higher productivity



## Driving forces

### Lifelong Learning, a little adapted to what's relevant for us

#### Driving topics today

- (Industrial) Software
- Information
- Digital/ Automation
- Computational Thinking
- Electrification
- Mechatronics
- Business Model Innovation
- Artificial Intelligence

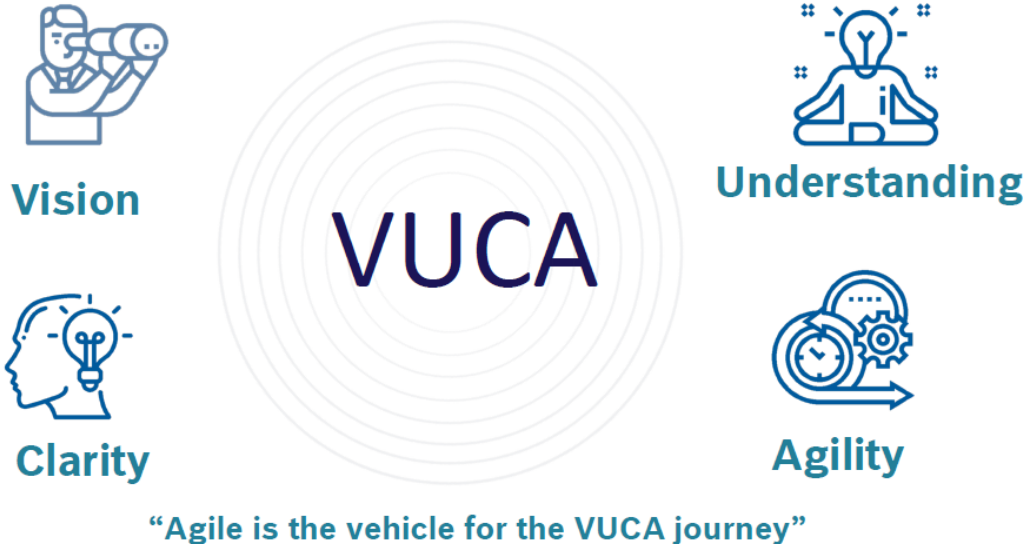
#### Competencies

- Critical thinking / problem-solving
- Creativity
- Communication
- Collaboration

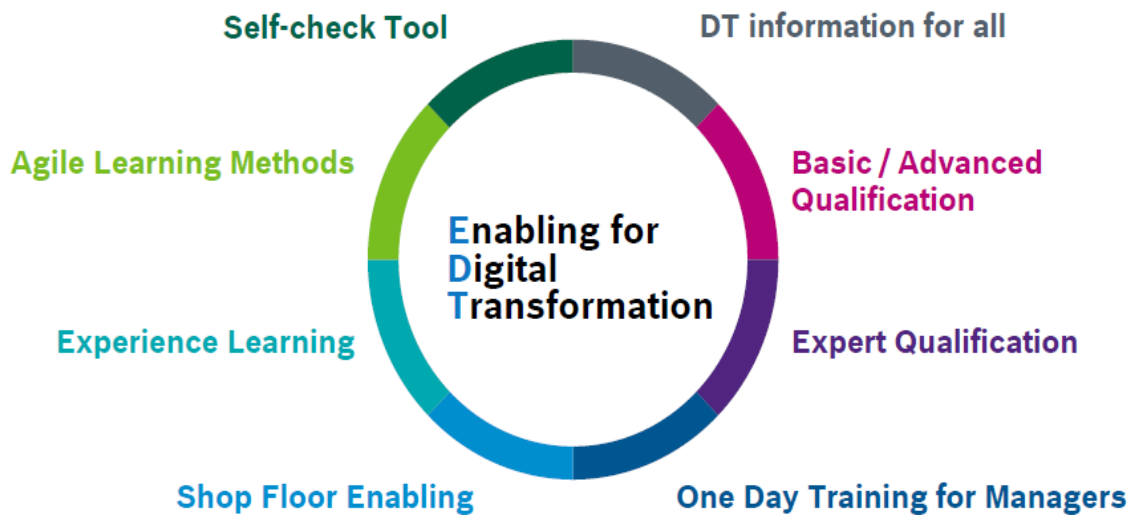
#### Character Qualities

- Curiosity
- Initiative
- Persistence / grit
- Adaptability
- Leadership
- Social and cultural awareness

- ▶ In today's innovation-driven economy, employees need a **different mix of skills** than in the past.
- ▶ Technologies have the potential to **lower the cost and improve the quality of education**.
- ▶ Jobs will become more non-routine and require **deeper analytical and interpersonal skills**.

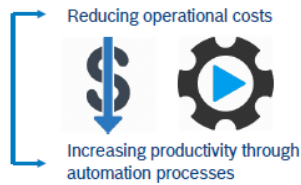


Bosch Initiative  
Bosch Learning Company





## Companies in cooperation with TVET Integrating Industry 4.0 in Education



- In need of skilled workforce:
- Handle complex situations
  - Solve problems
  - Think critically

- Incorporate **i4.0 studies** in **vocational program** (better understanding and application of i4.0)
- Equip with **real i4.0 machines/application** in the classroom
- **Apprentice** program with **multinational companies**
- Using **digitalization** to optimize further **training**



- Automation technology
- Control systems
- Innovation abilities

“Integration Industry 4.0 in TVET: in vocational program / equip classroom with real I 4.0 applications”



## Key Note

### “... Erfahrungsraum: technology-enhanced pedagogical models for supporting students learning Teachers digital competence:”

#### Requirements for teachers in vocational education due to digitalization in selected industries and their need for "digital competences"

Francesca Amenduni, Senior Researcher and Chiara Antonietti, Junior Researcher, Swiss Federal University for Vocational Education and Training

The „Erfahrungsraum“: a technology-enhanced pedagogical model for supporting students' learning at the borders between VET school and workplaces

#### Requirements for teachers in vocational education due to digitalization in selected industries and their need for "digital competences"

Francesca Amenduni; Chiara Antonietti, Swiss Federal University for Vocational Education and Training

#### Part I: e-Dap

The fast and ever-ending digitalization of workplaces has a huge impact on the design and development of vocational education and training (VET) programs. We are assisting to *disruptive* changes brought by the introduction of industry 4.0 technologies in almost all the economic fields, from agriculture and food industries to manufactory and services.

Dealing with these kinds of *disruptive transformation* requires to consider not only tangible elements (e.g. new technological systems and infrastructure) but also intangible elements, such as professional practices, competences, and skills. As the increasing implementation of digital technologies in workplaces might demand employees' higher level of digital competence, VET institutions should be ready to

respond to these requests by providing learners with an adequate level of digital competence.

Therefore, to effectively support the development of VET students' digital skills, teachers would need to be driven by evidence-based educational models, able to provide a guide regarding digital technologies integration in teaching in VET contexts. In this document, we propose the “*Erfahrungsraum*” model because it includes all these characteristics.

#### ***The “Erfahrungsraum” model and concrete applications with educational digital technologies***

The “*Erfahrungsraum*” is a technology-enhanced pedagogical model for supporting students' learning at the borders between VET school and workplaces. According to it, when adequately exploited, technologies can provide a specific space to reflect upon apprentices' professional experiences, thus supporting learning and professional development.

The Erfahrungsraum model is organised in four phases:

1. executing at the physical workplace and capturing relevant evidence (I quadrant);
2. selecting and storing relevant professional experiences (II quadrant);
3. reflecting on the experience through clustering, augmenting and writing activities (III quadrant);
4. practicing and simulating at school (IV quadrant);

The Erfahrungsraum model can be successfully implemented through the adoption of highly accessible and low-cost digital tools (e.g. videos, mobile phone applications) but also through cutting edges digital solutions (e.g. head mounted Virtual - VR - and Augmented Reality - AR). The model invites teachers to reflect upon the reasons why a specific technology should be used and for which purpose. In many previous experiences, the Erfahrungsraum model was successfully implemented through low-cost digital technologies like mobile web app or video tools.

A first example of concrete application of the Erfahrungsraum model is the **e-Dap**. The e-DAP is a mobile learning solution allowing chef apprentices to create one's own e-portfolio and recipe book, which in the Swiss context has also the function of *Learning Personal Documentation* (LPD). The LPD is a mandatory and administrative task for all the VET

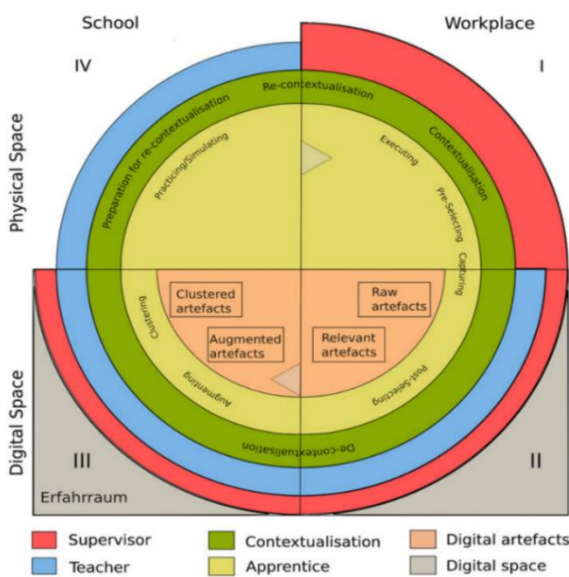
professions which requires apprentices to document, through a specific templates, major works and achievements carried out at the company.

Disruptive digitalization of workplace and Industry 4.0

Learners' digital competence

the e-DAP is always combined with a few prompts for the apprentices to further reflect on their professional experiences (Mauroux, et al., 2016). In-company supervisors can comment apprentices' reflections, giving a contextualized and focused feedback. Apprentices can explicitly require such a feedback from their supervisors through a simple button in the e-DAP. In addition, teachers can access to the apprentices' pictures and recipes and use them to design specific learning activities in classroom. In this way, visual information from the workplace become materials to stimulate theory-driven reflection on the professional practice in compliance with the Erfahrungsraum model.

The e-DAP approach was replicated to different extent in other professions. For instance, in the Dual-T project, the Realto application was designed to be used by whatever profession and at the same time to be customizable in the learning documentation section to the need and specificities of the single profession. Realto is a platform for integrated vocational education developed within the context of the Swiss project Dual-T<sup>1</sup>. In compliance with the Erfahrungsraum model, the goal of Realto is to bridge the apprentices' experiences across learning locations by exploiting the combination of mobile devices and an online learning environment. Realto allows the users to share professional-related experiences through different media (photos, text, audio, video), create and store specific learning activities based on expanding experience through reflection, connect the stakeholders (apprentices, teachers and supervisors) to inform and coordinate the competence development progress, interact with peers in a Social network environment (based on posts, comments, messages, likes and sharing), manipulate images through, annotations, overlay and grouping, and create a workplace-oriented customizable learning journal.



*The Erfahrungsraum model.*

In the e-DAP, the LPD is conceived as a recipe book which can be personalized and continuously updated by apprentices based on what they perform at the workplace. For each recipe, apprentices can upload a set of pictures of their professional performance, taken through a smartphone. Each recipe in

<sup>1</sup> [https://regiosuisse.ch/sites/default/files/2018-12/WSF2018%20Poster%2010\\_REALTO%20A%20platform%20for%20integrated%20vocational%20education\\_SFIVET.pdf](https://regiosuisse.ch/sites/default/files/2018-12/WSF2018%20Poster%2010_REALTO%20A%20platform%20for%20integrated%20vocational%20education_SFIVET.pdf)

programmes. Simulations can make theoretical knowledge more relevant and facilitate making sense of practical situations in the workplace. Moreover, they reduce the chance to damage company's materials, and injury at the workplace.

Simulations can be carried out:

- In a *physical space* through the support of digital technologies. For example, apprentices can video record and analyse a simulation of a professional practice carried out a school or in an inter-company course;
- In a *virtual space* which can be accessed through a screen or through head-mounted displays (immersive Virtual Reality - VR).

In the *physical space*, the video can be used to record the apprentices' relevant procedures. Depending on the context, a simulated procedure can be video recorded. The video-material can be imported on iVideo.education, a digital platform specifically designed to turn simple videos into *hypervideo* for professional training purposes. Moreover, apprentices and the teachers can insert comments in specific video time-frames (so called video annotations), which can support on one side apprentice' self-reflection and on the other side more detailed and focused feedback from the supervisors.

In recent years, *virtual simulations* of the workplaces are adopted as innovative training solutions in VET contexts. Virtual prototypes allow apprentices to investigate different possible situations, and to recreate low frequency, dangerous or expensive events as many times as needed. VR can also be used with limited supervision allowing apprentices access training at their convenience, without requiring a trainer to provide constant supervision. **Immersive 3D VR** environments are consistently found to facilitate work-related experiential learning of apprentices, outperforming desktop or table VR experiences because of a higher sense of presence in the immersive VR experience. SFUVET has carried out experimentations with an Immersive 3D VR application called GardenVR<sup>2</sup>. Garden VR allows apprentices to practice and develop their designing

skills through designing a virtual garden in an immersive environment. In GardenVR apprentices can experience two main perspectives called the design mode and the explore mode. In the design mode, the learners are given the top view of the garden and they can place objects such as trees in the garden. In the explore mode instead learners can explore the garden by walking through it in a 360-degree 3D environment. Apprentices are invited to switch between the two modes in accordance with their objectives. GardenVR also provides the functions of daily, seasonal, and yearly changes in the gardens. Learners can fast-forward the time to visualize the evolution of the garden supporting the advantage of VR-based simulations to reduce the time demand for experiments.

### ***Conditions for a successful implementation of educational digital technologies in VET contexts***

While the availability of the digital infrastructure lightly explains the technology use by teachers (Drossel et al., 2017), the teachers' digital competence might better predict the technology integration in teaching and learning. Indeed, teachers who are confident users of technology are more likely to integrate digital tools and software in their teaching. On the contrary, the lack of digital competence could lead teachers to do not use technology for learning activities with students.

The teachers' digital competence is a broad concept that includes not only the technical skills of using technological devices and digital resources in educational context, but it comprehends also the pedagogical dimension, attitude, strategies and awareness that enables teachers using technology to achieve teaching and learning goals effectively.

The European framework of Digital Competence for Educators (DigCompEdu) provides a frame of reference to assess and support the development of the digital competence of teachers at all educational levels including vocational education and training.

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<sup>2</sup> <https://www.youtube.com/watch?v=ivgi1b8IS7A>

DigCompEdu considers the digital competence as the ability to make a safe, critical, and creative use of technology to enrich teaching and learning objectives keeping a tight focus on the pedagogical dimension of technology integration. The framework identifies 22 specific digital competences of educators categorized into the following six areas: 1) *professional engagement*, 2) *digital resources*, 3) *teaching and learning*, 4) *assessment*, 5) *empowering learners*, 6) *facilitating learners' digital competence*. The area related to *professional engagement* emphasizes the importance of professional continuous training, communication and collaboration with colleagues that are essential for guarantee the connectivity between the different learning places in the context of vocational education. The competence of selecting, creating and modify *digital resource* is essential for personalizing instructional content to the specific profession and working context. The *teaching and learning* area highlights the importance of using technology to support interactive, collaborative, reflective and self-regulated learning activities. Also, the use of technology for *assessing* and providing students feedback is considered part of teachers' digital competence. In addition, the DigCompEdu emphasis the teachers' role in developing learners' digital competence, that is relevant issue in vocational education. VET teachers should support apprentices in acquiring the digital competence required in the work environment that is rapidly moving towards digital transformation.

Ideally, in addition to acquiring the necessary digital competence, teachers should also comprehend the additional value that a technology can add to teaching from a pedagogical point of view. When selecting digital tool, the focus must always be on the students' learning. Teachers often use technology to make their work easier (e.g., supporting oral explanation, speeding up administrative tasks) without really taking into account the learners' needs. Instead, the successful integration of technology into teaching and learning means introducing digital tools that are effective for the learning and developing students' professional knowledge and skills.

Technology accessibility and availability is a necessary but not sufficient condition

Teachers' digital competence explains technology integration well.

Technology integration focuses on students' learning needs



## Panel Discussion

**Based on the overall discussion of changes of work and labor market movements which have focused on TVET since several years, thoughts on TVET teacher training are now developed based on guiding questions.**

Moderator: Guido Lotz

Panelists:

Ralph Hippe, Learning and Employability Expert, CEDEFOP

Wahid Razzali, Vice-Chancellor, University Tun Hussein Onn Malaysia (UTHM) Malaysia

Lars Fiechel, Cluster Coordinator Skills Development, Ethiopia, GIZ

Lisa Marie Kreibich, Social Sector Specialist, ADB

Karine Sonigo, Skills Digitalization Specialist, Skills and Employability Branch, ILO

### Questions & Answers

#### 1. How should TVET teachers be trained in the digital age?

Teachers play an essential role in order to both align training to the rapidly changing technological requirements of the industry and utilize digital resources in training appropriately. Aligning the digital literacy training of teachers which corresponds to the chosen method of teaching is fundamental to ensure effective learning outcomes.

