Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

Blended Learning Guidelines for Technical Secondary Schools (TSSs) in Rwanda

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Preamble

The development of these Blended Learning Guidelines represents a significant milestone in the development of Rwanda's Technical and Vocational Education and Training (TVET) sector especially Technical Secondary Schools. These guidelines are an important tool for integrating innovative pedagogical approaches into technical secondary education to meet the demands of an increasingly dynamic labour market and contribute to the country's broader development agenda.

Rwanda's Vision 2050 aims to transform the country into a high-income economy driven by innovation, sustainability and inclusiveness. Central to achieving this ambitious vision is the development of human capital - a workforce equipped with the skills, knowledge and competencies needed to drive economic transformation. Technical and Vocational Education and Training (TVET) plays a key role in this effort, equipping individuals with practical skills that align with the evolving needs of the industry.

As outlined in the Education Sector Strategic Plan (ESSP), digitalisation is a cornerstone of Rwanda's strategy to modernise its education system. The integration of digital tools and blended learning methods promotes inclusivity, flexibility and efficiency in the delivery of education. Blended learning, which combines traditional face-to-face teaching with innovative digital tools, provides an adaptable framework for expanding access to quality education and improving learning outcomes across the country.

These guidelines have been developed through extensive consultations with educators, students, parents, civil society, policymakers and industry stakeholders to ensure that they address the unique needs of Rwanda's Technical Secondary schools. They serve as a comprehensive resource to guide the effective implementation of blended learning, models, technological requirements, digital skills for students and trainers required, curricula adaptations, and quality assurance among others. These guidelines are expected to improve teaching methods and expand opportunities for learners to develop the digital skills critical to success in the modern economy.

By embracing blended learning, Rwanda is not only equipping its youth with globally competitive skills but also fostering a culture of lifelong learning essential to achieving the goals set out in Vision 2050. These guidelines reaffirm the commitment of the Rwanda TVET Board (RTB) to drive innovation and excellence in TVET, ensuring that no learner is left behind in the digital age.

Dipl.-Ing. Paul UMUKUNZI Director General
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Abbreviations and Acronyms

ADDIE: Analysis, Design, Develop, Implement and Evaluate
AI: Artificial Intelligence
AR: Augmented Reality
BYOD: Bring Your Own Device
CBA: Competence-Based Assessment
CBC: Competence-Based Curriculum
CBT: Competence-Based Training CCTV: Closed Circuit Television
CoP: Community of Practice
DPs. Development Partners
CPD: Continuous Professional Development
CSO: Civil Society Organisations
HDD: Hard Disk Drive
IDS: Intrusion Detection System
ICT: Information and Communication Technology
ISPs: Internet Service Providers
LAN: Local Area Network
LMS: Learning Management System
MDM: Mobile Device Management
MERL: Monitoring, Evaluation, Research and Learning
MFA: Multi-factor Authentication
MINEDUC: Ministry of Education
MINICT: Ministry of ICT and Innovation
NAC: Network Access Control
NESA: National Examination and School Inspection Authority
NST1: National Strategy for Transformation 1
NST2: National Strategy for Transformation 2
OERs: Open Education Resources
RTB: Rwanda TVET Board
RISA: Rwanda Information Society Authority
RP: Rwanda Polytechnic
RTTI: Rwanda TVET Trainer Institute
SDMS: School Data Management System
SDNs: Content Delivery Networks
SSO: Single Sign-on
TMIS: Teacher Management Information System
TSSs: Technical Secondary Schools
TVET: Technical, Vocational Education and Training
OJT: On-the-job training
OS: Operating System
XR: Extended Reality
VPN: Virtual Private Network
VR: Virtual Reality
UNICEF: United Nations Children's Fund
UPS: Uninterrupted Power Supply
UR: University of Rwanda
WCAG: Web Content Accessibility Guidelines

Acknowledgement

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Their commitment to excellence has ensured the successful implementation of key project activities in line with Rwanda's vision of a knowledge-based economy. The Ministry of Education (MINEDUC) provided critical policy guidance to ensure the blended Learning guideline's alignment with national education goals. Similarly, the Rwanda Information Society Authority (RISA) played a key role in integrating digital technologies into the TVET system, while the National Examination and School Inspection Authority (NESA) ensured that the guidelines met the highest standards of educational quality and assessment.

We also acknowledge the valuable contributions of development partners, including GIZ and the Digital Skills Foundation (DSF), whose technical expertise and resource alignment greatly strengthened the digital aspects and pedagogy and digital skills for teachers. The University of Rwanda, Rwanda Education Board (REB) and Rwanda Polytechnic/RTTI provided essential academic, best practices and research insights that enriched the implementation of blended learning strategies in TVET institutions.

Civil society organisations were also crucial to this initiative. Organisations such as Edified Generation, Rwanda Assistive Technology Association (RATA) and Seeing Hands have supported inclusivity, especially catering to all disability considerations in the guidelines, accessibility and professional development for teachers and learners alike. Their commitment to promoting an inclusive education system has been a cornerstone of this project.

Finally, we acknowledge the invaluable contribution of private sector representatives, who have ensured that vocational education and training programmes remain responsive to market needs, as well as teachers, students and parents, whose adaptability, enthusiasm and support have been essential to the success of selecting blended learning approaches. The leadership of the Chief Digital Officer-MINEDUC and other policymakers has been crucial in championing blended learning guidelines, especially by providing insights on digital aspects and fostering an enabling environment for innovation in TVET. This collaboration on the quality of the guidelines' end product demonstrated the power of collaboration and a shared vision. Together, we have laid a strong foundation for innovative, inclusive and digital initiatives under these guidelines, which will empower the technical secondary education system in Rwanda, a pathway to achieving the goals of Vision 2050.

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1.Background and Rationale

1.1. Introduction

Information and Communication Technology (ICT) has revolutionised education systems worldwide, changing the way knowledge is delivered, accessed and shared. In an increasingly digital age, the integration of ICT in education is not just a tool, but a necessity to promote inclusive, equitable and quality learning. Globally, ICT in education addresses the need for innovation to prepare students for a highly interconnected and technology-driven world. From facilitating online learning and digital content delivery to improving access for marginalised communities, its impact is far-reaching.

In Africa, the need for ICT in education is more pronounced due to challenges such as limited access to quality educational resources, teacher shortages and infrastructure constraints. ICT offers a way to bridge these gaps by providing e-learning platforms, virtual classrooms and digital resources that can overcome traditional barriers. Initiatives such as the African Union's Continental Education Strategy for Africa (CESA) 2016-2025 highlight the commitment to using technology to improve educational outcomes across the continent. This growing reliance on ICT in education underscores the urgency of comprehensive strategies to address digital infrastructure, teacher training, and resource development. Looking at the global, continental and national landscapes, it is clear that ICT is not only reshaping education but also empowering learners to thrive in an increasingly complex world.

Rwanda is an example of a forward-thinking approach to ICT in education. As part of its Vision 2050 Skills development and youth employment promotion are the core elements of Rwanda's transformative vision 2050. To realize this national goal, Rwanda aspires to build a dynamic and capable workforce, meeting the rising demand for high-skilled jobs and a sustainable economy. Technical and Vocational Education and Training (TVET) plays a pivotal role in the national agenda, focusing on equipping individuals with practical knowledge, hands-on skills, and competencies needed for different occupations to allow Rwandans broader participation in the labour market, addressing both current and future job demands.

The Rwanda Digital Talent Policy (2020) stipulates that the country commends the development of digital skills, with TVET institutions playing a central role in equipping the workforce with practical skills for a digital economy. Education Strategic Plan (ESSP-2018/2024) also highlights that using ICT, TVET will increase expansion to a wider audience through online and distance programmes. Moreover, this is aligned with the National Strategy for Transformation (NST2) in its pillar of improving quality education through equipping TVET and HLIs to enhance STEM learning and alignment to market demands.