Continuous professional development for existing workforce of TVET teachers (in-service training) to help TVET teachers to adapt to changing requirements resulting from digitalization (e. g. in terms of learning outcomes, content, online and hybrid modes of delivery etc.)

Continuous professional development to go beyond training & learning offerings, which need to be complemented by coaching, mentoring and ongoing support (e. g. with a view to make use of digital learning resources)

In parallel revising pre-service education of TVET teachers to prepare new generation of TVET teachers in accordance with new requirements resulting from digitalization

- Teachers need to be able to teach digital competence = ‘confident, critical and responsible use of, and engagement for digital technologies for learning at work, and for participation in society’ (European Council 2018)
- Training should prepare teachers to use digital technologies (incl. remote and blended learning) and understand labour market skills needs

Teachers should be retrained. Almost every aspect (content, pedagogy, values) is highly relevant as we did not react fast enough to the Industry 4.0 strategy and were caught by surprise by the Covid-19 Pandemic.

Establish more sustainable holistic reform of teacher training systems.

#### 2. Is there a need to adapt curricula and training contents – which processes would support that?

In the light of the significant and ongoing changes in the world of work due to digitalization - and resulting changes related to competence requirements: *Undoubtedly yes.*

- When the world of work in professions is changing with digital and automation technology development, curricula and training content have to change as well, both for teachers/trainers and for students/apprentices. This needs to be catered for through changes in our educational systems.
- Yes, there is a great need to adapt to the new process of training. We are developing a certificate of competence of TVET Teachers.

Curricula and training contents need to be updated on a regular, continuous basis, because:

- New content is emerging through digitalization and automation, new skills as well – are

students equipped with digital learning skills when entering TVET?

- The process of finding out which content has changed in a profession can only be successful through a very close relationship between companies/private sector and the relevant authorities responsible for curriculum and training development, they need to work hand in hand in strong multi-stakeholder collaboration systems. It also needs a mode of operation that is capable of being amended/adapted quickly whenever needed.

Involvement of the business sector is essential for responsiveness of curricula and training contents to labour market and employers' needs.

- Surveys and toolkits (Cedefop) and self-reflection tools (e.g. SELFIE) help to understand the specific needs and show good practices.
- 3. Are didactical concepts and training methods available which respond to the changing competence requirements caused by digitalization?**

Important to support IR 4.0 related emerging skills areas while at the same time ensuring that children master foundational skills. The most critical skills for high labour market outcomes are complex problem solving, critical thinking, creativity, people management, emotional intelligence, etc. These are also the skills that are most difficult to automate. The importance of promoting different types of skills: cognitive, non-cognitive and occupational skills.

New modes of delivery (online and hybrid) and the use of digital resources in learning processes require didactical concepts to be updated and revised.

- Digital technologies can allow learners to be more collaborative and active, have more personalised pathways, use simulative job environments.
- How to develop a simple concept that can be acceptable across different cultural backgrounds and economic development. (As an

example, in a measure of learning; SOLO as compared to BLOOMS taxonomy.)

**4. Which role do digital resources play in the process of modernizing TVET?**

Lots of opportunities to be exploited, including e. g. simulations, VR, AR, mixed realities, asynchronous learning etc.

- They play a key role, offering new opportunities, e. g. new experiences for learning, lower costs, personalization, easier access, team/peer learning, decoupling of learning from time/place, etc.
- Different resources are available (each with different features): OER, AR/VR, learning analytics/AI, VLE, MOOCs, assessments.

As long as we do not forget how humans are learning, digital resources, digital learning environments, digitally supported learning processes will play a vital role in TVET. There is potential through digital means to reach more learners, there is potential to update learning material in a faster way and make it accessible for more learners, etc.

However, limitations to be also kept in mind; especially with regard to acquiring practical skills. Despite all the opportunities: Digital learning cannot (fully) replace the "real experience": "You cannot learn swimming without ever going into a pool".

Challenges: appropriate government policies and coordination are not in place for scaling online learning, digital infrastructure is limited including low connectivity, inadequate access to devices and lack of digital contents, teachers lack digital and pedagogical skills to manage digital resources, and there are too many global providers but inadequate comprehensive solutions at country level.

**5. Will new cooperation mechanisms in terms of learning and training venues become more relevant because of digitalization**

As emphasised by the panellists, cooperation between public and private sector stakeholders becomes even more important. Digitalization is an enabler:

- Digital technologies allow to better connect schoolbased and WBL environments, e. g. organisation of alternance, design of materials and assessment practices, monitoring evolution, feedback loops, etc.
- In interconnected societies cooperation and collaboration becomes more relevant, and easier. Learning how digitally cooperate and co-create also between different places of learning (Lernortkooperation – cooperation of learning environments) therefore can be designed much easier and it is a must to support the immense challenges that learners have to face.
- Hybridisation of teachers and trainers: promoting exchanges helps keeping abreast of developments.

What would be the strategy to improve innovating practice that is relevant for our graduates that will nurture them to be Technopreneur?

## „ ... Cooperation with Industry ...“

**Karine Sonigo / ILO:**

“Structured / systematic approaches  
Strengthen PPP’s / policy initiatives”

**Lars Fiechel / GIZ:**

“Combining perspectives of Micro-Meso-Macro  
Level  
(Companies – Colleges)”

**Lisa Marie Kreibich / ADB:**

“Curricula must be based on industry requirements – update Curricula in cooperation with companies / associations

- Facilitation: workshops / councils
  - Knowledge partners”





## Day 2: Workshop - 19th of October 2021

### “Digitalization and TVET”: Requirements and Ap- proaches for Competence Development of TVET per- sonnel (managing staff and teaching staff) in interna- tional and development co- operation

#### Objectives

- Derivation of impacts in competence requirements of workforce in economy, production, work and business processes from digitalization
- Derivation of consequences in TVET teaching and management processes because of the changes in work and work organization caused by digitalization
- Clarification of competence requirements of teachers and trainers because of the changes in industry driven by digitalization
- Development of ideas and proposals for Competence and Capacity Development for TVET personnel towards perspective (pre- and in-service) education and training of TVET teaching personnel

#### Audience / Target Group

- Representatives / Staff of Development Agencies, Development Banks
- Stakeholder of TVET institutions, related organisations, authorities of partner countries
- Representatives of TVET projects
- Representatives of TVET teacher institutions
- Representatives of business sector
- Representatives from UNEVOC, ADB, ILO

#### Format / Structure

- Online Conference (Kick Off)
- Parallel online workshops
- Concluding session

#### Expected Outcomes

- Recommendations for development of TVET teacher training in a digitalized world of work - appropriate to the demand of the business sector
- Didactical concepts of TVET teaching in a digitalized world of work
- Materials for training and training concepts for the implementation of digitalization in TVET
- Case descriptions for best practice approaches and models of pre- and in-service TVET teacher training by consideration of digitalization
- Recommendations for pre- and in-service training approaches for TVET teachers
- Tool Box(es), Materials
- Recommendations for strategies for the support of lower developed countries in integration of digitalization in TVET and skills development

# Agenda Workshops

19th October 2021

08:00 – 11:45 GMT+2 (Amsterdam, Berlin, Rome)

Moderation: Ulrike Schmidt, GIZ TVET Academy

## Wrap-up/ Introduction

### Welcome and General Overview

Ulrike Schmidt, GIZ TVET Academy

### Key messages from Kick-off

#### Introduction of Workshop Moderators

Harry Stolte, GIZ TVET Academy

## Keynote:

### “Integration of digitalization into TVET Teacher Training”

Frank Bünning, University Magdeburg

### Introduction of Workshops in a panel session

Moderators of Workshops

## Workshop 1

Moderator: Georg Spöttl, University Bremen

### Occupational Structures, Training Contents

This session addresses the core issue of how to structure occupational profiles and standards considering the massive changes in the world of work due to new technologies and digitalization. Selected examples will reveal the processes and mechanisms behind the adaptation of curricula.

### “Structural models of occupations and approach of adjustments in metal and electrical sector in alignment towards Digitalization / Industry 4.0 in Germany”

Gert Zinke, BIBB

### “Approaches in adaptation of training programs towards requirements of Digitalization / Industry 4.0 in selected occupations in Vietnam”

Nguyen Khanh Cuong, College LILAMA II

### “Designing of Blended Learning Concepts by combination of virtual knowledge transfer and practical skills development”

Holger Regber, Festo Didactic

### “ADB experience in supporting client countries in aligning TVET curriculum to Industry Revolution 4.0 technologies”

Fook Yen Chong, ADB

### “Changing technology – changing vocational education? Ongoing challenges for companies and vocational schools“

Christoph Metzler, Institute of German Economy

## Workshop 2

Moderator

Hector Niehues-Jeuffroy, GIZ Sectoral Department TVET

### **Digital Resources, Media, Tools, Platforms**

Digitalization and the discussion of digital resources, media, tools and platforms belong closely together. Chances are that the challenge posed by digitization can partly be solved by creating those resources and making them available. This session will provide you with insights into good practices of e-learning and virtual reality training projects.

**“Development of a national eLearning platform – approach, concept and support by cTVET:**

- **Open source Digital Tool Management System**
- **MS Office 365 Education”**

Lukas Dietrich, Advisor, GIZ, cTVET Mongolia

**“(Digital) Capacity Building in the Perspective of ITC ILO – the triple helix”**

Stefano Merante, ITC ILO, Turin

**“Integration of AR/BIM Software in project-based training – examples from training in electrical / sanitary installation in South Africa”**

Harald Fleischmann, CEO, Fosh-Learning

**“Conceptual approaches in piloting and dissemination of e-learning in TVET colleges in Vietnam”**

Christian Hoffmann, Advisor, GIZ Vietnam

**“The Benefit of Digitalization in Technical Vocational Education and Training”**

Christian Eismann, Christiani GmbH

**“Digitalization of Training Institutions – a multi-level approach from the Jordanian Water Sector”**

Dirk Winkler, Program Director, GIZ Jordan

### Workshop 3

Moderator

Ulrike Schmidt, GIZ TVET Academy

#### **Training processes, didactical concepts, methods, cooperation mechanisms, multiple learning venues**

The creation of successful training processes depends on customized didactical concepts, methods of teaching and learning and cooperation of multiple TVET stakeholders. This session puts quality development in the center and seeks to find answers and examples on how to shape TVET in order to address competence requirements that result from digitalization.

#### **“Remote Teaching & Learning of TVET Lecturers: Approach to ICT upskilling, outreach, challenges and potentials”**

Gerda Magnus, Department of Higher Education and Training (DHET) South Africa

#### **“The certified ‘National e-Trainer in TVET’ in Mongolia – Concept of the training approach”**

Andreas Hörfurter, eLearning & Training Consultant, Common Sense

#### **“Elements of an Eco-System for Digital Transformation in TVET Vietnam and Approaches for Implementation”**

Pham Xuan Hoan, Advisor, GIZ Vietnam

#### **“Digitalization of Vocational Training – facing the challenge and taking the opportunities”**

Kevin Wäschebach, Christiani GmbH

#### **“Digital teaching and learning specialist: a comprehensive modular training portfolio on digital teaching and learning in TVET”**

Stephanie Schenk, GIZ TVET Academy

#### **“E-Learning Empowerment Training” Sri Lanka**

Tatjana Rest, Advisor, GIZ Sri Lanka

### Conclusions / Recommendations

## Objectives

- Derivation of impacts in competence requirements of workforce in economy, production, work and business processes from digitalization
- Derivation of consequences in TVET teaching and management processes because of the changes in work and work organization caused by digitalization
- Clarification of competence requirements of teachers and trainers because of the changes in industry driven by digitalization
- Development of ideas and proposals for Competence and Capacity Development for TVET personnel towards perspective (pre- and in-service) education and training of TVET teaching personnel

## Audience / Target Group

- Representatives / Staff of Development Agencies, Development Banks
- Stakeholder of TVET institutions, related organisations, authorities of partner countries
- Representatives of TVET projects
- Representatives of TVET teacher institutions
- Representatives of business sector
- Representatives from UNEVOC, ADB, ILO

## Format / Structure

- Online Conference (Kick Off)
- Parallel online workshops
- Concluding session

## Expected Outcomes

- Recommendations for development of TVET teacher training in a digitalized world of work - appropriate to the demand of the business sector
- Didactical concepts of TVET teaching in a digitalized world of work
- Materials for training and training concepts for the implementation of digitalization in TVET
- Case descriptions for best practice approaches and models of pre- and in-service TVET teacher training by consideration of digitalization
- Recommendations for pre- and in-service training approaches for TVET teachers
- Tool Box(es), Materials
- Recommendations for strategies for the support of lower developed countries in integration of digitalization in TVET and skills development

## Guiding Questions for the Group Work

### Overall Questions for Each Working Group

As for the concrete planning of the direction of each workshop out of three, a short description of each workshop exist and the core questions should ensure that the input of the workshops corresponds to the targets of the conference. For framing the discussion in the workshops after the input of the presenters, some overall guidelines / questions for the moderators will be described below. These guidelines/ questions should help to define relevant outcome:

1. What has to be done in training centers to ensure access to “digitalization topics” in the specific lessons?
2. How must the management be prepared for the new requirements? What are the core activities the management should fulfill?
3. How should teachers be prepared for the paradigm change? What are the main areas teachers have to be qualified for?
4. Which modes of learning (didactical approaches) for the preparation for digitalization should be supported? What is likely to become “good practice” and why?

### **Workshop Session (1)**

#### **Occupational Structures, Training Contents**

This session addresses core issues in vocational education. What needs to be clarified is how occupational profiles are to be structured in view to the massive changes in the world of work by digitalization. Questions that arise are:

- a) Is it a question of adjusting occupations and competences solely to technical developments and qualifying for them?
- b) What role does the change in work and work organization play regarding changes in occupational structures and training contents?
- c) Would it be advantageous to choose next to a focus on technology a focus on work processes on the design of the foundation of qualification and competence development?

### **Workshop Session (2)**

#### **Digital Resources, Media, Tools, Platforms**

Digitalization and the discussion of digital resources, media, tools and platforms belong closely together. Numerous statements go in the direction that the challenge posed by digitalization can be solved by making resources, media, tools and platforms available. The questions that arise in this context are:

- a) What approach in resources, media, tools and platforms is appropriate for promoting competencies in TVET in the direction of digitalization?
- b) How can skilled workers be qualified for digitalized production facilities and networked systems supported by what kind of digital resources?
- c) How should the increased complexity of networked systems become the subject of didactical appropriate qualification and competence development?

### **Workshop Session (3)**

#### **Training processes, didactical concepts, methods, cooperation mechanisms, multiple learning venues**

How to shape didactical concepts and training processes, methods of learning, cooperation and other approaches to learning and training in TVET addressing competence requirements resulting from digitalization is a deeply discussed issue without clear answers. The shaping of learning processes depends on the didactical concepts and methods of learning. Answers can be given to further issues of quality development in a learning and training situation. Questions which have to be considered are:

- a) How should learning processes be designed to develop competences that are necessary for dealing with digitalization?
- b) How should didactic concepts be designed to promote learning for a complex, digitalized working world?
- c) What qualification profile do TVET teachers need in order to be able to particularly promote learning with a view to digitalization?

### **Session on Final Conclusion / Presentation of Recommendations**

## Keynote

„... increased demand and need to use digital learning and teaching media meaningfully...”

### Integration of Digitalization into TVET Teacher Training

Frank Bünning, Chair of Technology and Education, Otto-von-Guericke University

The meaning and the importance of the keynote is to trigger off ideas and thoughts for forthcoming discussions here in workshops. Of course, I'll try to elaborate and outline general developments. In order to make it more attractive and appealing for you and to trigger our thoughts in the workshops, I'll try to underpin my general statements with examples from my university. So you have both, you have the general statements and you have examples from the Magdeburg University, how we try to put it into practice here, because Magdeburg University is one of a large TVET teacher institution in the area of technology.

Before we focus on details, we can have a very general look on the issue of TVET teacher education and digitalization. We can basically identify three driving forces for this:

- it's quite obvious, the world of work goes digital
- we find an advancement and increased availability of digital learning and teaching media, and that can be used in teaching of TVET, but also in the education process of the TVET teacher education
- we cannot ignore the fact that there's an increased demand for the meaningful use of digital media.

To sum it up, these are the three different driving forces, and I'll refer to these driving forces in my keynote.