To align with Rwanda's broader digital transformation agenda, TVET institutions and schools are encouraged to integrate Information and Communication Technology (ICT) for innovative teaching, learning and assessment, making TVET programs more relevant for the job market and the digital economy. Through careful, thoughtful course blending and with consideration of digital and e-pedagogical skills levels, and the level of digital infrastructure, Internet access, learning for anyone can now take place in any contexts. Same as with the need to consider the different needs and learning styles of the learners in the four-wall classroom, it is also paramount to plan ahead and consider the enablers of a conducive blended learning environment and related inhibitors for digital learning. In this regard, guidelines for blended learning are needed to support the design of courses for TVET schools for better preparation of TVET students to learn and develop into 21st century global workforces that are relevant for the current digital market.

The purpose of the proposed blended learning guidelines is to provide guidance on the creation of a conducive and contextual blended learning environment in TVET schools in Rwanda through proper integration of emerging technologies in teaching, learning and assessment practices. The following are the objectives of this version of blended learning guidelines:

- To provide practical guidance on Blended Learning adoption in technical and vocational secondary schools in Rwanda towards the alignment with the National TVET Digitalization Strategy and the goals outlined in the National Strategy for Transformation (NST2), which aims to drive Rwanda towards a knowledge-based economy.
- To identify and define the philosophy, scope, principles and procedures for the creation and use of blended learning environments for students and staff at Rwanda TVET schools to improve teaching, learning, and TVET student success.
- To provide guidance on blended learning design for TVET schools in Rwanda and on the process of integrating appropriate technology for innovative teaching, learning and assessment practices.
- To generate guiding information, best practices, standards and approaches of how TVET schools in Rwanda can embark and continuously integrate blended learning in technical and vocational education and training for preparing the 21st skills workforce.

In consideration with the existing landscape of policy and regulatory frameworks in Rwanda, these blended learning guidelines are aligned with the following policies and strategies related to education and ICT:

- Rwanda Vision 2050
- National Strategy for Transformation Two (NST2)
- ICT in Education Policy
- Education Sector Strategic Plan (ESSP)
- ICT Strategy for Rwanda TVET Board
- National AI Policy
- Teacher Development and Management Policy
- TVET Policy
- National TVET Digitalisation Strategy for Rwanda
- TVET Competence-Based Training and Assessment Implementation Framework

1.2. Levels of Integration of ICT in Teaching Program

Depending on different levels of resources available in terms of ICT and electronic devices, training can take different formats. An example of the typology proposed by Melbourne (2017) showing how ICT can be integrated into the curriculum is presented here below:

- Traditional classroom instruction: When students attend face-to-face classroom lectures, they are also given, as a normal practice/standard, access to supplementary technology- based training resources and/or management tools.

- Blended learning: Learners can attend some face-to-face classes, get learning resources, have student-to-student and student-to-teacher interactions, and participate in learning activities in an online environment. As part of a blended programme, online activities and offline learning/assessment can be mixed in several subjects.

For example, learners may be asked to review some lesson contents in advance and complete online test items and simulation activities before practical/mentoring sessions take place in laboratories/practice facilities. Besides, some modules of the blended programme can be offered purely online (See Figure 1).

- Fully online instruction: This can take various forms, and the best known is Massive Open Online Courses (MOOCs). Training programmes are now being delivered purely online in many training institutions, and learners are not required to attend on-campus sessions. Learning resources are provided online, and all interactions/communication and assessments take place via a learning management system or other technology-based platforms.

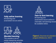

Fully online learning
All learning and assessment occurs online.
Face to face learning
All learning and assessment occurs online in classroom, but learning resources may be available online.
Blended learning
This provides a mix of online interactive activities and face to face learning environment.

Figure 1. Structure of a blended program (Melbourne, 2017)

Among the three blended learning approaches above, the one also known as hybrid or mixed is being adopted worldwide due to its immense benefits of offering flexibility by combining various learning modalities, allowing students to access materials and learn at their own pace. It supports those needing extra time to master skills, keeps students engaged outside school, and enables educators to collaborate and develop professionally.

1.3. Laying the Foundations for Blended Learning

The Government of Rwanda has made significant strides in ICT infrastructure, internet connectivity, digital skills development, and private sector growth in the IT sector. It has established a robust fiber-optic network, which ensures nationwide internet access and supports initiatives like 4G LTE expansion. Through programs like the Digital Ambassadors Program and ICT training centres, Rwanda has prioritised equipping its population with essential digital skills, including teachers. Additionally, the private IT sector has flourished, with Kigali emerging as a regional hub for innovation and start-ups, supported by government initiatives such as the Kigali Innovation City and partnerships fostering entrepreneurship and technology-driven solutions.

It is in this regard, Rwanda elaborated its TVET digitalization strategy that focuses on integrating digital technologies into teaching methods within the Technical and Vocational Education and Training (TVET) system, aiming to improve learning quality by utilizing blended learning approaches, providing digital literacy training for teachers, leverage on emerging technologies and developing online curriculum materials to transition towards a knowledge-based economy; this is primarily led by the Rwanda TVET Board (RTB) with a dedicated "Digital Technologies Division" to oversee implementation and curriculum transformation.

To align with Rwanda's broader digital transformation agenda, TVET institutions and schools are encouraged to integrate Information and Communication Technology (ICT) for innovative teaching, learning and assessment, making TVET programs more relevant for the job market and the digital economy.

Through careful and thoughtful blending of courses, taking into account the level of digital and e- pedagogical skills, the level of digital infrastructure, and internet access, learning can now take place in any context for anyone.

There is a need to consider different needs and learning styles of learners in the four-walled classroom, it is also vital to plan ahead and consider the enablers of a conducive blended learning environment and the associated barriers to digital learning. In this regard, blended learning guidelines are needed to support the design of courses for TVET schools to better prepare TVET students to learn and develop into a 21st-century global workforce that is relevant to the current digital marketplace.

1.4. Scope and Objectives of Blended Learning Guidelines

These guidelines provide a clear contextual blended learning framework for integrating traditional face-to-face teaching with digital learning methods, ensuring consistency, quality, and effectiveness in Technical Secondary Schools in Rwanda. They will help educators, institutions, and policymakers

design and implement blended learning approaches tailored to learner needs while addressing challenges like digital divides and resource gaps. In addition, the proposed blended learning guidelines aim to support TVET trainers to effectively integrate both traditional face-to-face and online teaching and learning methods by enhancing the quality of training. With these guidelines, TVET trainers in Rwandan Technical Secondary Schools (TSSs) will be able to design and create flexible, engaging, inclusive and accessible blended learning courses. Also, the proposed guidelines will provide clear guidance for TVET trainers on implementing E-assessment practices such as online quizzes, practical lab projects and demonstrations, and other digital assessments in a blended learning environment.

These guidelines accentuate the promotion of accessibility, inclusivity, and innovation in TVET programs while ensuring alignment with educational goals, labour market demands and a sustainable economy. The following are the objectives of this version of blended learning guidelines:

- Adapt TSSs competence-based curricula to blended learning aligned specifically with local educational contexts and systems.
- Standardise practices and maintain quality across different courses or programs offered in a blended learning environment.
- Equip TVET trainers with the skills to effectively prepare and implement teaching/learning sessions using digital tools and emerging technologies.
- Ensure digital learning is accessible and inclusive for all learners (per gender, disabilities...).
- Align blended learning with curriculum competences needed on labour market.
- Foster innovation in teaching methods like flipped classrooms and student-centered learning.
- Provide frameworks for quality assurance, continuous monitoring and evaluation of blended learning implementation in TVET.