It is out of question and out of debate that we are just at the beginning to capture the opportunities for digital work. Digitalization will have serious impacts on the workforce and also on the way work is conducted. Increasingly, we see digital tools and we see new digital jobs and roles. And as our teachers prepare our future workforce, it has to be included in our TVET teacher training program. However, the challenge is digitalization must be reflected but embedded in the vocational domain. What I'm trying to say is digitization does not serve a selfish purpose, but it can come in very different shapes and faces when it comes to the vocational domain. Therefore, it has to come together with developments in the vocational domain.

### Driving Forces

- World of Work goes digital
- Advancement and increased availability of digital learning and teaching Media
- Increased demand and need to use of digital learning and teaching Media meaningfully

Let's take our Bachelor of Teaching Mechanical Engineering. On the one hand, we have the explicit integration of issues of digitalization. The TVET teacher for mechanical engineering is heavily confronted with digitization in the context of Industry 4.0 applications. And therefore, we have a separate module in that TVET teacher training program that deals exclusively with aspects of Industry 4.0. That is one separate module, and I would refer to this as an explicit integration because the digitalization is directly addressed in that module.

But we also have what we find implicit integration of digitalization. We have another example from the same bachelor program. On the first glance, it doesn't look like digitalization, but the module of foundations of factory automation deals with a lot of issues that are closely, extremely closely linked with digitalization. And here we find a very close linkage again with the world of work. But it's not

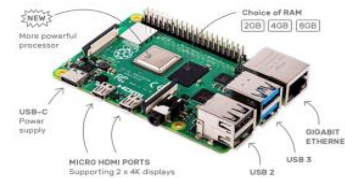
called digitalization, it is implied. So therefore, I would consider these modules also as modules that touch on digitalization. We have these two different types. We find another tendency we need to discuss here. The tendency is the advancement and increased availability of digital learning and teaching material. We have just passed by an area of very dense innovation in the area of digitalization. Many of them would have long term impacts of our world of work and on the way, we teach in the future. One of them that will have very serious long-term impact on our teaching world is the availability of digital learning material. Just an example in 2019, almost 70 percent of US companies offered learning opportunities via smartphones. And the availability of learning media must also be reflected in our TVET teacher programs. And here we have again examples from my university how we integrated in our program. In one of our modules we have integrated the usage of learning platforms. Here we use our own platform. We have developed an own platform just for cost reasons. There's free of charge and whether it is an open source material that can be used world-wide. We confront students with a learning platform, and we teach them how to adjust learning platforms to their very special needs.

We also integrate physical computing. When it comes to the issue of digitalization, we have two different aspects:

- we have learning media. Graduates need to learn how to handle these media.
- we need to prepare teachers in how to integrate digital media into existing hardware. and programs.

The Raspberry Pi and what we do with it is called physical computing. Physical computing means you can understand and work on actual mini computer. Why we use a Raspberry Pi is quite simple. It's very cheap. It's easy to handle, but nonetheless it shows you the general working procedures and the general elements of every single computer. By integrating them, our students acquire knowledge about the general ways of operating computers.

### Example Raspberry Pi – Appealing low budget hardware



- Raspberry Pi**
- € 35 -70 single board computer
  - Linux Debian Based OS with integrated Python 2.7 and 3.5
  - 40 GPIO pins for experimental Breadboard setups
  - LAN and Wireless LAN Capabilities
  - Flexible OS with integrated OER (e.g MITs Scratch, Libre Office, etc.)

We have to link up learner concepts with digital media. The physical computing via Raspberry is a very good anchor to practice project-based learning and teaching. You can exercise a lot of projects on it. We use the physical computing side also for project-based learning. And you can have very idealistic problem-solving teaching approaches by using that Raspberry Pi. That links up to what we generally expect from our future workforce. They need to develop problem-solving skills. Last but not least, we also practice with it flipped classrooms.

“... students have to accept the challenges of digitalization...”



The Raspberry Pi as such, is almost identical with the very applicable digital approaches in industry. We have what we call a sandbox. A sandbox is a protected environment for different machinery control. What you can practice and exercise with the Pi is, how to drive and steer machines and how to control processes. When you look at the very actual media and hardware they use in the companies, you come up to the conclusion that it's very close and very similar. So therefore, it's also a good approach for learner centered concepts that simulate what's really going on in industry.

“...teachers always have to develop their own learning material...”

**Example: B.Sc. TVET Teaching, Mechanical Engineering (explicit)**

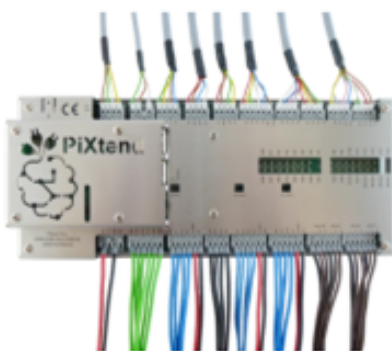
Module: Introduction to Digitalization and Industry -4.0-Applications

Overall goal: The module introduces students to the challenges of digitalization and automation in the context of industrial production and logistics. By means of several case studies, students develop a clear understanding of application fields and the relevant technologies, trends and emerging business models relevant to production companies.

“... learner centred concepts stimulate reflection...”

Some conclusions: On the one hand TVET teacher education programs must integrate the topic of digitalization. But again, it must be closely linked to the vocational domain. Digitalization does not serve a selfish purpose. It is always linked to actual jobs and works. Therefore, it has to come together with vocational domain. On the other hand, TVET teachers must become proficient in the use of digital media. But using is not enough. They are also the need to be prepared to develop their own learning media. No matter the fact that there's a lot of learning material, you always have to develop your own. There's no way to avoid this. Thirdly, TVET teachers must be prepared to use digital media in order to foster learner centered approaches. They have very good potential to put it into practice, but this is not automatically the case. Therefore, we need to prepare our future teachers to practice learner centered approaches. Last but not least, digital media is also used for communication in the school community, in the school and among the school management. We have different software's around. That is a very essential aspect. Our TVET teachers must use that for efficient school and in-house communication.

**Raspberry Pi in industry**



- Embracing the Internet of Things for the Industrie 4.0 as industriell IoT Gateways and embedded computers
- Able to run industry standard serial communication protocols
- Enabling rapid electronic prototyping within different industry sectors
- Enables Sandbox Environments for VET setups at in company trainings for in the fields of robotics, AI and Logistics

# Keynote

## Digitalization and TVET Teacher Training

Harry Stolte, GIZ TVET Academy

### Opening Speeches

Perspectives from International Organizations (UNESCO-UNEVOC / ILO) and Development Banks (ADB)

Relevant common understanding regarding demand / perspective main emphasis for interventions in terms of **Capacity Development**

- **UNESCO-UNEVOC** - support TVET Personnel towards change demands resulting from Digitalization by
  - Collection of precise data on the needs of TVET Teachers
  - Platform to share their needs, experiences as well as resources
  - Care for their professional development and support
- **ILO** - develop capabilities - to be addressed into pre- and in-service for all (new) roles of teaching staff, as
  - More specialization in education structures and ecosystems
  - Clarification of work processes involved
  - Instructional design / media production / Content curation / online facilitation / learning architecture design
- **ADB** – Rethinking Capacity Development with focus on
  - Knowledge solutions and Partnerships
  - Digital learning framework / roadmap
  - Strengthen in-company training
  - Ecosystem approach and multisectoral approach

## Perspectives from Industry

### Siemens (Thomas Leubner)

- Platforms and ecosystems – leading paradigms for future business
- #Next work – Methodology to determine future skills and competencies (clusters) for future job profiles
- Core knowledge & processes, data-driven insights, enabling tools & technologies, service delivery & trends
- Data Literacy, failure mode & effects analysis, process design / integration / simulation skills, programming skills, specific system knowledge, sensor & actuator expertise
- Continuously updating of curriculum for education, re- and upskilling
- New way of teaching: Competence and Project Oriented Education (COPEd)
- „My Learning World“: Global learner Community – providing personalized learning experience / flexible access anytime / anywhere

### Bosch (Guru Mallikarjuna)

- Employees need a different mix of skills than in the past
- Technologies have the potential to lower the cost and improve the quality of education
- Jobs will become more non-routine and require deeper analytical and interpersonal skills
- VUCA: Vision-Understanding-Clarity-Agility (Agile is the vehicle for the VUCA journey)
- Bosch Learning Company – Enabling for Digital Transformation;
- Elements: Self-check Tool, DT information for all, Basic/Advanced/Expert Qualification, One Day Training for Managers, Shop Floor Enabling, Experience Learning, Agile Learning Methods

- Integration Industry 4.0 in Education – Companies cooperation with TVET
- Incorporate i4.0 studies in vocational program (better understanding and application of i4.0)
- Equip with real i4.0 machines/application in the classroom
- Apprentice program with multinational companies
- Using digitalization to optimize further training

### Perspectives from Science

#### Swiss Federal University for Vocational Education and Training (Francesca Amenduni & Chiara Antonietti)

- Changes in VET programs – driven by
  - Disruptive digitalization of workplace and Industry 4.0
  - Learners' digital competence
  - Evidence-based models
- For a successful implementation of educational digital technologies in VET contexts
  - Technology accessibility and availability is a necessary but not sufficient condition
  - Teachers' digital competence explains technology integration well.
- The „Erfahrraum“: a technology-enhanced pedagogical model for supporting students' learning at the borders between VET school and workplaces (using digital tools in VET, as utility tools, interactive and collaborative tools, simulation/AR/VR/robots)
- “Erfahrraum” model as pedagogical guidance to design training for developing VET teachers' digital competence
- Technology integration focuses on students' learning needs.

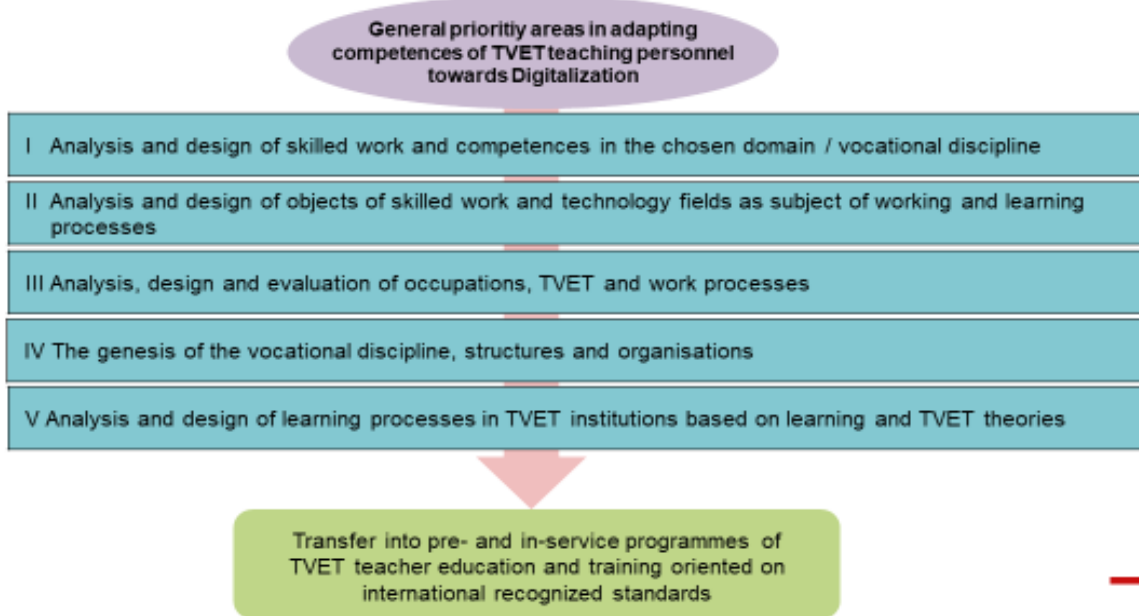
### Panel Discussion

#### „Multi-Experts“ Perspectives on TVET Teacher Training regarding Digitalization

Teachers play an essential role in order to both align training to the rapidly changing technological requirements of the industry

- and utilize digital resources in training appropriately.
- Aligning the digital literacy training of teachers which corresponds to the chosen method of teaching is fundamental to ensure
- effective learning outcomes / New teaching methods, new or different didactics
- Limited resource / lack digital content – access / limited digital skills of teachers
- Platforms – for distributing knowledge
- Training should prepare teachers to use digital technologies (incl. remote and blended learning) and understand labour market skills needs
- Digital resource is secondary resource – work reality first / Simulation allow preparation
- Infrastructure (low-medium-high tech) adapted support strategies
- Strengthen PPP's / policy initiatives
- Digital technology allow better connect school with company (remote sharing of equipment)
- The present capacity (industrial attachment / apprenticeship) is low but the demand is high
- New content is coming into existence through digitalization and automation, new skills as well – are students equipped with
- digital learning skills when entering TVET?
- Combining perspectives of Micro-Meso-Macro Level (Companies – Colleges) / Structured systematic approaches
- *Short term: only “repair deficits” - Better: holistic approaches on systematic teacher training (incl. equipment/content..)*
- *reform TVET teacher training systems / modernization of pre- and in-service training for TVET Teachers*

**DIGITALIZATION and TVET**  
Requirements and Approaches for TVET Personnel in International and Development Cooperation



Page 8 | 7 November, 2021 | TVET Academy - Academy for International Cooperation (AIZ)

## „Digital Resources“



**Ralph Hippe:** “Simulation allow preparation”

**Wahid Razzali:** “digital resource is secondary resource – work reality first”

## Challenges



**Lisa Marie Kreibich:**

“Limited resource / lack digital content – access / limited digital skills of teachers Infrastructure (low-medium-high tech) adapted support strategies, limited government policies

- Teachers professional development”

Source: [www.giz.de](http://www.giz.de)

## New Cooperation mechanisms

Complex learning environments – mirroring complex work environments Project based learning

### **Ralph Hippe:**

Digital technology allow better connect school with company

Online record book of training process

Remote sharing of equipment

### **Lisa Marie Kreibich:**

Industry Partnerships / Centres of Excellence (in industrial areas)

How TVET Teachers should be trained in the digital age

### **Lisa Marie Kreibich:**

- Short term: only repair
- Better: Holistic approaches on systematic teacher training (incl. equipment/ content.) – reform TVET teacher training systems

### **Wahid Razzali,**

### **Karine Sonigo:**

- Platforms – distributing knowledge
- Digital TVET framework (to be published)



Source: <http://medien-kompetenz-netzwerk.de>

# Workshop 1

## Occupational structures, training contents

Moderation: Georg Spöttl, University of Bremen

Rapporteur: Holger Regber, Project Manager,  
Festo Didactic

This session addresses the core issue of how to structure occupational profiles and standards considering the massive changes in the world of work as well as changes in production and business processes by digitalization. Selected examples will reveal the processes and mechanisms behind the adaptation of curricula.

### Introduction

All presentations delivered in the Workshops discussed the future needs of industry and the shaping of training profiles triggered by the digitalized challenges. Different ways of occupational structures were under discussion due to different fields and requirements. The common driver of all presentations and the discussions was the question “how TVET should react due to digitalization.” The answers were manifold:

- a. An approach of agile teaching to master the volatile requirements for the TVET world is necessary!
- b. A differentiation and individualization of occupational profiles is needed. It should be split into common training modules and individualized company-oriented profiles!
- c. We need an adaption of future workers’ qualifications. This must be done in cooperation with the business sector.
- d. Industry 4.0 technologies are part of several professions and emerge in traditional jobs!
- e. The best mix of cooperation between companies and vocational schools have to be identified and ways for enabling teachers and trainers for digitalization have to be created!

Initiatives are needed to find the correct approaches to enable TVET teachers and trainers to drive the process to get “Fit for Industry 4.0”.

### Inputs / Discussion

#### **Structural models of occupations and approaches of adjustments in metal and electrical sector in alignment towards Digitalization / Industry 4.0 in Germany**

Gert Zinke, BIBB, Germany

A brief insight was given into the German discussion on future structural models of training occupations in response to digitalization. However, the question arose whether the training system would be fit for the future because of the challenge of digitalization. Some of the main statements were:

- Digitalization is changing the core of the occupational profiles.
- Digitalization does not call the professional concept into question.
- Digitalization meets the skilled workforce unequally

#### Installing new Standard Competences

All German training regulations contain so-called common standard competencies. These competencies were renewed in 2021. Examples for the supplemented themes would be the competent handling of digital media and data. Also, communicative and social competences as well as appreciation of social diversity amongst one another. Furthermore, the ability to act and take decisions considering economic, ecological and social aspects within their professional environment.

Four new themes have now been introduced to supplement all current training regulations:

- Digitised Working World
- Environment and Sustainability
- Safety and Health at the Workplace
- Company, VET, Labour and Tariff Law

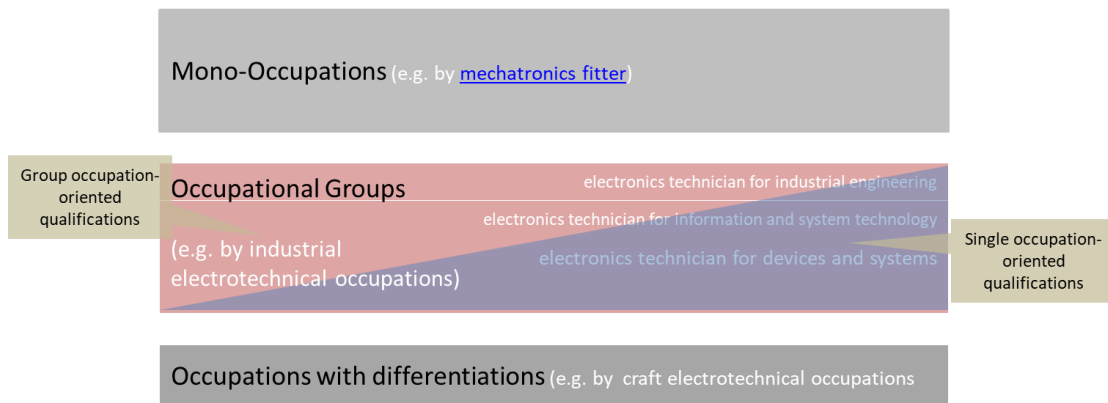
These new themes will be included into all the present occupational programs and so, will apply to all trainees. All companies involved in training are obliged to integrate and implement these subjects in their individual company training programs.

It is to specifically emphasise: this general framework is the common basis upon which vocation-specific content can be added. Taking the new occupation in 2021 "electronics technician for building system integration" as an example, the course would be based on the above mentioned new four „champions“.

And in addition, it would have his vocation-specific requirements added to it.

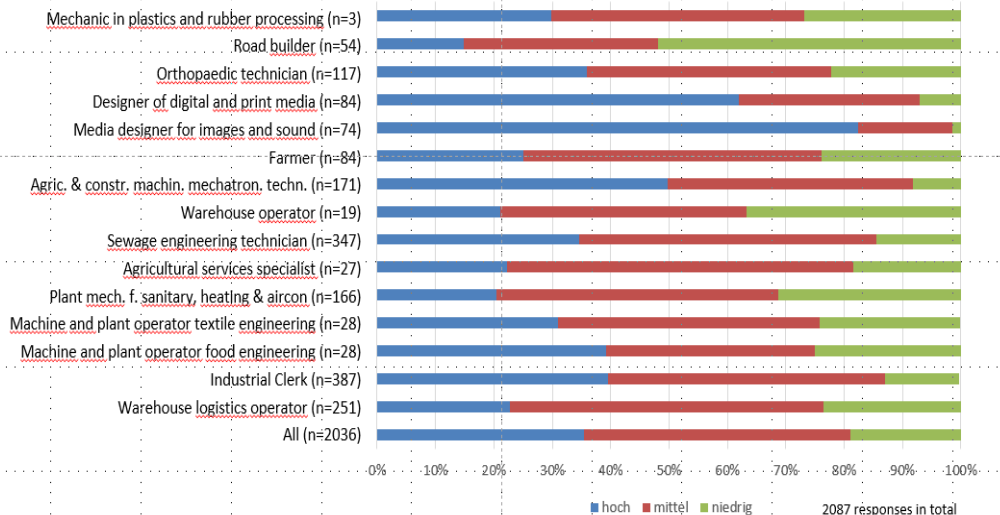
All of these points are considered during the whole traineeship at all training venues and are also integrated into the final examinations.

### Structure Models of Training Occupations inside of Metal- and Electro-Technical Training Occupations



### Digitalisation Level in Work Processes results given by Occupation Screenings (2018)...

*How do you rate the current degree of digitalisation of your company in the work area of [target profession]?*



**Approaches in adaption of training programs towards requirements of Digitalization / Industry 4.0 in selected occupations in Vietnam**

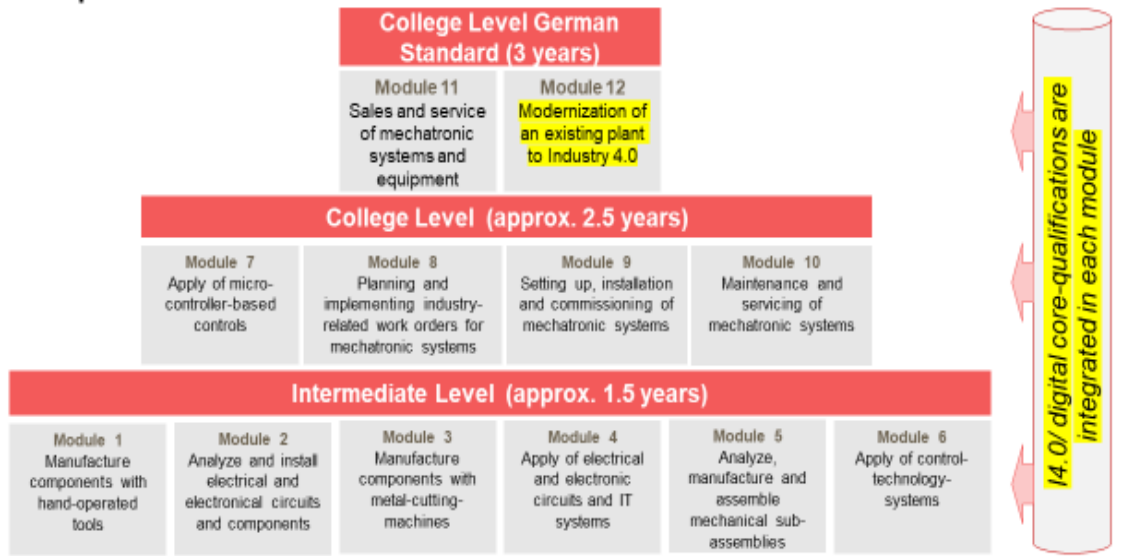
Nguyen Khanh Cuong, College LILAMA II, Vietnam

The focus of the presentation was the development of the Vietnamese vocational training system and the embedding of LILAMA II, an internationally oriented college. The current challenges posed by

Industry 4.0 and the resulting training concepts were presented. The necessity of training TVET teachers and in-company trainers was emphasized. The concept of LILAMA II college in cooperation with industrial companies was presented in detail.

**Adapting training programmes towards I 4.0**

**Example: Mechatronics**



**Upgrading training equipment towards I 4.0**



Provided CPSi4.0 training station, acquired in the frame of the DPP "Integrating requirements of Industry 4.0 into TVET" with Bosch-Rexroth AG



**Designing of blended learning concepts by combination of virtual knowledge transfer and practical skill development**

Holger Regber, Festo Didactic

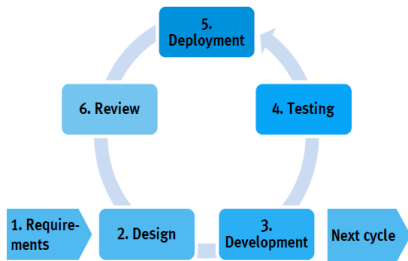
The presented "blended learning concept" directly connects to the requirements and qualification needs of Industry 4.0. The tasks of the skilled workers in the modern factory are summarized and combined with an "Agile Teaching" model. This model is the basis for competence development, which focuses on two approaches:

- knowledge-oriented e-learning and
- skills development in presence sessions.

Based on "paths of real tasks", the two approaches are used to promote the development of competences among skilled workers.

**A Change of Thinking about Teaching is needed**

As answer of massive volatile impacts, the management theory recommends the development to an **Agile Organization**.



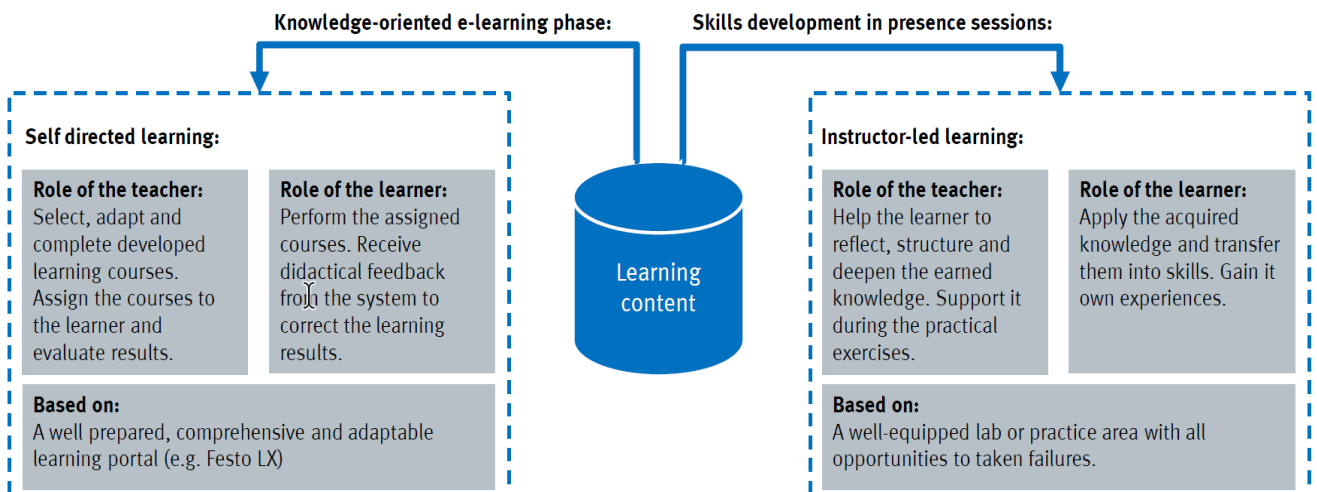
What does it mean?: **Agile Teaching**

Classical teaching	Agil Teaching
At the start, all requirements are known.	At the start, some requirements are fuzzy.
Based on rigid curricula.	Based on framework curricula and collaboration with the companies
Sequential teaching process	Iterative teaching process
Rigid process	Continues improvements are possible
Clear hierarchy	Self-organization and self-responsibility
Lesson-oriented teaching	Task-oriented teaching
...	...

Some consequences for the learning

- Role change:** from teacher/instructor to a coach
- Demand-oriented:** the learning contents focus more the needed topics
- Self-responsibility:** the learners are responsible for the learning success, not the teacher
- Competence-based:** the main focus is on the development of action competence
- Simplified transfer:** the knowledge can be applied immediately

**Blended Learning: one Agile Teaching Method**



**ADB experience in supporting client countries in aligning TVET curriculum to “Industry Revolution 4.0” technologies**

Fook Yen Chong, ADB

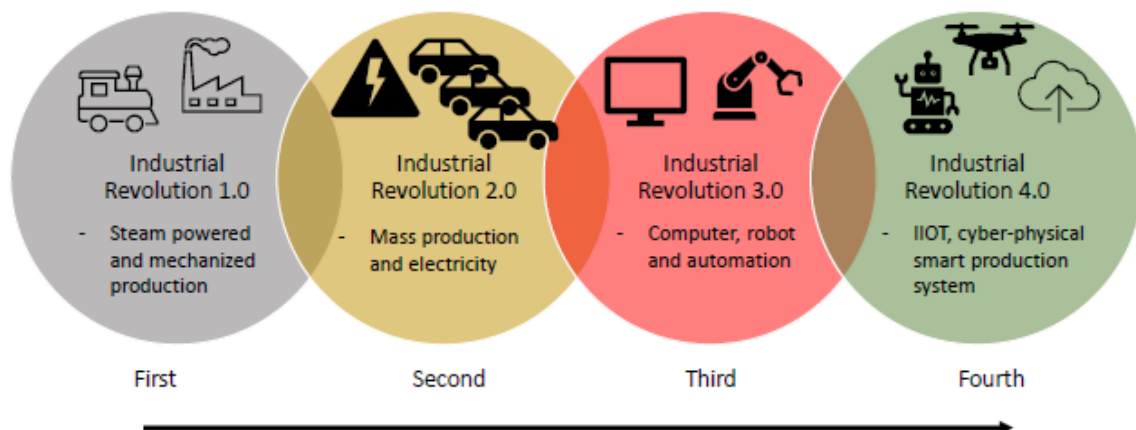
In the recent years, Asian Development Bank (ADB) has seen increased interest from Developing Member Countries (DMCs) to incorporate industrial revolution 4.0 (4IR) technologies and initiatives in ADB financed TVET and Higher Education projects. For example, the strengthening innovation for Philippines TVET (SIPTVETS) project has a strong focus on developing and delivering new 4IR curriculum and learning content across seven priority industry sectors. SIPTVETS project has the strong support of the Philippines Department of Industry that is leading the country national programs and initiatives on 4IR in transforming industries. Another example is the development of the Apparel & Textile industry transformation map for Cambodia as a continued support arising from a 4IR study ADB did for Cambodia.

ADB supports on 4IR includes but not limited to:

- ASEAN 4.0 study jointly with World Economic Forum (WEF) (2017)
- Reaping the benefits of Industry 4.0 study on Vietnam, Cambodia, Indonesia, and the Philippines (2021)
- Study on Industry 4.0 in selected Central West Asia Countries (to be published 2021)
  - Established the Global Technology Innovation Village Platform with Singapore Polytechnic and 19 other lead technology companies and government institutions to jointly promote and support 4IR transformations in DMCs, particularly on capacity building, knowledge, and experience sharing (2020)
  - Joint promotion of Global SIRI (Smart Industry Readiness Index) with WEF (2021); and

Incorporating strong focus on 4IR skillsets including new curriculum and learning content design and development in TVET/skill development projects financed by ADB.

**Industrial Revolutions**



ADB recognizes that 4IR technologies are cross-cutting and applies to all industries sectors. And 4IR transformation may be gradual different due to technology costs and absorption capacity of industries and learning institutions in DMCs. To help DMCs in their 4IR transformation journey, ADB practices the approach of (i) supporting DMCs in mindsets transformation through 4IR awareness studies and training initiatives; (ii) skillsets

transformation by facilitating partnerships and co-operation with lead technologies companies and learning institutions that already have well developed 4IR solutions and training courses; (iii) behaviors transformation by establishing sustainable ecosystem at project level on advanced technologies co-solutioning with companies. Through practices on co-solutioning for 4IR applications with companies, curriculum design and development will be better contextualized to the need of the countries.