2. Meaning, benefits and types of blended learning

2.1. Definitions of blended learning

The literature suggests a vast range of definitions for Blended learning. However, the way this concept is applied is different from contexts. Blended learning can be defined as an approach, a model, a process and or a strategy.

- According to Graham, blended learning is the combination of face-to-face instruction with computer-mediated instruction. Here the emphasis is on the hybrid nature of blended learning, highlighting the integration of traditional and digital approaches (Graham, 2006).

- Vaughan asserts that blended learning is "the organic integration of thoughtfully selected and complementary face-to-face and online approaches and technologies." Vaughan emphasizes the intentional and harmonious integration of traditional and digital methods, ensuring that both modalities complement each other to enhance the learning experience (Vaughan, 2021). The author emphasises the perspectives of blended learning in higher education.

- Whereas Staker & Horn perceive blended learning as a formal education program in which a student learns at least in part through online learning, with some element of student control over time, place, path, and/or pace (Staker & Horn, 20112). The definition insists on learner autonomy, stressing the importance of flexibility in how students interact with content.

- Sing adds an important element, where blended learning involves the thoughtful "fusion of face-to-face and online learning experiences, ensuring the strengths ofeach modality are combined to maximize learning impact" (Singh et al., 2021). He extends the concept to include pedagogical design, emphasizing the purposeful integration of modalities to enhance learning outcomes.

Currently, blended learning is considered as an educational approach that combines traditional face-to-face instruction with online or digital learning activities, integrating the best aspects of both methods to enhance the teaching and learning experience. It provides flexibility in content delivery, supports personalized learning, and encourages active participation by leveraging technology alongside conventional classroom interactions.

2.2. Benefits of Blended Learning Adoption in Technical Secondary Schools

The use of information and communication technology (ICT) has demonstrated its value in enhancing teaching and learning within TVET. ICT offers transformational pedagogy to innovatively streamline the acquisition of relevant theoretical and practical skills using, for example, simulation tools, multimedia content or technology-enabled collaborative learning platforms.

TVET schools across the world have also been integrating ICT in teaching, learning and assessment practices (Manditereza & Chamboko-Mpotaringa, 2024; Chinengundu, 2020). The application of ICT in TVET can undoubtedly enhance the processing and acquisition of skills and knowledge through various levels of learning engagement and social learning.

The benefit of adopting blended learning:

- **Improve TVET quality and enhanced skill acquisition:** Blended learning has proved to enhance skills acquisition than traditional method since it allows TVET learners to combine theory with hands-on practice using virtual labs and simulations.

- **Flexibility and increased access:** In technology-mediated learning, students are not required to be physically together in one place but may be connected digitally through online communities. Being an approach of technology-mediated instruction, web-enhanced instruction, or mixed-mode instruction, a blended learning environment may use both synchronous and asynchronous modes of delivery to improve learner experiences and access to education.

- **Improved teacher efficiency:** Teachers using blended learning methods save time with automated assessments and digital resources. Also, a well-trained teacher can be shared among schools to cover the same course simultaneously in many schools.

- **Reduction of training costs:** In TVET, blended learning reduces costs by spreading the high fixed costs of quality material development over a larger number of learners and lowering variable costs through reusable content and activities. It minimizes reliance on expensive physical infrastructure by reducing on-campus time through careful planning and integrating workplace learning, which uses existing industry facilities and employer contributions.

- **Increase inclusion**: Development in information technology and advancement in assistive devices aremaking it easier and even possible for people with disabilities to learn and work through blended learning.

- **Support for Lifelong Learning:** blended TVET programs support upskilling and reskilling initiatives.

- **Boosts Employability:** Blended learning facilitates the acquisition of soft skills (e.g. communication skills, digital skills, financial literacy) with technical training through collaborative online tools. BL also facilitate more practice which enables TVET learners to acquire practical knowledge. This result in graduates with improved soft and practical skills which lead to secure jobs quickly faster than those trained using traditional methods.

2.3. Organisation of blended learning implementation in TVET Schools

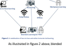


Figure 2: A combination of face-to-face and online instructor-led learning

As illustrated in figure 2 above, blended learning in Technical and Vocational Education and Training (TVET) combines face-to-face instruction with online, offline, and workplace-based learning. Students enrolled in TVET programs acquire theoretical knowledge and practical skills through in-class sessions guided by instructors, self-paced online

or offline learning, and hands-on workplace experiences.
Workplace learning enables students to apply theoretical concepts in real-world settings, gain practical experience, and develop competencies tailored to their specific trades or professions. This process often includes workshop practices, internships, apprenticeships, on-the-job training, and collaborative, trade-specific professional work experiences. These structured opportunities bridge the gap between classroom or online learning and actual workplace demands, enhancing students' job readiness.

In some TVET environments equipped with advanced technologies, training, learning and assessments integrate innovative tools such as simulations, virtual reality (VR), augmented reality (AR), mixed reality (MR), artificial intelligence (AI), and multimedia content creation platforms. These tools enrich the learning process by providing immersive and interactive experiences, ensuring students are well-prepared for the dynamic demands of their chosen professions.

2.4.Standard Types of Blended Learning

Blended learning can be adopted depending on different school context, teachers' digital literacy, students' digital skills, trade requirements and available ICT infrastructure. Institutions and schools may use a model of their choice provided that it is aligned with their curricula and courses. As described by Clayton Christensen Institute and cited by Hashim & Hamidon (2022), there are 4 main

blended learning models (Rotation Models, Flex Model, A La Carte Model, Enriched Model) The known blended learning models are the following:

a) Station Rotation Model
In this type of model, learners' groups in a course or subject move between various learning stations on a fixed schedule or based on the teacher's discretion. These stations include diverse activities, with at least one station dedicated to online learning, ensuring a mix of instructional methods.

b) Lab Rotation Model
Similar to the previous one, the lab rotation model allows learners' groups to rotate through different learning physical environments such as science lab, computer lab, maker space, etc...

Online learning occurs in a dedicated computer lab with appropriate digital tools to allow remote collaboration, lab work and simulation of learning. Computer labs are critical resources when schools aim to transform instruction in a blended learning environment.

Technical schools that have established well-equipped computer labs and/or smart classrooms, the Lab Rotation blended learning model is a suitable approach that may integrate a combination of teacher-facilitated online learning in a lab setting with face-to-face instruction and other offline, yet computer-supported learning modalities.

c) Individual Rotation Model
Unlike the above rotation models, the individual rotation model allows learners from the same class or subject to rotate only to the learning activities that are scheduled by instructors. This means that a class is grouped according to learning activities and each group has its turn for face-to-face as well as online. In the individual Rotation Model, stations (face-to-face or online learning spaces) or activities may include a combination of teacher-led instruction, online learning events, group-based projects,

and individual learning tasks. Instructors can tailor the rotation schedule for each student to ensure they are engaged with content in a self-paced and own style.

This model is different from the Station or Lab Rotation models because students don't rotate in the same order as a group. Instead, each student has an individualized rotation path, which is typically based on their learning needs, preferences, or progress.
The individual rotation model allows for a more customized learning experience, as students have the possibility to spend varying time at different stations depending on their strengths and areas for improvement. In essence, the individual Rotation Model gives students greater control over their learning journey by providing a flexible, individualized schedule of learning activities through a range of digital content formats.

d) Flipped Classroom Model
Flipped classroom is a model in which students first explore new course content outside a class by watching a pre-recorded lecture video or digital module, or by completing a reading or preparatory assignment. In-class time is organised around student engagement, enquiry and assessment, allowing students to engage with, apply and elaborate on course concepts. Class sessions typically involve collaborative coursework and the use of active learning strategies such as case studies, problem sets or structured discussions. This model is also appropriate for TVET schools integrating blended learning whereby TVET students will be able to apply their previous skills to engage with the provided learning resources (both digital and physical).

e) Flex Model
This model is a highly flexible approach where the majority of learning takes place online, but there are regular face-to-face support sessions with the teacher, providing a combination of independent online learning and face-to-face interaction. The key feature of the Flex model is that students have control over the pace and location of their learning, meaning they can choose when and where they engage with online content. The teacher provides guidance and support during scheduled face-to- face sessions, but students have the freedom to work independently most of the time.
This flex learning model is particularly suitable for online learning, where most of the content is delivered digitally, allowing students to engage in self-regulated learning. In this approach, students typically work independently through e-learning platforms, accessing lecture resources and assignments at their convenience. As illustrated in Figure 6, this model offers the flexibility to combine various teaching methods, such as online classes, in-class lectures, workshops, and group- based projects conducted in laboratories, workshops, or apprenticeship settings.

f) A La Carte Model
This blended learning model provides a learner-centred approach that allows students to design their own learning experience by choosing their own learning subjects or content to be delivered through online classrooms and supplementing it with school-based courses.

This model provides a flexible and customizable approach to learning where students can choose from a variety of learning activities, resources, and courses to meet their individual needs, styles and preferences. With this model, students can personalise their learning experiences which may be either online or face-to-face learning modalities.

This approach can be used when schools are unable to deliver certain elective courses or activities through face-to-face lectures. It aims to create a learner-centred environment where students have more control over their learning paths and adapt their educational experience to their individual interests, styles and career goals.

This model requires enough resources in

terms of personnel such as teachers to supervise this self- paced learning, instructional designers who work on the courses to avail fully online as well as face-to-face versions, computers to be used at home, and enough internet.

g) Enriched Virtual Model
This model puts more emphasis on creating an online learning environment as the primary mode of delivery for teaching, learning and assessment with periodic in-class instruction of face-to-face interactions between students as well as teachers and students. This model provides an online environment which allows students to complete most of their coursework online but also attend in- person sessions or labs for practical, hands-on training or other critical face-to-face learning activities.

2.5. Blended Learning models applicable to TVET system.

Blended learning models in Technical and Vocational Education and Training (TVET) integrate particularly face-to-face instruction, digital tools, and workplace-based experiences to provide a holistic learning approach (Owston, York & Murtha, 2013; Garrison & Vaughan, 2008). These models combine theoretical knowledge, practical skills, and real-world applications, ensuring students are well-prepared for their professions (Hashim & Hamidon,2022). These models can be summarised as follow:

- **Learning in the classroom and workshop enhanced with technology:** Where main teaching and learning activities take place at the school premises (in classrooms, workshops and computer labs). Technology can be integrated mainly to improve the quality of learning and teaching.

- **On-the-job training supplemented with classroom, distance and online learning:** With this model, learners attend some theory-based lectures in the classroom and some other learning activities online. Thereafter, learners can then engage in apprenticeships at the workplace and TVET schools can assess learners at distance and the workplace to ensure coherence and quality of the apprenticeship.

- **Fully distance and online learning**: This model suggests that general, mostly theoretical, skills can be acquired regardless of a specific context. Considering that practical skills are the core part of TVET, this board model suggests that these skills can be developed at the learners' home or workplace. This model is more flexible and self-paced with minimum instructor intervention and support.

By leveraging technology and hands-on training, blended learning enhances flexibility, engagement, and job readiness for TVET programs.

3. Adapted blended learning model for TSSs in Rwanda

Among the 3 blended learning modes discussed in section 2.5, the fully distance and online learning mode cannot be applied to all the practical TVET courses since schools may not have all the technology required to complete practical parts such as virtual labs or workshops. On-the-job training supplemented with classrooms, distance and online can be suitable for dual training programs in TVET which also has been started in Rwanda. Learning in the classroom and workshop, enhanced with technology can be adapted to suit the local context of TSSs.

In the current TSSs programs context, the Rwanda TVET competency-based model emphasises on establishing the requirements for imparting students with soft skills, theoretical and practical knowledge. In this regard, the proposed adapted blended learning model for TSSs has been thoughtfully adjusted to address the unique challenges and opportunities of the TSSs context in Rwanda. With a mix of boarding and day students, including students from remote areas with limited access to devices or the Internet, the model ensures flexibility and inclusivity for all learners.

The proposed adaptable model for blended learning recognises also the aspects of shared computer labs, rotational schedules between classrooms, workshops, and workplace attachments which provide hands-on learning experiences for all students, including those with disabilities. Recognizing the limited IT infrastructure and internet in some remote schools, offline digital content and low-tech solutions are also highly prioritized.

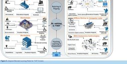

Adaptable Blended Learning Model for TVET Schools
Traditional F2F Environment
In-class
Workshops
Workplace
Virtual Learning Environment
Online/Offline/Home via LMS
LMS
Offline/Online in Computer Labs
With Immersive technologies
Rotating & Flipping
BL setting in TVET
Teaching, Learning & Assessment

Figure 3: Adapted Blended Learning Model for TVET Schools

The model in Figure 3 illustrates how blended learning can be designed to meet the current needs of TSSs programs and study time, ensuring effective integration of blended learning into the existing TVET system while fostering equitable access to resources and opportunities for all learners.

The above proposed blended learning model has been designed based on the assessment findings from the pilot TSSs (both rural and urban areas). The implementation of this model will follow the following processes:

- **Rotation and flipping teaching, learning and assessment activities:** As TSSs lack adequate infrastructure such as computer labs, smart classrooms and workshops, the proposed adapted blended learning model entails that some lecture sessions will be rotated in these premises to allow all learners and trades to equally benefit from these infrastructures.

- **Hybrid Course Design:** This model suggests that TVET schools should deliver theoretical content such as lectures, readings, and assessments via LMS and other digital communication tools like Zoom, Google Meet and MS Teams. This allows for self-paced learning, flexible schedules, and access to additional resources such as videos, chats, discussion forums, and quizzes). Also, the model proposed learning offline at home, and thus, lectures and demonstrations will be recorded and uploaded for students to watch asynchronously. In addition, the model suggests also that the interactive materials should encourage student engagement.

- **Appropriate digital infrastructure:** This model proposes that digital infrastructure and devices such as laptops and desktops, smartphones and tablets should be in place. A specialised LMS integrated with digital tools for inclusion shall be accessible by teachers and students with less effort. LMS should be designed to support both the delivery of interactive digital content and the management of online assessments, asynchronous forums, live sessions, and resource sharing.

- **E-portfolios and Logbooks:** The proposed model suggests that both tools will be essential for tracking students' progress, reflecting on their learning experiences, and providing evidence of their skills development both online and offline. As shown in Figure 3, E-portfolio

portals will serve as digital collections of TVET student work, reflections, assessments, and progress over time. E-portfolios will be typically used to document achievements, skills, and competencies acquired throughout the training period from both the F2F environment and the Online learning environment. As for the logbooks, these will be used by TVET students to document their internships and apprenticeship practices and skills acquired at the industry- based workplace or during the workshop sessions.

- **Integrating assistive technologies and resources:** This model also suggests that assistive tools and resources will be established at TVET schools to enable hybrid learning. For the F2F learning environment, accessibility and mobility in physical spaces will be ensured for TVET students to easily move in classrooms and workshops. On the other side, assistive technologies and applications will be used on LMS, in computer lab tools and in the immersive learning environment to cater for diversity and inclusion for all TVET students.

- **Promoting practical hands-on training (Offline & Online):** This adapted blended learning model promotes the use of workshops and computer labs for practical hands-on sessions for TVET students which is very important for TVET curriculum. Where feasible, the model encourages the use of virtual labs or simulations for skills that may not require direct physical presence.

The model also echoes the design of learner assessments where TVET students demonstrate practical skills. These proposed assessments in this model include practical projects, case studies, or lab-based activities using simulation tools and digital twins.