## IR4.0 initiatives by ADB

ASEAN 4.0 study jointly with WEF

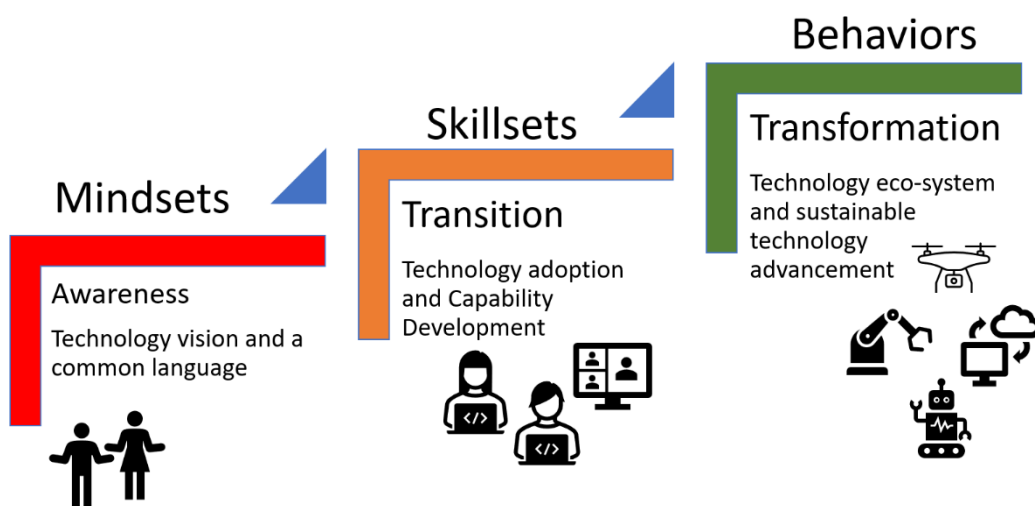
Reaping the benefits of IR4.0 (4 ASEAN Countries) + Central West Asian Countries

Under Global Technology Innovation Village platform (GTIV), ADB and SP together with GTIV partners organized a series of IR4.0 workshops for selected DMCs

Global SIRI assessment jointly with WEF for selected DMCs

Project level IR4.0 design

## Transformation Approach for TVET Institutions



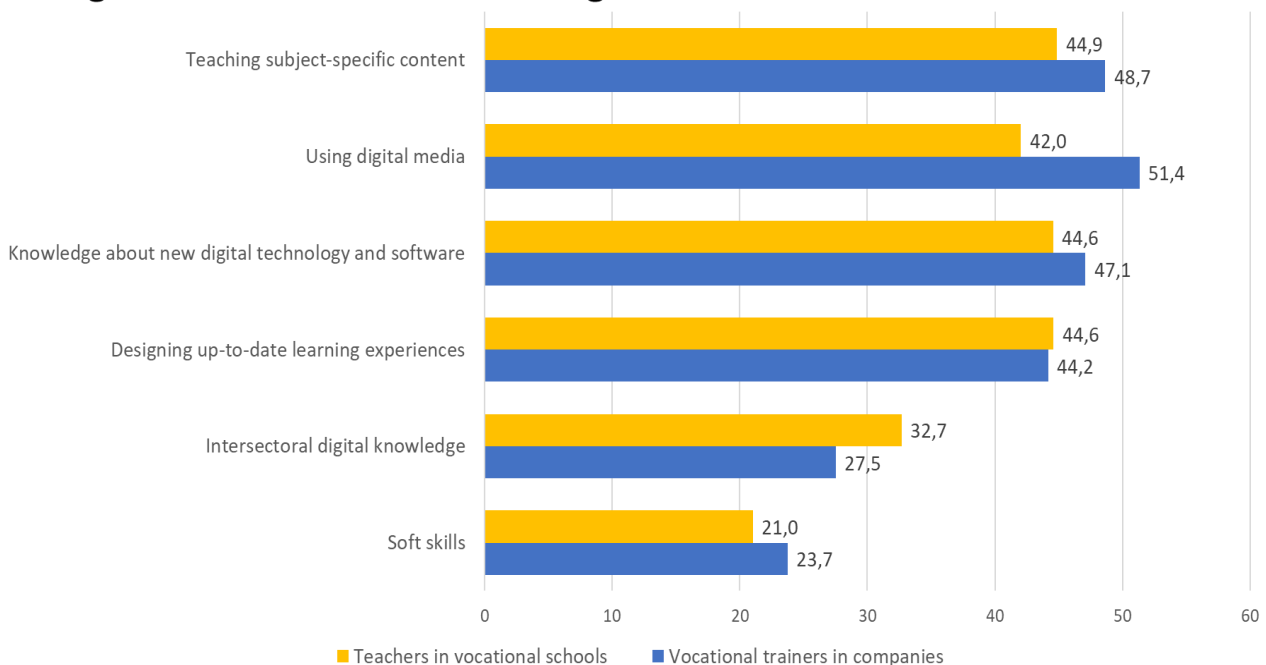
**Changing technology – changing vocational education? Ongoing challenges for companies and vocational schools**

Christoph Metzler, Institute of German Economy (iw)

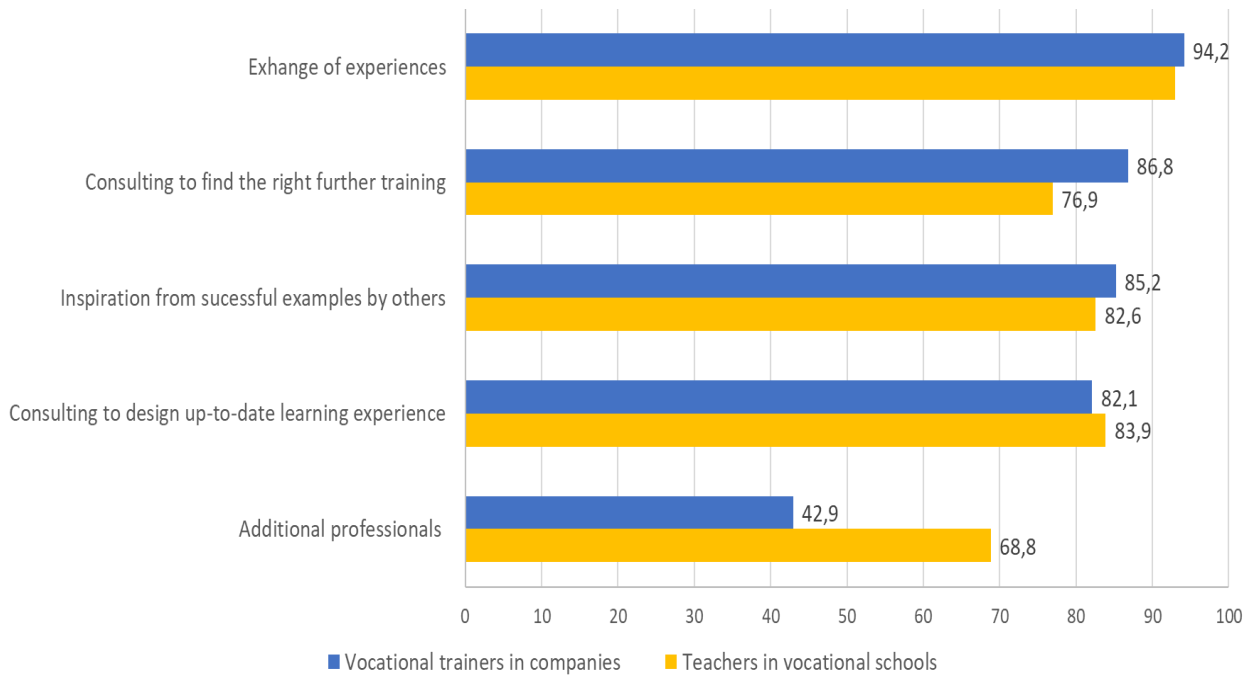
Using quantitative data from recent surveys of executives of German companies and German professionals engaged in TVET, the presentation aims to offer a short introduction to the status of digitalization within the German dual vocational training system. Based on three short research questions changing demands due to digitalization, current challenges, and possible solutions to foster digitalization are presented. First, competencies are discussed that from the perspective of executives of companies are essential for German skilled workers with a vocational degree after successfully finishing an apprenticeship.

Looking at the competencies currently trained within an apprenticeship, a strong cooperation of German companies and vocational schools can be established. Vocational trainers in companies and teachers in vocational schools are both challenged by the changing nature of their job due to digitalization, e.g., they need more time to fulfill their duties as they find the contents to train increasingly complex. TVET professionals from both groups have a similar and high demand in further training to improve their digital competencies but might need different support measures to foster digitalization. The presentation closes with impulses for further discussion and possible research.

In these areas, German professionals in TVET report a high need for further training



## These support measures are seen as helpful by German professionals in TVET



## Workshop 2

### Digital resources, media, tools, platforms

Moderation: Hector Niehues-Jeuffroy, GIZ Sectoral Department TVET

Rapporteur: Hector Niehues-Jeuffroy, Fachplaner

Digitalization and the discussion about digital resources, media, tools and platforms belong closely together. Chances are that the challenge posed by digitalization can partly be solved by creating those digital resources media, tools, platforms and making them available. This session will provide with insights into good practices of e-learning up to the use of virtual reality in training processes.

#### Introduction

While the digitalization of TVET is more than a merely technological process, digital technology is at its heart. Correspondingly, Workshop #2 explored the use of digital technologies – especially extended reality (XR) and e-learning – in TVET.

In terms of approaches towards the use of digital technology in TVET, the discussion

showed that sustainable digitalization of both individual institutions and broader TVET systems cannot work with approaches that target a single level, e.g., only TVET teachers or only TVET management. Rather, as exemplified by the GIZ-supported digitalization of training institutions in the Jordanian water sector, there is a clear need for multilevel, holistic approaches that combine capacity development at the micro (individual), meso (institutional) and macro (ecosystem) levels. The workshop also showed that digital technology was generally introduced into TVET by a small vanguard of digital enthusiasts – often with COVID-19 lockdowns as catalyst –, followed by a wave of national standardization and coordination, rather than through centrally planned top-down initiatives. In light of these successes, a key recommendation is to leave sufficient room for pilots before scaling up the use of a digital technology throughout a TVET system. Moreover,

the various digitalization journeys showed the need to invest sufficient resources into the planning stage of technology adoption. At this stage, the local context(s) of digital technology adoption should be carefully assessed, as failing to do so may endanger the initiative's sustainability and risks exacerbating existing digital divides if already marginalized target groups struggle to access and use the technology.

Concurrent with the vision of a future of TVET where learning is increasingly blended, the workshop showcased several examples of e-learning. These included the development of a national e-learning platform for TVET in Mongolia, the introduction of e-learning in Vietnamese TVET colleges, the use of e-learning in the Jordanian water sector, and Christiani's translation of technical books into e-learning modules. A major discussion revolved around the use of open-source e-learning software – most e-learning case studies used Moodle (plus a few Big Blue Button users) – as an alternative to the use of licensed software (e.g., Articulate Rise). While open-source software is more flexible and available for free, making it a default choice for low-resource TVET systems, using it requires more training than user-friendly licensed solutions. However, the potential that the use and maintenance of open-source solutions for the creation of context-adapted learning management systems or e-learning materials may also provide positive externalities such as the build-up of valuable IT skills should also be considered. Moreover, the use of open-source solutions may also enable students to become involved in the creation or customization of learning contents and thus take stronger ownership of their learning journey. Key challenges in the adoption of e-learning (and especially online learning) included limited internet connectivity and a lack of compatible devices at TVET institutions and students' homes, the lack of affordable and relevant (e.g., in terms of language) e-learning contents, a lack of standardization regarding technology and digital resources, limited digital skills among TVET teachers and trainers, and the lack of local capacities for the further development of e-learning. Finding the right balance between online vs. offline, self-paced vs. instructor-paced learning was described as determined by the context, infrastructure and access, digital literacy and the motivation of target groups.

In line with XR's key role in blended learning, the workshop highlighted the growing use of XR in TVET, with featured XR applications including Christiani's AR-compatible textbooks, the use of integrated Building Information Modeling (BIM), VR and mixed reality software in project-based training in South Africa, and the use of AR/VR at ITCILO's VocTech Lab. Participants agreed that XR approaches offer substantial advantages for TVET – e.g., higher skill retention through simulation, new digital tools for assessment (e.g., trade tests), flexibility, efficiency through digitalization, early exposure to digital work environments and better occupational health and safety. However, they also urged to consider the heterogeneity of XR approaches as well as challenges related to their use, especially in LMICs; chief among these challenges stands the high cost of especially VR devices and learning contents, but also the need to train teachers and users and to develop new pedagogical approaches.

Both with regard to e-learning and to XR, the workshop raised interesting questions around the data of digital technology users. While providers of digital technology seem interested in collecting data on the performance and user context of digital technology (e.g., to improve their service offer), they feel restricted by data privacy frameworks (e.g., the EU GDPR) and firms' reluctance to share performance data. Importantly, if the further development of digital technology is mainly based on feedback data that reflects the needs of developed contexts and if such needs substantially differ from those of LMICs, digital technology may be ill-adapted for LMICs' TVET contexts – the growing availability of user data from LMIC contexts notwithstanding.

Concludingly, the workshop saw the opportunities afforded by the use of digital technology in TVET contrasted with the implementation challenges encountered in many low- and middle-income countries (LMICs). While the workshop showed that e-learning and XR can be successfully used in TVET contexts in LMICs, the questions of whether and especially under which conditions digital technology can cost effectively improve learning outcomes in LMICs' TVET systems await further and more rigorous investigation.

## Inputs / Discussion

### **Development of a national eLearning platform – approach, concept and support by eTVET** Lukas Dietrich, GIZ-Advisor, eTVET Mongolia

#### Background

The Government of Mongolia reacted swiftly to the spreading Covid-19 pandemic and as one of the first measures, schools were closed in January 2020 lasting until September 2021. This effected the teaching and learning situation at Mongolian Technical Vocational Education and Training (TVET) Institutions tremendously. eLearning suddenly became essential for the Mongolian TVET sector. A major challenge was that existing online training materials, textbooks and other media in Mongolian language were not available nationwide and previous efforts to use eLearning/blended learning have not resulted in sustainable solutions. TVET teachers had to switch from face-to-face to online teaching from one day to the next, with no instruments and methods provided for the distance teaching to reach the TVET students remotely. Additional funding provided by the German Government allowed the Cooperative Technical and Vocational Education and Training Project (cTVET) to support the Mongolian TVET sector with regard to eLearning.

#### Approach

Together with a community of practices (TVET school staff, teachers, Ministry and implementing agency, private sector) challenges with regard to eLearning in Mongolia were identified and requirements were formulated. The main challenge was to ensure a sustainable systematic and structured approach while responding to the immediate demands created by the Covid-19 pandemic. Therefore, a hybrid approach was implemented. This approach built on a) providing an easy-to-use resource pool that can be used in TVET training by the teachers with immediate effect, while – in the background – developing b) a strategic, long-term approach for a national “Mongolian Digital TVET Learning Platform”. This process was accompanied by capacity development measures of administrators (to maintain the learning platform) and of an eLearning

team (to develop and produce adequate eLearning content / see WS3).

**Approach a)**

TVET Learning Resource Pool (short term):

The Resource Pool was designed as a temporary one-time Covid-19 emergency measure. A website with quality checked, existing resources as well as methodology for Covid-19-related distance education was set-up and made available to the Mongolian TVET sector.

**Approach b)**

national Mongolian TVET eLearning Platform (LMS) (long term):

Based on an informed decision-making process for the technical solution, an open source software (Moodle) a comprehensive platform allowing TVET training institutions to set up their own eLearning courses and training measures, share resources, provide student access to their courses, provide in-company trainers a space to learn online, enable the Ministry to communicate to the schools and distribute regulations was set-up (running from a central server). The LMS is managed by a local team of administrators (TVET Assessment, Information and Methodology Centre).

In addition, the digital infrastructure at the 7 supported TVET schools was updated and the schools were registered for the Microsoft 365 Education package.

Status quo

TVET schools as well as the national TVET implementation agency (TVET AIMC) are piloting the national Mongolian TVET eLearning Platform, running courses and developing eLearning material. Additional TVET schools expressed interest to join. The step by step roll-out allows to identify and address challenges (technical and structural e.g. definition of roles and responsibilities) and to provide the necessary support by the cTVET project.

**Development process of Mongolian eLearning platform Dietrich, Lukas GIZ MN**





**(Digital) Capacity Building in the perspective of ILO – the triple helix**

Stefano Merante, ITC ILO, Turin

The general thesis of this paper was as follows:

TVET made a very profound mistake in the last 20-30 years. It was assumed that

- vocational skills
- technical skills and
- softskills

could only be developed by teaching theory in the classroom and practical exercises in workshops and laboratories. This fact prevented the development of digitalized tools for learning, which can help to eliminate the separation of classroom learning and practical training. According to the speaker, AR & VR (augmented reality and virtual reality) are particularly suitable for the interpretation of online learning and physical training.



In order to realize the outlined claim, ITC/ILO has developed a "digital capacity building concept", the so-called "Triple Helix" model with the three interconnected activities in building capacities:

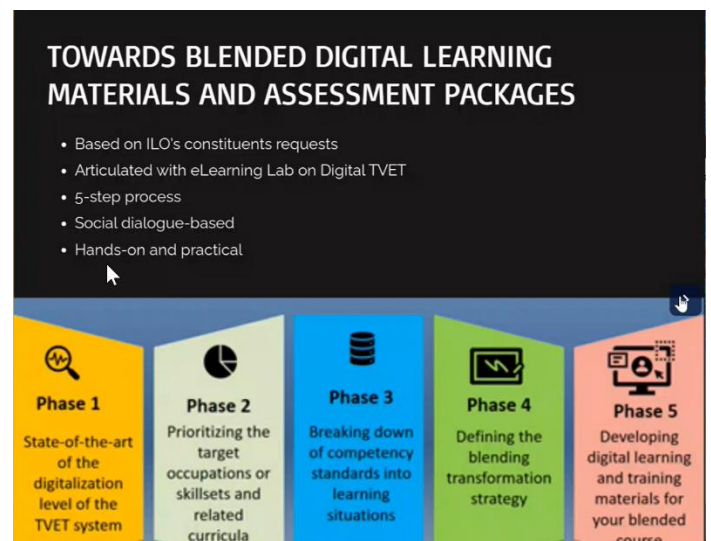
- capacity development support for individuals,
- capacity development support for organizations, and
- capacity development support, aimed at the ECO-system, with which individuals and organizations interact.

Capacity development is understood as a process that includes feedback loops, overcoming of barriers and much more. This process is intended to help

"digital enthusiasts"

to ensure immediate actions. Teachers, trainers, young people play an important role. Especially the "Generation Alpha" has to be inspired, for which "specific teachers" are needed.