4. Accessibility and inclusivity in blended learning environment

Prior to designing and delivering a TVET curriculum, an assessment of learner types and categories has to be conducted to prepare for inclusion and diversity. Learner disability and gender are critical considerations in the blended learning curricula for TSSs in Rwanda.

4.1. Considerations on disability in blended learning environment

UNICEF for example proposes that before introducing blended learning in the classroom, it is crucial to assess learners' needs and identify appropriate equipment and software for them to engage in all learning activities (UNICEF, 2024). The UNICEF framework can support schools to make inclusive and accessible choices with digital content to address a range of visible and hidden disabilities. This framework, presented in Table 5 below, categorises different types of disability such as vision, hearing, mobility, neurodivergent, and cognitive and mental health problems.

Table 5. Types of disability, inclusion and accessibility choices

Disability	Video	Audio	Presentations	Interactive Activity
Vision	• Provide transcripts (for screenreaders)	• Provide transcripts • Use clear audio	• Use alt text • Use built in headings • Use large font sizes	• Make sure content can be navigable via keyboard • Links are descriptive • Use audio indicators for feedback
Hearing	• Provide subtitles • Provide transcripts (for spoken narration)	• Provide transcripts	• Insert sign language video • Include captions in embedded video	• Use visual indicators for feedback • Avoid audio-only commands
Neurodivergent & Learning	• Use adjustable speed	• Balance narration and background sound • Provide transcripts • Use clear audio	• Clear, structured layouts • Use animations sparingly • Use clear direct instructions • Avoid mixed graphic elements • Use visual aids	• Allow users to set their pace • Give clear direct instructions • Avoid locked navigation • Unlimited assessments & retakes
Mobility	• Access with assisted device or screenreader • Provide sufficient time for all user interactions without time constraints.	• Access with assisted device or screenreader	• Make sure kids can access learning with an assisted device and/or screenreader	• Access with assisted device or screenreader • Large and spaced touch points • Avoid drag-and-drop • Unlimited assessments • Wide window of assessments
Mental Health & cognition	• Offer control over sensory inputs (e.g., ability to mute) • Avoid potentially triggering content without warnings.	• Provide transcripts	• Use calming colors and avoid flashy animations. • Provide clear, direct information without overcrowding	• Allow users to set their pace. • Offer break reminders.

Under each type of disability, examples of equipment and software that may support learners to engage in video, audio, and presentations (texts and graphics) as well as interactive learning activities and simulations are also described in the framework proposed by UNICEF.

When designing a TVET curriculum, all types and levels of disability are recorded and included in the course design, and they will be considered during the course delivery. By following the UDL guidelines (CAST, 2025) and assuming that everyone has the right to grow and thrive, all types of disability can be accommodated in a blended learning environment. Specific considerations for disabilities include:

1) Physical disabilities:

- For example, trainers may ensure keyboard is user-friendly and the LMS navigation is compatible with appropriate assistive tools/software in place.
- In-class sessions, workshops or computer labs: These learning spaces have to be designed to enable easy movement and ensure the spaces are easily workable. Otherwise, the school should provide motorised lifts or lightweight tools to reduce physical strain.

2) Sensory disability:

- On visual impairment: Trainers can use tactile markers on tools and machinery and provide verbal cues and hands-on guidance during training sessions.
- For hearing impairment: Trainers may offer captioned contents for audio-visual formats. Sign language interpretations and real-time transcriptions may also be provided for learners in need. It would also be important to use visual alerts when providing instructions and alarms in classrooms, workshops and labs.

3) Cognitive disabilities:

- Trainers are encouraged to use simplified (step-by-step) instructions and straightforward language with visual and verbal reinforcement. Visual aids such as diagrams, mind maps may be used also to explain complex concepts

- Trainers should also allow extra time for task completion and provide frequent reminders and prompts. Accordingly, it is important also to provide visual schedules and checklists for task organisation to support focus and memory when delivering the course.

4) Neurodivergent learners (e.g., Autism):

- Trainers may for example allow for using sensory regulations tools such as noise cancelling headphones or stress balls.
- Trainers may also use role-play or simulations to practice workplace interactions
- It is important also use LMS with capabilities for learners to customise their LMS interface such as colour scheme and layouts).

5) Emotional or behavioural disabilities:

- Trainers should incorporate learning activities that build emotional intelligence and self- regulation for those who may feel overwhelmed
- It is crucial also to provide opportunities for learners' reflection and self-paced learning to reduce stress.
- Trainers should also offer regular check-ins and provide timely feedback that emphasizes strengths and confidence.

6) Language and communication barriers:

- Trainers should provide multilingual support in course content, LMS and other digital tools to be used in blended learning environment
- It is also important to use icons, symbols, graphics alongside text-based content to convey meaning

Hence, the design and delivery of TVET curriculum in a blended learning mode can consider mainly the following three aspects as proposed in the UDL guidelines:

4.1.1.Multiple Means of Engagement

This approach enables TVET trainers to focus on creating an inclusive and flexible learning environment that keeps learners motivated and engaged in class, workshops and online. Following this approach, the blended learning course need to be designed by considering the following:

- Freedom of choice and autonomy: This allows students to choose learning activities, topics of format for engagement in the course content such as Group Work, Creative hands-on projects and individual work. Additionally, TVET trainers should provide diverse ways to foster students' participationsuch as verbal contributions, digital uploads, written responses, live demos ...etc.

- **Enable a welcoming environment:** For example, trainers should use icebreakers or team building activities during both online and offline environments to build a sense of community and belongingness.

- **Provide flexible participation options:** Trainers should use for example, asynchronous options for learners in a need of extra time. When designing online sessions, trainers may offer forums, chats, or live videos call to allow ways of teacher-learner and teacher-teacher interaction.

- **Create a safe and inclusive learning environment:** Trainers may build a culture that values empathy and respect for gender and disability inclusion in online and offline learning environments. Trainers will also for example include cues, signals or assistive tools to indicate a safe space (virtual or in-classroom) for all learners. Trainers may even enable anonymous question submission to encourage learner participation.

- **Incorporate learning interests:** Trainers should connect learning activities to real-world applications and personal interests to increase perceptions on course relevance.

- **Provide emotional and behavioural support:** Trainers may encourage peer mentorship or buddy tools to build confidence and reduce anxiety. They may also offer calming or sensory-friendly spaces for learners who need breaks during the course delivery (virtual and offline).

4.1.2. Multiple Means of Representation

This approach implies that TVET trainers should present course information (online and offline) in a variety of ways to address different sensory, cognitive and language barriers for learners. To accommodate multiple modes of presentation, TVET trainers should design and deliver blended learning courses using the following strategies:

- **Provide accessible course materials:**
  - TVET trainers may use screen reader-friendly documents, brailles, large print and captioned audio-visual and graphic content for learners with visual impairment.
  - Trainers may also provide sign language interpretation or real-time captioning for students with hearing impairment
  - They should also offer content in multiple languages, or simplified formats for learners with cognitive disabilities
- **Use multimodal instructions:** It is important also to use multimodal instructions such as verbal explanations with visual aids. Trainers may also record live sessions for learners who prefer listening after in-class or virtual sessions

- **Ensure assistive technology compatibility:** Trainers may check to ensure assistive technology compatibility such as speech-to-text apps, screen magnifiers, or digital note- taking tools.

- **Demonstrate and repeat:** Trainers may offer video tutorials or simulations for learners to review and learn at their own pace.

4.1.3. Multiple Means of Action and Expression

According to this approach, TVET trainers are encouraged to demonstrate their understanding of the course in diverse ways by accommodating their physical, sensory and cognitive needs. The following strategies are recommended to ensure multiple means of learner action and expression.

- **Offer flexible options for learner expression:** Trainers may allow learners to respond for example verbally, in writing and through drawings or using digital tools if available at school. For an online environment, trainers should allow multiple formats for learning and assignment activities and content such as audios, videos, texts and graphics.

- **Scaffold learning activities:** Trainers may break complex tasks into small ones and conduct coaching and check-ins at each stage. It would also make sense to include practical quizzes or interactive learning activities to reinforce learning.

- **Adapt workstations and tools:** Trainers should assess and ensure that workspaces are accessible with adjustable-height desks, ergonomic tools, adaptive equipment, or user- friendly and inclusive LMS and other software.

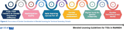
- **Encourage peer and mentor support:** Trainers may encourage peer collaboration and feedback through synchronous and asynchronous discussion forums or group projects. It is also important to create mentorship opportunities by pairing junior trainers with students.

A detailed description of these strategies for accessibility and inclusivity as well as assistive tools and resources to be provided for effective integration of blended learning in TSSs in Rwanda is in Annex (ii). These strategies are categorised for traditional in-class as well as in Virtual Learning environments for TVET schools. In brief, considering the proposed strategies for inclusion and diversity when blending TVET courses, further aspects below are important for TSSs adopting blended learning:

- General inclusive practices at TSSs should address physical disabilities, sensory disabilities (visual and hearing impairments), cognitive disabilities, emotional and behavioural disabilities, and language/communication barriers.
- Schools should use the Web Content Accessibility Guidelines (WCAG)(W3C, 2024) to ensure the content is accessible through LMS by all types of learners.

4.2. Gender consideration in blended learning

The current TVET curricula, at least in TSSs, do not specify the different needs, preferences, and challenges those individual learners face, based on their gender. When adopting blended learning in TSSs, it is important that the curricula be gender responsive. This entails that the adaptable pedagogy to deliver blended learning courses will ensure that teaching, learning and assessment approaches, strategies, and practices actively recognize and address the gender-related needs, experiences, and inequalities of different genders. Gender-responsive pedagogy will be implemented in blended learning environment of TSSs by considering the following aspects:


Gender inclusive content
Gender sensitive language
Diverse learning tools
Reflections on gender roles
Gender-based mentorship & support
1
2
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11
Train TVET trainers on Gender responsive pedagogy
Participation equity
Safe learning spaces for all
Gender responsive assessment
Digital tools for gender inclusivity
Gender inclusive group works

Figure 6. Focus areas of Gender Consideration in Blended Learning for Technical Secondary Schools

More details on how inclusive gender consideration in blended learning in TSSs is provided in table below:

Table 2. Consideration of Gender in Blended Learning Environment

Area of focus	Gender-Responsive Strategy	Example of Implementation
1. Gender inclusive Content	Ensure that all learning materials (online and offline) are gender-neutral and reflect diverse gender perspectives.	Use textbooks, pictures, videos, and case studies that highlight the contributions of both men and women in technical fields.
2. Train trainers on gender-responsive pedagogy	Ensure TVET trainers are equiped with gender responsive skills	Train a pool of trainers at each TSS on gender responsive pedagogy and create a related community of practice (CoP) across TSSs
3. Participation equity	Encourage equal participation from all genders, both in classrooms, workshops and online environments.	• Monitor classroom discussions to ensure both male and female students have equal opportunities to speak. • In online forums, encourage active participation from everyone.
4. Gender-sensitive language	Use inclusive, non-biased language in all teaching materials, course content, and communication.	Avoid using gendered pronouns unless necessary, and use terms like "students" or "learners" instead of "guys" or "girls."
5. Safe Learning spaces for all	Create safe and supportive environments in the physical classroom, workshops and online, free from gender-based harassment or discrimination.	• Implement a zero-tolerance policy for gender-based harassment • Ensure moderators are available to oversee online discussions to prevent bullying.
6. Diverse learning tools	Use a variety of teaching tools that cater to diverse learning styles and experiences, ensuring gender inclusivity in both physical and virtual spaces.	Provide online resources such as videos, graphics, interactive simulations, and digital textbooks that reflect diverse gender roles.
7. Gender-responsive assessment	Design assessments that do not favor one gender over another, ensuring fairness in evaluation.	• Create assessments that are free from gender bias, • Offer multiple ways for students to demonstrate their knowledge (e.g., written, oral, practical).
8. Reflection on gender roles	Include discussions and activities that encourage students to critically reflect on societal gender roles and stereotypes within their field of study.	For example, in a course about building construction: • Initiate discussions about gendered stereotypes (e.g., women in STEM), • Challenge students to explore non-stereotypical roles.
9. Digital tools for gender inclusivity	Use technology to create an equitable learning experience, providing tools that support diverse needs and promote gender inclusivity.	Integrate accessible learning platforms that provide features like text-to-speech, language options, and adaptive learning paths for all students, regardless of gender.
10. Gender-based mentorship and support	Provide mentorship opportunities that address gender disparities, ensuring both male and female students have equal access to role models and guidance.	• Pair male and female students with mentors of any gender, • Ensure that students have a variety of role models and guidance within their chosen fields.
11. Gender-inclusive group work	Organize group work in a way that ensures equal participation from all genders, avoiding stereotypes and biases in group task assignments.	Ensure that groups are formed in a way that encourages mixed-gender collaboration and that all students contribute equally to projects.

4.3. Steps for digital content development with UDL guidelines

The development of course materials should follow the Universal Design for Learning (UDL) principles such as using alternative text for images, captioned and subtitled videos, and transcribed audio content. Practical steps for digital content development using UDL guidelines are proposed here below for reference:

Table 3. Proposed steps for digital content development using UDL Guidelines

Step	Activity
Conduct content needs analysis as per the TVET Curriculum	• Assess the school context, learners' profiles, including their abilities, access to technology, and learning preferences. • Identify potential barriers to accessing and using digital content.
Create accessible and inclusive digital content	• Download and use free or low-cost tools to develop content that meets UDL standards such as: - HSP, SCORM Package, and Authoring tools such as iSpring, Adobe captivate, Camtesia for interactive content - Canva, Draw.io for visual aids and infographics Audacity, Adobe Premiere, Macromedia for video and audio editing • Test content on various devices (smartphones, low-end computers) to ensure accessibility and compatibility.
Apply Universal Design for Learning (UDL) Principles	• **Multiple Means of Representation:** - Provide content in multiple formats (text, audio, video, visuals) to cater for diverse learners. • **Multiple Means of Action and Expression:** - Include interactive activities, quizzes, and options for learners to demonstrate skills. • **Multiple Means of Engagement:** - Incorporate gamification, real-world challenges, and collaborative projects to sustain motivation.
Content piloting and iteration	• Run pilot tests with diverse learners to gather feedback on usability and accessibility of the created digital content. • Continuously improve content based on feedback and adapting to learners' needs and course type.
Upload content on the RTB LMS under related manual/course	• Step-by-step organising the content and uploading the created content under each unit of the course on the LMS • Check if the created content can be accessible on different browsers • Provide downloadable versions of content for learners with limited internet access

5. Blended Learning Course Creation: A TVET School Perspective

As we design courses concerning learning objectives, learner diversities, status of available digital infrastructure, digital tools and other school-based contexts, it is paramount to consider a deliberate approach to the design of technology-supported learning experiences to ensure the success of blended learning. For TVET Schools, a careful and holistic approach should be selected to ensure that the opted technology enhances the learning experience, meets the specific needs of students, and aligns with the institutional and national goals of TVET programs. Such a holistic approach may entail aligning appropriate technology with trade-based curricula and related learning outcomes, accessibility, diversity and equity, hands-on practical learning, user-centred approach, interactive and collaborative learning, innovative learner evaluation and assessment, instructor and learner support, privacy and security, and trade-based industry involvement among others.