ITC has set up the so-called VocTechLab for capacity development, which is based on blended learning concepts and implements digitalized learning units that use AR and VR as instruments. This is based on a model with Five Phases.



**Integration of AR/BIM software in project-based-training – 2 examples from training in electrical / sanitary installation in South Africa**

Harald Fleischmann, CEO, Fosh-Learning

The South African Department of Higher Education and Training (DHET) has identified that the current artisan supply system is ineffective and that it does not produce the required results. A decision was therefore taken to pilot a dual apprenticeship system in South Africa to improve on the prevailing system. This pilot commenced in 2013 and the Skills for a Green Economy programme (SD4GE II) that is facilitated by the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), is one of the initiatives that contributes to the overarching aims of skills development in South Africa.

Low trade test pass rates of the participants despite a dual and modern approach have proven the importance of critical thinking skills not only for a pass, but more so for a successful career in a fast-changing, technologically complex, client driven environment. Therefore generic, output driven teaching needs to change to a project-based approach making use of new methodologies such as flipped classrooms, virtual reality and BIM software.

Virtual Pilot Trade Test Plumbing

The participants were exposed to a virtual construction site in various building stages. Participants had to interact and move around within the building site, solving interdisciplinary professional and work-related problems and finally perform the practical task.

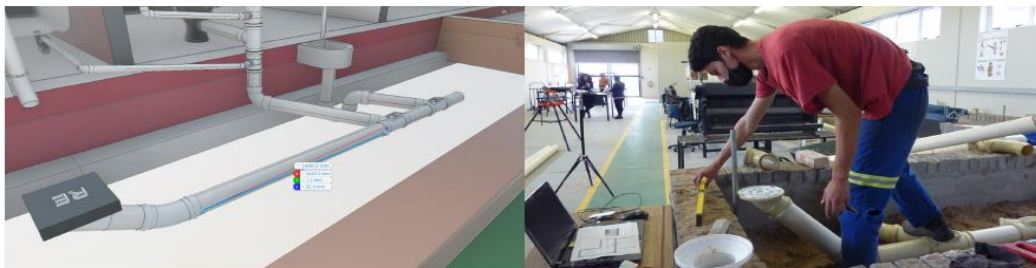
Common topics, such as hot water preparation, above and below ground drainage, sanitary fixtures and rainwater harvesting, had to be performed digitally and within this virtual environment.



virtual

vs.

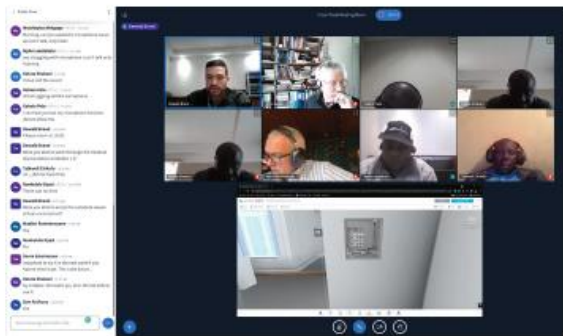
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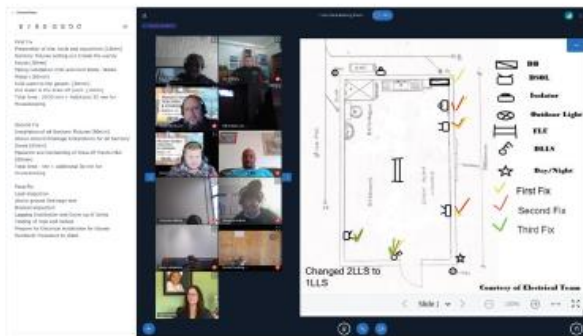
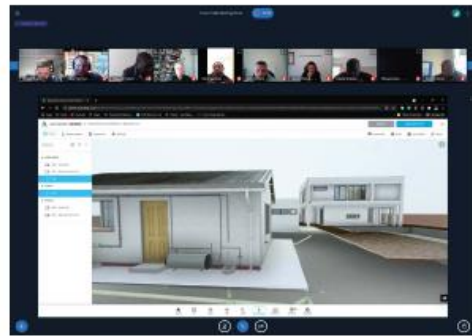
Lecturer Capacity Building

As part of their cooperation agreement with the South African Department of Higher Education (DHET), the SD4GE II project developed and piloted an innovative and modular approach for Lecturer Capacity Building (LCB). The concept integrates theory, practice and actual workplace experience, combining virtual and real work life tasks with mentoring from industry experts.

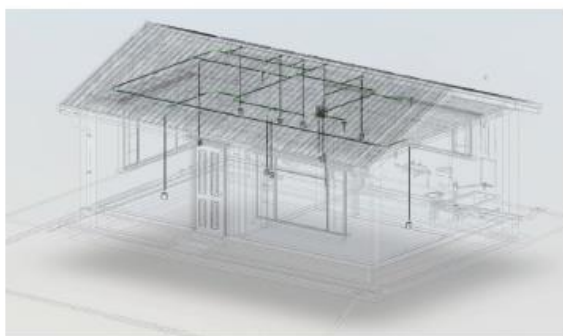
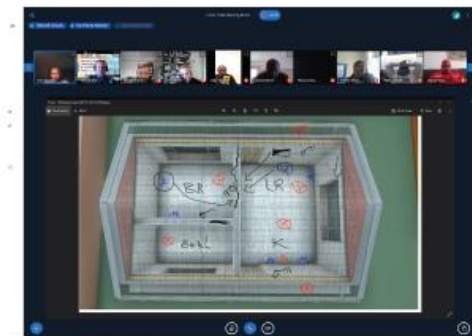
This lecturer capacity training implemented BIM material, VR as well as live streaming to showcase the efficiency of using these tools in a training environment. This allowed lecturers from different trades and industry experts to collaborate in virtual and various real world environments from multiple locations. This form of training allows for lecturers and artisans from different backgrounds to come together and share their knowledge on a common platform. Being able to explore, plan and execute tasks collaboratively proves to be very valuable when training lecturers from different disciplines.



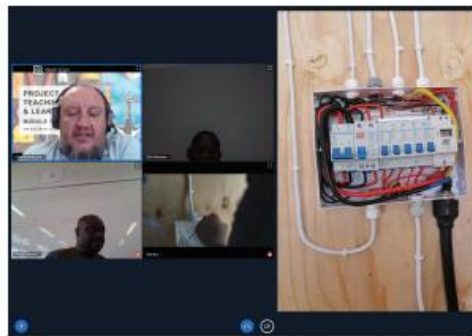
Exploring the granny flat virtual environment



Planning of electrical layout in virtual environment



Isolated electrical layout in virtual environment



Collaborative Discussions of test on DB Board - reality

### Key points of the didactic concept

- The training process is conceptually designed and implemented as an interdisciplinary and comprehensively integrated teaching project in such a way that the participants are able to transfer it directly to their own teaching work.
- The fully integrated concept of the advanced training series includes planning, methodological implementation, multimedia support and evaluation of the lessons.
- The subjects and problems of the training modules are derived directly from the professional assignments of the respective occupational fields.
- Relevant skills and knowledge are identified and developed from the professional work assignments.
- The reality of the profession is reflected in the training through a holistic project approach: Clarification of the order, information retrieval, planning, execution, commissioning, testing, handover, documentation
- The learning and work processes are interdisciplinary and capture the holistic and complex nature of today's professional reality.
- Situation- and work process-oriented use of digital instruments such as virtual reality.
- Target and purpose-oriented integration of IR 4.0 topics, blended learning, virtual learning and e-learning elements.
- Reflection of the teacher and student roles by changing the perspective while going through the learning and working processes.
- Strengthening the role of the teacher as a mediator and questioning the role of the lecturer through the increasing transfer and assumption of responsibility for learning processes by participants.
- Promotion of lifelong learning by active participation in the learning processes and development of knowledge and skills by the participants.
- Stimulation and support of peer-to-peer learning and work arrangements of participants, also via digital platforms.

Using BIM (Building Information Modelling) for project-based learning allows lecturers / apprentices without specialist architectural training to view, teach and learn from architectural content. This encourages open accessibility, enabling anyone to explore and access this information without the requirement to duplicate data.

Lecturers can collaboratively (across trades) work in this open space from multiple locations that would traditionally be limited to on-site learning. Having a single dataset allows edits to the curriculum that will automatically propagate throughout the entire system. This detailed dataset forms the backbone of the gamified educational content used for teaching and assessment tasks.

VR and mixed reality technologies improve artisans' technical abilities that are applied within the digital BIM environment. These systems are interactive, dynamic and draw on the skills required of the artisans who operates in the 4th industrial revolution.

## Conceptual approaches in piloting and dissemination of e-learning in TVET Colleges in Vietnam

Christian, Hoffmann, Advisor, GIZ Vietnam

### Development of online teaching approaches

During this turbulent Corona period began the digitization component of the GIZ program “Reform of the TVET sector in Vietnam” advising on the digital transformation of the TVET sector in general and support for 11 selected TVET colleges in particular.

In their efforts to keep teaching operations going as far and as well as possible, the colleges went through different phases of their approach:

Since the switch to online teaching was completely unexpected, the colleges gave their teachers a free hand during this first phase as to how they could conduct their teaching. Important was only that the trainees were somehow reached. The teachers used the digital tools they knew best; Video conferencing apps such as MS Teams, Zoom, Skype or Google Meet were used for synchronous lessons, as well as mobile communication apps such as WhatsApp, Zalo and Telegram. Teaching materials and homework were sent by e-mail, technical processes in the workshops were recorded using explanatory videos and uploaded to YouTube, other teachers used the newly created classroom function on Facebook. The advantage of these many individual solutions for the colleges was that hardly any investment was necessary, neither in the technical infrastructure nor in the capacity building of the actors involved.

After a few weeks of experimentation, most colleges pushed for a unified approach to their online teaching. Many TVET colleges as well as many primary and secondary schools in Vietnam opted for the solution with google classroom for lecture delivery and google meet for synchronous teaching. The google classroom solution is quite handy, as the entire google suite palette with apps for chatting, saving data and calendar functions can be integrated. Another argument in favour of this approach is that the (limited) use of this lecture delivery software has so far been free of charge and can be used intuitively without much training.

From March 2021, GIZ has been promoting the digital learning management platform Atingi of the German Federal Ministry for Economic Cooperation and Development (BMZ). The Moodle-based Atingi enables access to digital learning content free of charge and in compliance with European data protection regulations (GDPR). With Atingi, the GIZ-supported TVET colleges in Vietnam had a real learning management system (LMS) available for the first time, which enables collaborative learning and, through its interfaces and plug-in options to other programs, also allows the integration of advanced solutions for technical training content. However, the use of Atingi required extensive training, especially at the level of the course creator, in order to be able to exploit the manifold possibilities of the Moodle based LMS.

After the initial euphoria when using Atingi, two disadvantages soon emerged in relation to the use of Atingi for regular TVET lessons: On the one hand, Atingi cannot be customized for the individual TVET college, neither in terms of design nor in terms of the interfaces and, on the other hand, the administration has access to various learner data, but these are located outside of the school's IT infrastructure in the Atingi cloud, so that they would have to be laboriously imported.

However, these disadvantages can be overcome if the individual colleges download the open-source Moodle free of charge and install it on their servers. What sounds so simple, however, has two major technical implications:

On the one hand, the server capacity of the school has to be expanded to meet the requirements of the LMS, in particular the integrated video software BigBlueButton, and, if possible, shifted from a local server to the cloud. And secondly, the LMS Moodle has to be linked to the existing data architecture of the school through quite extensive programming work in order to be able to optimally analyze the data obtained from the LMS. These two investments on the part of the TVET colleges are quite costly and time-consuming.

The GIZ program implemented the described solution as best practice at the TVET college LILAMA 2 in Dong Nai / Southern Vietnam in mid-2021

(Slide 1) and the first Moodle courses have been running in trial operation since September 2021, before all (online) lessons will be carried out on the Moodle LMS from January 2022 onwards. The dissemination of this solution to the other TVET colleges will start from 2022.

Challenges

During the consulting and implementation processes, various challenges arose in the areas of human resources and technology:

Regarding human resources, the school's IT administrators play a key role; they absolutely must be carefully involved in the change process and support the solution, as they will be responsible for the functioning of the IT infrastructure in the future. To do this, they must be enabled through targeted training measures. The same applies to teachers, who will also assume different roles in the future, such as course creators, tutors, or the creators of teaching materials.

On the technical side, the enormous capacities were initially underestimated, which is required to have an entire TVET institution in operation online; server capacity had to be upgraded several times and designed flexibly so that larger capacities are available at short notice during exam times, for example. In addition, the programming work, connecting the Moodle LMS with the existing digital ecosystem of the college, was more challenging than initially planned, but in the end the local IT agencies managed to find creative solutions for this.

Outlook

What are the lessons learned from this experience? Which technical solutions will be best able to map and advance the digital transformation process at TVET colleges in the future?

Does the future lie in one stop solutions, as we have implemented them in our pilot college LILAMA 2? A kind of all-encompassing system in which the TVET actors immerse themselves and use everything from e-learning to enterprise resource planning to extended reality applications? Or will there be a juxtaposition of different, incompatible technologies, where among others glass technology, robotics and virtual reality trainings compete?

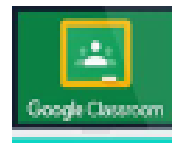
**GIZ Vietnam approach to DX in TVET**



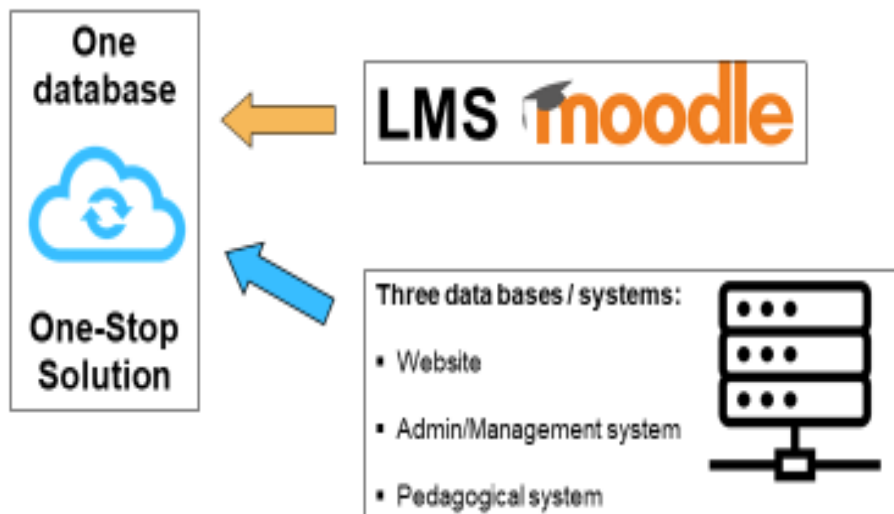
© Ho Tu Bao (2020)

## E-Teaching technical Szenario 1

- At the beginning of the Corona crisis
- Mixed approach
- The teachers choose their favorite apps
- (almost) No investments needed
- Minimal capacity building



## Best practice solution at LILAMA 2 college



## The benefit of Digitalization in vocational education and training

Christian Eismann, Paul Christiani GmbH & Co. KG

Digitalization, as a phenomenon of the current industrial transformation, has a huge impact on vocational education and training. New content in the fields of IoT, immersive learning, which includes AR and VR is increasingly becoming part of technical training. Also, the mediation of knowledge takes on digital ways, as we know e-learning and digital books have long since found their way into training. This presentation sets the goal to highlight the several benefits that come to light when implementing digitalization to the program of vocational education and training. It is clear to see that social circumstances affect the involvement towards digitalization, hence the pandemic contributed to the fostering of home office and the rapid forward motion of digitalization. Some working places haven't had another choice and some of them have sensed the opportunity to reach out to the holdouts in their company. So, after the pressure dominated phase of finding quick solutions to overcome social distancing in education the trainers could purchase willingly and reasonable to enforce the digital ways in their vocational training. Even e-Learnings gained more importance than ever, although their long-predicted peak was missed over the years. Recently the world of education and training seizes the perspectives and practical strategies the teachers are given, what adds up to connect theory and practice at the working place. Basic requirements are discussed, for example the way of communication and the possibility of decentralized training (multi-user rooms in VR/AR), which means that internationally operating companies are able to mediate a unitized course of instruction. Therefore, Christiani provides the know-how alongside the hard- and software that is required by the students. The latter's requests on being taught holistically and with all the available technologies shall not be underestimated. Since it is now a user-generated learning world in which students are not necessarily dependent on the teacher's measures it is inevitable to keep up with the technologies in the very beginning of the vocational apprenticeship. This can be resolved by taking risks

and being open-minded. Yet Christiani does not approach digital transformation by means of eliminating the existing methods, but to combine them and enhance them. On that note the content of printed media serves the produced e-learning and the AR-application enhances the printed media by for example displaying 3D-objects on particular pages, where an enhancement is truly needed. In view of handling the digital transformation in a reasonable way, trainers should consider a digital literacy. Because to digitalize objects, books, or other teaching aids just for the sake of digitalization is not the goal we pursue. However, the upwind of digitalization should be used to full capacity to leave no trainer behind and to provide the students with the knowledge they are going to need in the near future. Christiani works on several projects to ensure this development. Be it the production of e-learning (learning management system), the provision of high-quality content or the chances of mixed reality and immersive learning by creating solutions in the fields of AR that are lucrative or in the segments of VR to extend the range to products off-the-shelf.



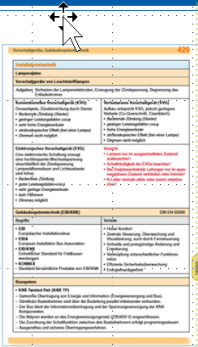
Digital enhancement in vocational training

## Technical book series in the fields of electrical engineering

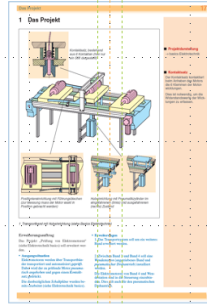
Christiani

Seite 1531

### Electrical Trades Handbook



### Electrical Engineering basics & advanced



### Exam Preparation for the finals part I and II

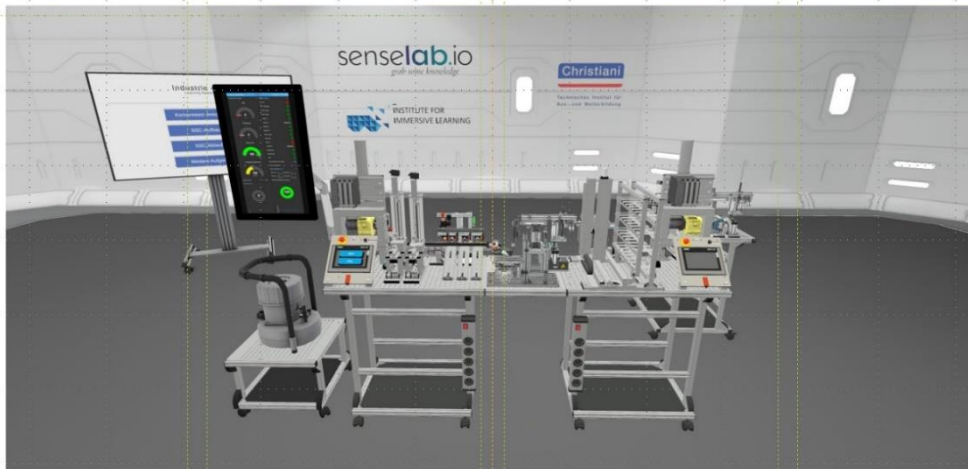


Digital enhancement in vocational training

## XR-Collaboration

Christiani

Seite 1531



Digital enhancement in vocational training

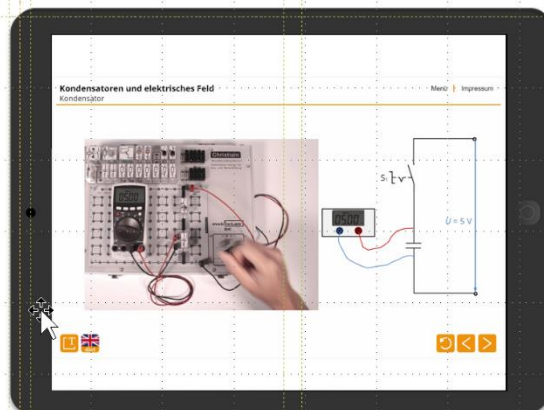
## E-Learnings based on the technical books

Christiani

Seite 1531

30 thematic modules, for instance:

- ✓ The basics of Electrical Engineering
- ✓ Electronics 1 – Passive components: resistances
- ✓ Electronics 2 – Passive components: capacitor and coil



## Digitalization of Training Institutions – A multi-level approach from the Jordanian Water Sector

Dirk Winkler, Program Director, GIZ Jordan

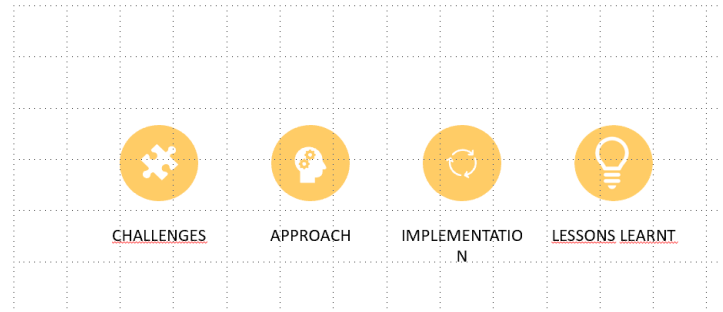
The demand for water in Jordan is continuously increasing due to the expansion of irrigated agriculture, industry and population growth and the fast-growing need for drinking water exceed the available renewable water resources by far. On top of that, current climate forecasts predict more and more fluctuating precipitation patterns. Freshwater availability in Jordan is thus expected to further decline. The groundwater level is falling in addition the Water resources are inefficiently managed in Jordan.

The Ministry of Water and Irrigation and the Jordanian water utilities such as the Water Authority of Jordan (WAJ), the Aqaba Water Company (AWC), Yarmouk Water Company (YWC), Miyahuna Water Company (MWC) do not have enough qualified specialists to operate and maintain the water/sanitation network and technical facilities efficiently in the long term.

The lack of qualified specialists who can offer water and sanitation services at the household level as well as the lack of qualified operating personnel in the water supply companies prevents the efficient use of water as a resource. The capacities of sanitary and water supply specialists in Jordan are inadequate.

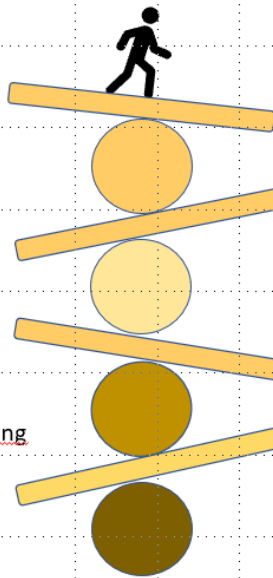
The GIZ project Wastewater Treatment and Reuse (WTR) supported the establishment of the Water Training Center. The Water Training Center is operated under the umbrella of the Water Authority of Jordan, but it is foreseen to serve as training center for the whole Jordanian Water Sector. Digitalization is not only of high relevance because of the Corona pandemic. In order to manage the center efficiently offering state-of-the-art training courses, GIZ assists WAJ in the digitalization of the Water Training Center. To overcome challenges like missing IT equipment, limited software licenses and poor qualified personnel, a multi-level approach has been adopted:

- The management level is addressed by training the steering committee to create acceptance and to acknowledge Digitalization. Therefore, specially designed training courses as well as continuous exchange take place.
- The second level is the institutional Level: Adequate technical equipment (software and hardware) as well as a Learning Management System (open source) have been/ will be provided to design and conduct digital trainings.
- In addition a comprehensive process of organizational development will ensure that digital processes are anchored within the institution and so contribute to a sustainable institutionalization.
- The third level is the level of personnel. A sufficient number of trainers and admins is trained to use different tools and media to make digital training more attractive.



### Challenges

- ✓ Limited personnel resources
- ✓ Overload of existing staff
- ✓ Constantly changing responsibilities and personnel
- ✓ Limited number of software licences
- ✓ Technical limitations, e.g. missing or old IT equipment



- ✓ Bureaucratic decision-making structures
- ✓ Strict regulations concerning the use of software
- ✓ Lack of digitalisation knowledge
- ✓ No clear tasks and job descriptions
- ✓ Lack of standard processes in training operation



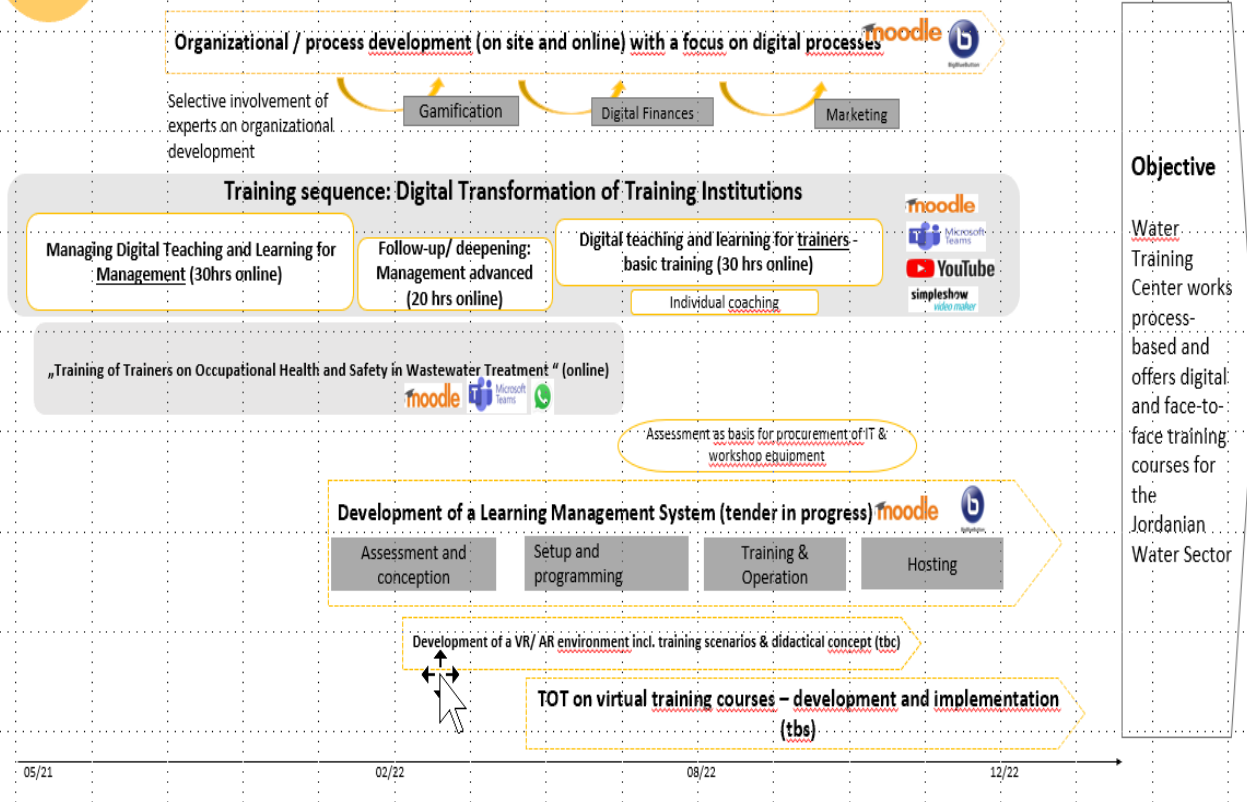
### Digitalization approach on 3 levels

- ✓ Sensitize and qualify **Management staff**
- ✓ Building a digital network to share resources, tools, and contents
- ✓ Strengthen sustainability digital processes through **institutionalization**, e.g. LMS
- ✓ Adequate technical equipment (software and hardware)
- ✓ Qualification of a sufficient number of **experts** in different topics
- ✓ Use different tools and media to make digital training attractive





## Implementation in practice



### Objective

Water Training Center works process-based and offers digital and face-to-face training courses for the Jordanian Water Sector

## Workshop 3

### Training processes, didactical concepts, methods, cooperation mechanisms, multiple learning venues

Moderation: Ulrike Schmidt, GIZ TVET Academy

Rapporteur: Martina Müller-Norouzi, Senoir Specialist TVET, GIZ

How to shape didactical concepts and training processes, methods of learning cooperation and other approaches to learning and training in TVET addressing competence requirements resulting from digitalization is a deeply discussed issue without clear answers. The shaping of learning processes depends on the didactical concepts and methods of learning. This session seeks to find answers on how to shape TVET teaching and learning processes addressing competence requirements that result from digitalization.

#### Introduction

Workshop 3 had **5 inputs** which we clustered into 2 groups. **The first group shows** examples how projects and programme partners of GIZ are dealing with the challenge to shape TVET against the background of digitalization:

1. Remote teaching and learning of TVET lecturers (South Africa)
2. “The certified “National e-Trainer in TVET” in Mongolia – Concept of the training approach”
3. E-learning empowerment training for teachers in Sri Lanka – concept and training approach

The second one started with a presentation from Viet Nam which shows a holistic approach how to respond to the challenges of digitalization in TVET on a nationwide to a local TVET institutes level.

4. “Elements of an Eco-System for Digital Transformation in TVET Vietnam and Approaches for Implementation”- Viet Nam

The second group includes the perspective from a German training provider (Christiani)

5. "Digitalization of Vocational Training – facing the challenge and taking the opportunities“

#### Inputs / Discussion

Which methods of learning (didactical approaches) need to be fostered at TVET colleges (TVET teachers) and in companies (in-company trainers) in order to better prepare teaching and learning for digitalized workplaces? and

Which qualification do TVET teachers need to promote learning and skills acquisition with a view to digital workplaces and modern technologies?

#### Remote teaching and learning of TVET lecturers: Approach to ICT upskilling, outreach, challenges and potential

Gerda Magnus, Department of Higher Education and Training (DHET), South Africa

The example from South Africa shows: the arrangement of project-based teaching & learning approaches in specific technical fields combined with remote teaching and learning for teachers and lecturers ensure action-oriented learning in particular fields. It is important to link the training intervention to specific topics / technical content. We need to create a reliable base of skills (technological, digital, pedagogical skills). It should be considered that e-learning needs shorter training sessions, otherwise the retention rates will decline (especially in-service program).

## WHAT THE FUTURE HOLDS

- Open learning unit created in the Department, developing and distributing digital content through a digital learner management platform
- The social consequences of the 4IR will demand much larger-scale access to education and training opportunities (Skilling and Upskilling)
- Education and training opportunities must be supported through open learning relevant in the context of a rapidly changing world of work;
- Access to high-quality educational opportunities that meet immediate demand for ‘digital skills’ in the labour market created by the 4IR;
- Massive increases in short-course skilling opportunities for unemployed and underemployed South Africans in parallel with wider government and private-sector efforts to rapidly grow new employment opportunities for those people;
- Curricula and educational programmes that are responsive to the accelerating pace of technological change and the world of work;
- Blended teaching methodologies must be considered and will probably remain in the future
- Social partners work together to develop human-centred solutions that consider the needs of the most vulnerable
- Educational that enable much greater flexibility (how and where students access learning opportunities)
- Accreditation systems that allow students to accumulate ‘stackable micro-credentials’ and recognition of learning outside formal national qualifications.

### The certified “National e-Trainer in TVET” in Mongolia – Concept of the training approach

Andreas Hörfurter, elearning & Training Consultant, Common Sense

The project to enable local TVET teachers to implement and develop digital learning and establishing multipliers for digital learning methodologies by a training of trainers in a multiplier\_/ snowball approach is used to ensure sustainability. This approach is part of a concept that is followed by the project in Mongolia. They also provide incentives like a **certificate** which is issued by AIMC/Ministry/GIZ/common sense after participants have participated in all aspects of this training AND implemented their own training; they combine theory and practice in each of the steps of the training so that theoretical inputs can always be tested by practice (used templates, local language, tutorials and instructional guidelines) the role of teachers must be clearly defined, it’s the task of the management and TVET authorities).

## Experiences

- ▶ Standard templates must...
  - ▷ support the local language;
  - ▷ be easy to use;
  - ▷ come with good tutorials and instructional guidelines.
- ▶ The role of multiplier teachers must be...
  - ▷ clearly defined;
  - ▷ backed by management and authorities.
- ▶ The digital learning related certification should be accredited for CPD.

### **E-learning empowerment training for teachers in Sri Lanka – concept and training approach**

Lara Oberheu, Advisor, GIZ Sri Lanka

Uwe Wickenberg, Consultant, Integration

The trainings want to empower teachers not only in Covid times but also for the future. And this Needs to have a specific **mindset**. New methodologies and didactical concepts but also IT infrastructure are needed to respond to the digital shift in TVET; this was highlighted in the presentation from Sri Lanka.