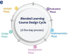

Figure 5. Proposed framework for blended learning course creation, inspired by ADDIE Model

Considering all the above aspects for effective blended learning integration in TVET schools, and the available learning design models in the literature, we propose a five-step process (Figure 5) for creating quality blended learning courses and improving learning experiences for TVET students. This proposed process is inspired by the ADDIE Model (Analysis, Design, Development, Implementation and Evaluation).

Following the steps of the ADDIE model as a guide to blended learning course design for TSSs, figure 5 above is proposed as a framework to guide trainers of TSSs in Rwanda on how they can organise their courses by considering a blended learning environment. TVET trainers will follow this five-step process for blended learning course design. A more detailed description and guidance on how Trainers will apply this five-step process for blended learning course creation is provided below.

5.1. A five-step process for blended learning course creation

5.1.1. Analysis Phase

The Analysis phase is a starting point for effective blended course design by TVET Trainers. This phase focuses mainly on gathering and analysing critical information that will inform the next phases of the course preparation and delivery. The goal of this phase is to understand the learning needs,objectives, constraints, and the learners' needs. This phase sets the foundation for the entire course and helps ensure that it aligns with the desired outcomes. A breakdown
of what TVET Trainers will do during
the analysis phase is presented below:

- **Learner analysis and needs:**
  - Trainers will determine the skills, knowledge, and competencies learners need to acquire in the blended course (Learning objectives).
  - Trainers will also analyse students' prior digital literacy, access to technology, familiarity with technology, and learner

needs for Face-to-face and virtual

learning environments.

- **Trade-based industry analysis:**
  - Trainers will conduct needs assessment on the current job market in comparison with trade-industry relevance.
  - This will be done for example, by analysing industry demands, consulting with employers, or reviewing job descriptions to identify key skills required in the field.

- **Technology & digital tools analysis:**
  - Trainers will navigate the school LMS that hosts the TVET courses and assess its functionalities and features to host their planned course content such as textbooks, graphics, animations and video resources. If schools have established VR/AR/XR and simulation tools.
  - Asses technological readiness such as internet access, and devices available for students
  - Trainers will also assess the course and align the course materials with these immersive technology tools and create an alignment towards learner access to their courses and digital content. Learning Outcomes.
  - In addition, trainers will assess the assistive tools/solutions integrated with the school LMS to support diversity and inclusion in their courses.
  - Trainers should also analyse the expected theoretical and hands-on TVET skills/knowledge/ competencies to be acquired by students in the blended learning environment and those to be acquired in-class, in workshops and at the workplace.

- **Content analysis:**
  - Trainers will analyse and determine if the course will involve theoretical, Practical and industry exposure.
  - At the same time, they will also assess their course content to decide on which part is to be delivered in self-paced online, in-class, labs, workshops or at the workplace.
  - Trainers will also assess the course content to ensure it is inclusive, accessible and can accommodate learners' diversities and preferences.

5.1.2. Design Phase

During the design phase of a Blended Learning Course, TSS Trainers take the insights gathered from the previous analysis phase and start to structure and organize the course. This phase involves creating a detailed blueprint for the course, determining the instructional strategies, selecting the appropriate technologies, and planning the course layout for both online and face-to-face components. The goal is to create a cohesive, engaging, and effective learning experience for students. TSS

- **Mapping the course structure and sequence:**
  - At this phase, trainers will map out the overall structure and sequence of the blended learning course.
  - Trainers will also define the main topics, subtopics, and how they will be delivered across online and offline sessions.
  - Following the course plan, trainers will design their blended course using a blended learning strategy.
  - Trainers will for example design their courses with:
    - Face-to-face learning activities (In-class sessions, Lab sessions, Workshop sessions and industry-based sessions)
    - Online learning activities (Discussion Forums, Lad Demos, Simulations)
    - Synchronous (Live) vs asynchronous

(Self-paced) course delivery
* Psychical versus online assessments.

- **Plan instructional strategies and learner engagement:**
  - Trainers will select strategies such as flipped classrooms, problem-based learning, collaborative learning, or direct instruction.
  - Trainers will also plan strategies like interactive quizzes, gamification, discussion prompts, and real-time feedback to enhance student engagement.

- **Content delivery formats and technology readiness:**
  - Trainers will design their course contents in diverse digital formats.
  - They will review the digital tools and platforms that will support the online components of the course. For example, trainers will consider tools for communication, collaboration, content delivery, and assessment.

  - Instructional designers and multimedia experts will assist them in designing relevant content formats such as:
    * Multimedia content (Text, Audio, video, simulated with VR/AR/XR, & AI generated
    *Adapted hands-on practice, case studies and projects in related TVET fields.

- **Assessment strategy (Safe and proctored):**
  - Trainers will design different assessments such as quizzes, individual and group projects, lab demos and simulations.
  - Considering the type of the course, trainers will for example design:
  - Formative Assessment (Online or Offline practical, Theoretical or Practical)
  - Summative Assessment (Online or Offline, Theoretical or Practical)
  - Proctoring mechanisms to be considered during learner assessment.

- **Design Levels of interaction (online or face-to-face):**
  - Trainers will design their course to ensure a high level of interaction by considering:
  - Peer-to-peer, Instructor-Learner, learner-content interaction
  - Learner / Instructor Support Mechanisms in Blended Learning Environment.

- **Mechanisms and tools for promoting diversity & inclusion:**
  - Trainers will design and avail tools and mechanisms for supporting diverse learners and needs.
  - The designed tools and mechanisms will be aligned with available assistive technologies and resource rooms at the TSS.

5.1.3. Development Phase

During the Development phase of a Blended Learning course for TSS, the main focus will be on creating and preparing all the course materials and activities that will be used in both online and face-to-face components of the course. Below is a detailed description of what TVET Trainers typically will do during the development phase of a blended learning course:

- **Create TVET Course Content and materials:**
  - Develop both digital and physical learning materials: This includes for example creating e- books, graphics, videos, slide presentations, interactive content, simulations, OERs, and practical assignments for both online and face-to-face learning.

  - The created digital content should be accessed by learners in the online component of the blended course.

- Create hands-on activities: For TVET courses, practical tasks are essential. Trainers create assignments or projects that allow students to apply their technical skills, both online (through simulations, virtual labs, etc.) and in person (via workshops or workplace activities).

* **Inclusive content:** Trainers ensure that before availing the content to students, all content and materials are inclusive and gender-neutral, reflecting a diverse range of perspectives and avoiding biases or stereotypes.

•**Develop Instructional Learning Activities:**

***Interactive learning activities:** TVET Trainers develop engaging and interactive activities, both for online and in-person learning. Created learning activities should promote active participation. These can include discussions, quizzes, group work, and problem-solving tasks.

***Blended Learning Activities:** For effective blended learning adoption, TVET trainers ensure that activities are well-balanced between online and face-to-face components. For example, online discussions can be supplemented with in-class workshops, or virtual labs can be complemented by practical tasks in a workshop setting.

•**Develop Learner Assessments & Evaluation tools:**

***Create Online and Offline Assessments:** Trainers can design both formative and summative assessments that can be delivered in a blended learning environment. This could involve quizzes, practical exams, assignments, E-portfolios or peer-reviewed projects.

***Rubrics and Feedback Mechanisms:** Trainers may design assessment rubrics that clearly outline how students will be evaluated. Additionally, feedback mechanisms are created at this phase to provide timely and constructive feedback to students.

- **Select and Prepare Technologies and Tools**

***Learning Management System (LMS) Setup:** Trainers set up and develop the course on the RTB LMS where students can access materials, submit assignments, and track their progress.

-Enrol students into the course: Trainers enrol students into the course and also ensure that the platform is user-friendly and accessible to all students.