*The methodology **flipped classroom** was used in the e-learning empowerment training in Sri Lanka as an example for participant-oriented e-learning - learning content is worked out by the learners at home and application and reflection of the learning content were done in plenary sessions; this approach has the additional value that participants produced e-learning content during the training and will use it later in the classroom. This also will strengthen key competences (like self-confidence, self-paced learning...); also, we emphasize the peer learning among the participants. **Outlook:** how to ensure that teachers keep working on e-learning when they are back to school; therefore, we have a **follow up** to “keep the fire burning”; the leadership must be integrated fully.*

### **E-Learning Empowerment Training**

for technical teachers at Vocational and Technical Training Institutes in Sri Lanka

#### **Methodology:**

##### *Flipped classroom*

- Learning content is worked out by the learners at home
- Application and reflection of the learning content in plenary sessions
- Flipped Classroom also served as an example for participant-oriented e-learning

### **E-Learning Empowerment Training**

for technical teachers at Vocational and Technical Training Institutes in Sri Lanka

#### **Outcome:**

- Developed **e-learning modules** that can be used in the classroom and in distance education
- Strengthened **e-learning competences**
- Strengthened **key competences** (like self-confidence, ...)

**How can we achieve an impact?**

**What happens after the pandemic?**

**Organisational conditions** must be created **and the leadership of the institute** must support the integration of e-learning into day-to-day operations

**through:**

- Creation of the **technological prerequisites** at the institutes
- Consideration of the **development time** in the teachers' teaching loads
- **Curricular integration** of the e-learning modules

***The current momentum  
can be used to modernise TVET***

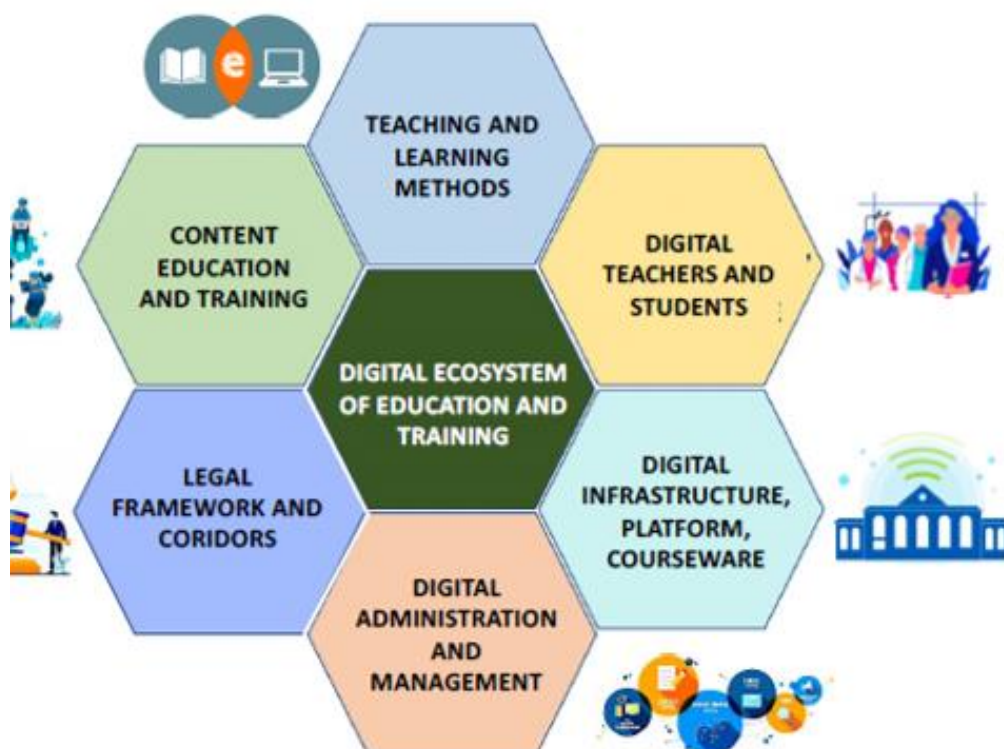


### Elements of an Eco-System for Digital Transformation in TVET Vietnam and Approaches for Implementation

Pham Xuan Hoan, Advisor, GIZ Vietnam

Which framework conditions for a digital shift in TVET institutes are important to have?

1. The TVET programme in Vietnam presented its holistic approach of an “Ecosystem of Digital Transformation in TVET (DX)” which includes the different fields of interventions for competence development
2. The government, ministry and 11 TVET institutions are fully involved; they have their strategies and implementation plans on DX in TVET
3. DX activities (advice, Studies, teacher training to keep them updated, there is also some kind of multiplier approach when build a community of core teachers), teaching materials ...) are always related / linked to the holistic approach
4. The approach shows very clearly how important it is to have a strategy and integrate all relevant TVET stakeholder / nationwide and at local level



**Ho Tu Bao (2020)**



### 3. DX activities supported by the TVET Programme

#### Education & training content

- Advice on training contents vs requirements of the 4<sup>th</sup> I.R and DX
- Study on distance learning of TVET since 2018 and recommendations

#### Teaching & learning methods

- Promote new teaching and learning methods on the digital environment
- Organize e-pedagogical training courses for multipliers
- Support the national competition on e-teaching design
- Develop guidance materials on online teaching and learning

#### Teachers & Students

- Keep teachers updated with new competencies required by the 4<sup>th</sup> I.R
- Organize training and webinars on digital literacy, LMS Atingi, open educational resources (OER)
- Build a community of core teachers from 11 colleges

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Programme Reform of TVET in Viet Nam



### 3. DX activities supported by the TVET Programme

#### Digital infra, platform, learning resources

- Digital platforms (OER, LMS, management) for TVET partners
- E-learning rooms, virtual conference room
- Cloud server solutions
- Training software, laptops, and other digital equipment....

#### Digital management, administration

- DX strategy development for TVET partners
- DX training for leaders, taskforces
- Advice on IT architecture and digital identity of TVET

#### Regulatory framework

- Policy review on DX in TVET
- Policy advice on distance learning

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## Digitalization of Vocational Training – facing the challenge and taking the opportunities

Kevin Wäschebach, Christiani GmbH

The speaker highlighted two pillars who determine the challenges of the digitalization process within the TVET sector.

### Training processes:

1. **Analyse/ Specify Digital Transformation Technologies** in order to determine the competences (which kind of digital technologies you want to use?)
2. **Qualification of teaching and training personnel:** it is essential that training personnel are trained at the very beginning of the entire process. Afterall, the teachers, trainers and instructors are the *instigators* and drivers of the entire process → *Ensure schooling and training in the VR and AR area*
3. **Reinforce cooperation** within and between learning centres and institutions: it is enormously important that vocational schools, training centres or company training centres introduce the same standard in order to standardize

### Didactic process:

4. Ensure digital competence for all young people (information and data literacy, communication and collaboration through digital technologies, digital content creation, safety (protect devices), problem solving in digital environment)
5. Enabling the development of new knowledge (training staff must be trained in hardware and software and how to teach the content, for example, when working in virtual space)
6. Reinforce competences that are difficult to replace by machines (u.a. content creation, technical management, communication are to be done by humans...)
7. Reinforce lifelong learning Digital transformation is to be supported by AR/VR

Academy | Further technical training and trainer qualification

**Digital Transformation of vocational education and training - facing the challenge and utilizing the opportunities**

**Christiani**

seit 1931

Enabling the development of new knowledge - **XR Lab** and Christiani Multi-user solution

#### **The XR Lab...**

... provides your company/organization the opportunity to test training concepts and content in virtual reality and augmented reality applications

#### **In the XR Lab...**

... you can not only use existing VR/AR/360° learning applications, but also create your own learning content.

As an experience and learning space for immersive learning, new potentials arise for teachers and learners that contribute significantly to learning success and motivation.



**Digital teaching and learning specialist: A comprehensive, modular training portfolio on digital teaching and learning in TVET**

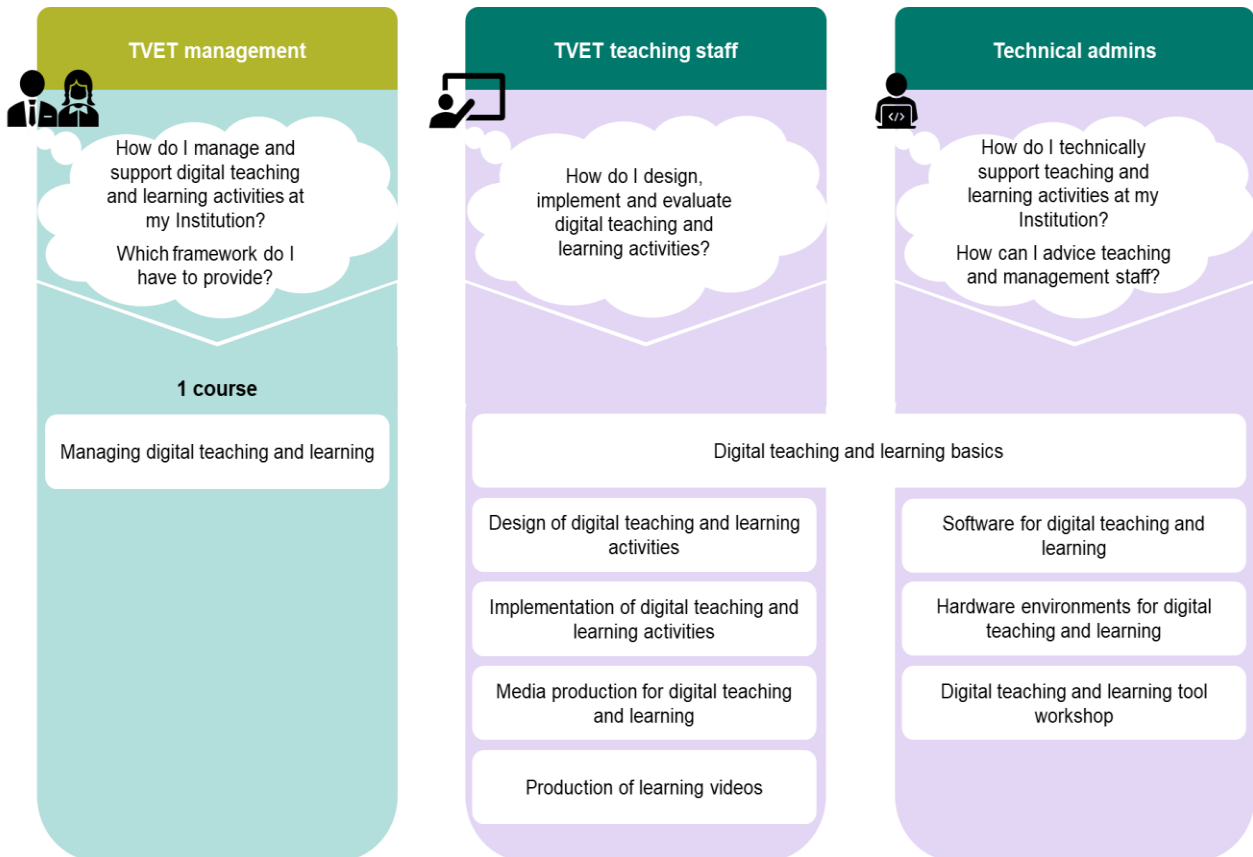
Stefanie Schenk, GIZ Expert

Besides the availability of digital infrastructure, an important prerequisite for successful digital teaching and learning in TVET are the corresponding methodological-didactic and digital competencies of the teaching staff. Also, administrators are needed to manage technical infrastructure, provide technical support to teaching staff and advice the management on technical decisions.

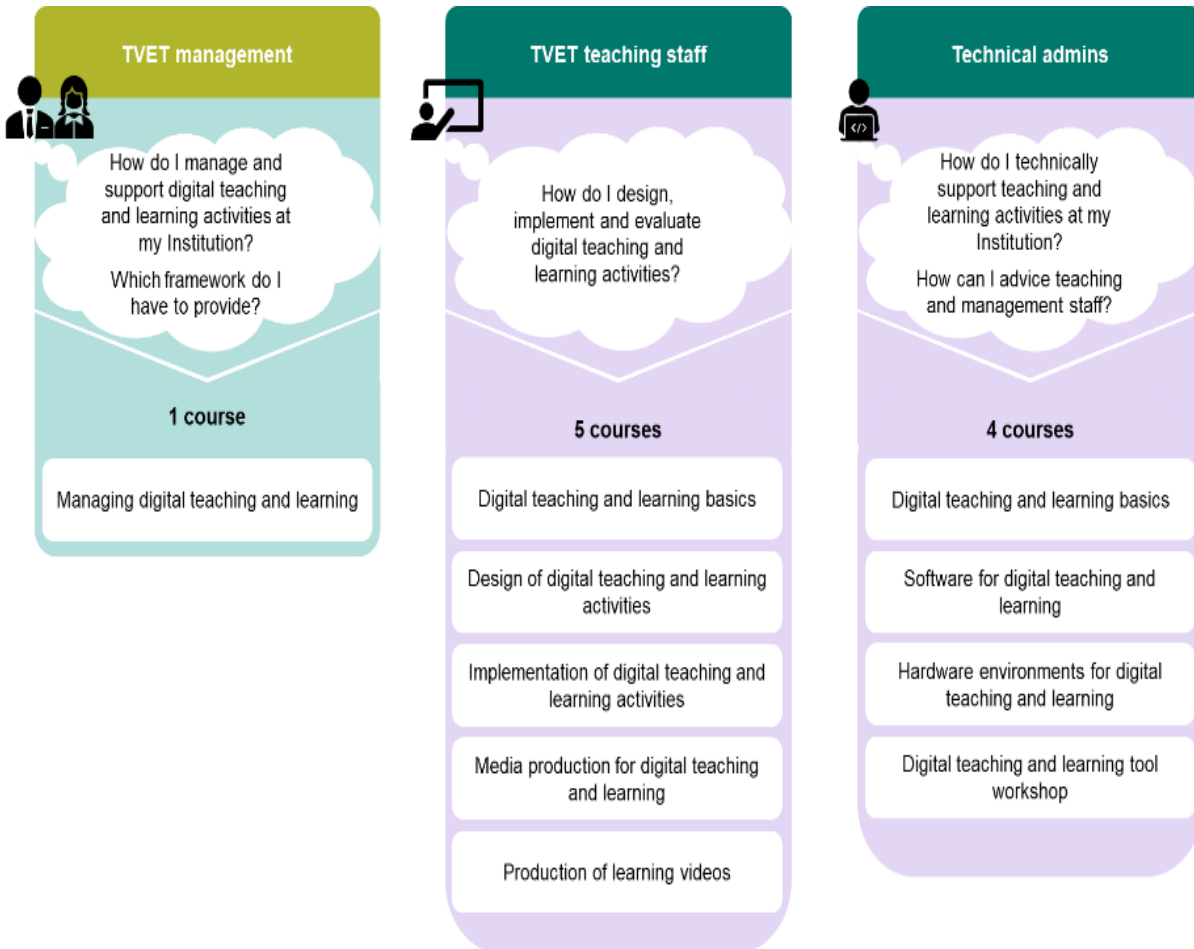
At the same time, TVET management staff must be aware of the relevance, opportunities, but also the requirements and challenges of digital teaching and learning to be able to ensure adequate financial, technical and human resources.

The TVET Academy therefore developed a comprehensive, modular training offer addressing three target groups of TVET personnel who are involved in the implementation of digital vocational education and training:

- TVET management
- TVET teaching staff
- Technical administrators



For those who are looking for more in-depth training, the TVET Academy developed the following specialization courses:



## Discussion

Which qualification do TVET teachers need to promote learning and skills acquisition with a view to digital workplaces and modern technologies?

1. A German training provider (Christiani) recommends
  - (Joint) qualification of teaching and training personnel (Christiani)
  - Bosch (conference): Different mix of skills; jobs will become more non-routine, they will require more analytical and interpersonal skills; Bosch supports the integration of industry 4.0 by cooperation with TVET institutions

Concept board – statement of participants:

- technical, digital, didactical skills / IT literacy skills
- e-learning planning and implementation
- basics of e-learning and tools knowledge
- understanding of e-learning importance, additional to old style approach
- soft skills (motivation, communication)
- be able to develop and analyse data

Which framework conditions for a digital shift in TVET institutes are important to have?

1. Sri Lanka stresses the importance of adequate framework conditions for the developing and implementing of e-learning at the institutes; they must be provided by the management of the institutes / by superiors of decision-making levels in the TVET landscape to promote the integration of e-learning into day-to-day operations, in particular
  - adequate technological prerequisites at schools should be available

- teachers and students need an adequate teaching and learning environment (internet access, mobile devices)
- and they experienced that the recognition of the development time for e-learning units in the teachers' teaching loads is important for the acceptance
- Integration of learning modules into the curricular

*In terms of competence development, it means that the TVET management in TVET institutes and in the respective Ministry and/or the TVET department level should be integrated into the entire process of establishing e-learning structures.*



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