***Set up other digital tools:** TVET trainers integrate other technologies such as virtual labs, simulation tools, and tools for synchronous and asynchronous collaboration such as MS Teams, Zoom, Google Meet, Google Docs, Padlet, Mentimeter, etc. Also, learner analytics tools should be integrated in the course to monitor engagement and progress as the course is being implemented

***Testing the Tools:** Trainers test all technological tools to ensure they work seamlessly for both in-person and online components. This includes ensuring compatibility with different devices (laptops, tablets, smartphones) and troubleshooting any potential issues.

- **Create Supportive Resources for Learners**

***User Guides and Tutorials:** Trainers work with instructional designers and E-learning officers to develop guides for students on how to navigate the online components of the course, including how to use the LMS, access materials, submit assignments and participate in online activities.

***Technical Support:** Trainers ensure that students have access to technical support for both hardware and software issues. This might include creating FAQs or instructional videos for a blended learning environment.

***Student Engagement Strategies:** Trainers design engagement strategies to keep students motivated in both face-to-face and online learning. This may include gamification, student progress tracking, and opportunities for interaction between student-teacher and student- student.

5.1.4. Implementation Phase

During the Implementation Phase of a Blended Learning Course following the ADDIE Model, TVET trainers focus on delivering the course to students while ensuring that the learning environment (both online and offline) are properly set. This phase involves putting the course plans, content, and tools created in the Development Phase into action and ensuring that students can effectively engage with and benefit from the developed course. Below are key activities under this phase of implementing a TVET course in a blended learning environment.

- **Deliver TVET course content:**

- Trainers present the course materials and facilitate learning in both the online and face- to-face components of the course. Example: Conduct live classes with MS Teams, upload content on the LMS,
- These course materials should be engaging, clear, and aligned with the course's objectives.
- Trainers also might ensure that all content is accessible to TVET students with different learning needs.

- **Facilitate online Learning:**

- Trainers manage and guide students through the online components of the blended learning course, ensuring engagement and participation. Example: Monitor online forums, host virtual office hours, and facilitate live webinars or group discussions on platforms like MS Teams, Webex or Zoom

- **Facilitate in-person learning:**

- Trainers can lead practical, hands-on training in the physical classroom or workshop setting to ensure students gain the necessary skills and knowledge.
- They may also conduct workshops, lab sessions, practical exams, or group activities where students can apply technical skills in real-world scenarios in their specific trade.

- **Continuously assess and evaluate student learning**

- Trainers implement learners' formative assessments and provide timely feedback to students on their performance.
- Formative assessments should align with the blended learning objectives and address both theoretical and practical learning outcomes.
- Continuous assessments are conducted during the BL course progress to make real-time improvements.
- For TVET courses, these assessments are ideally done by conducting online quizzes, assignments, practical tests and live demos, or course projects.
- At this level, trainers collect feedback from students regularly by using for example, quizzes, polls, student reflections, or informal discussions.
- These tools provide real-time data that can inform modifications during the course such as adjusting teaching approaches, content, or teaching pace.

- Trainers can also use rubrics or E-portfolios, Hackathons to ensure fair and transparent assessment of student work.
- With an effective continuous conducting of formative evaluation of learning, trainers may be able to adjust teaching

methods, revising the content, or learning pace. For example, if students are struggling with a particular concept, the trainer may revisit the topic or offer additional resources through both offline and online channels.

- **Monitor student progress:**

- Trainers track and assess student engagement and progress in both online and face-to- face environments

- Trainers use LMS analytics to monitor student activity, completion rates, participation, and performance on course assessments.

- Trainers also use both physical and virtual attendance to monitor student participation in the course learning activities

-Trainers can identify at-risk students early and provide necessary interventions, such as additional resources, in-person support, or peer coaching.

- **Provide ongoing student support:**

- Trainers make themselves available for support, offering help with technical issues (e.g., logging into the LMS) or academic challenges (e.g., understanding content).

- Trainers should also offer a variety of channels for students to seek support (e.g., email, forums, in-person office hours, peer-coaching hours or virtual meetings).

- **Ensure functionality of digital tools:**

-Trainers need to ensure the available digital tools and platforms that host the course are functioning well.

- This includes checking that the LMS is accessible, video conferencing tools are working properly, and that students have no trouble navigating the online elements of the course.

- Troubleshooting any technical issues promptly is essential for maintaining a smooth learning experience.

- **Foster a safe and inclusive blended learning environment:**

- Trainers should ensure that the blended learning environment is free from harassment and that students feel safe and supported. This includes, for example, addressing any instances of bias or discrimination and fostering inclusivity in group work or discussions.

- Gender-responsive and culturally sensitive teaching practices should be implemented by trainers to ensure equity.

5.1.5. Evaluation Phase

During the Evaluation Phase of a Blended Learning Course following the ADDIE Model, the main focus will be to assess both the effectiveness of the course and the achievement of its learning objectives. This phase involves collecting feedback, analysing data, and making adjustments to improve future iterations of the course. The blended learning course evaluation phase may occur after the course has concluded (summative evaluation). Below is a breakdown of what TVET trainers typically should do during the blended learning course evaluation phase:

- **Conduct summative course evaluation:**

-Review course outcomes, such as student success rates, dropout rates, and career progression after the course.

-Evaluate the overall effectiveness of the course after its completion to determine whether the learning objectives were met.

- Analyse final assessments, student performance, and feedback to assess overall course success and areas for improvement.

- Feedback from students is collected for example through post-course surveys to determine satisfaction and outcomes.

Distribute end-of-course surveys, conduct interviews or focus groups, or use feedback forms to gauge student satisfaction.

- **Analyse learner performance:**
  - Trainers should assess individual and group performance on both theoretical and practical assessments.
  - They should also review quiz results, practical exams, assignments, and learner participation rate to identify trends in student performance.

- **Assess teaching effectiveness and review of digital tools used:**
  - Trainers reflect on the delivery of the course to evaluate the effectiveness of teaching methods, tools, and technologies used.
  - They also perform self-reflection and peer reviews regarding the teaching approach, content delivery, and learner engagement and difficulties
  - Trainers may also analyse whether the LMS, virtual labs, video conferencing tools, and other digital tools worked effectively and were user-friendly.

- **Assess inclusive and gender responsiveness:**
  - Trainers evaluate if all students had equal opportunities to participate in the course,
  - They may also assess whether there were any gender biases, and if the course content was inclusive enough and addressed diverse learning needs.

- **Make improvements for future course delivery:**
  - Based on evaluation results; trainers identify areas for course improvement to enhance future iterations.
  - Trainers may for example adjust content, update resources, modify assessment strategies, or improve learner support based on evaluation data.
  - Overall, trainers may use data from evaluations to continuously improve the course, teaching methods, and learning experience, taking into consideration the theoretical skills and knowledge, practical hands-on competencies and student readiness for trade-based jobs

The ADDIE Model is highly adaptable to blended learning course creation for TSSs considering specific school context as it postulates a structured yet flexible framework for combining online and face-to-face instruction across all phases (See Figure 5). By systematically analysing TSSs context, and learner needs and styles, designing blended learning strategies, developing engaging content, implementing diverse learning formats, and evaluating learning outcomes, each school can create an effective blended learning environment that prepares TVET learners for the workforce with both theoretical knowledge and practical hands-on skills and competencies. Overall, while trainers are advised to follow the above-proposed blended learning course creation framework, other key aspects should also be considered for the effective TSS blended learning environment.

5.2. Other key aspects for consideration when creating a blended learning course

These aspects include for example the learner's accessibility to digital tools and digital literacy, focus on practical hands-on skills, TVET industry relevance and job readiness, consideration on skills and competence assessment, and learners' inclusivity and diversity.

5.2.1. Accessibility to digital tools and technology level

Technical secondary schools, their students and trainers have different characteristics in terms of technology access and level of digital readiness for adopting blended learning.

TSS students often come from diverse economic backgrounds and may have different levels of ownership and access to technology. Therefore, it is important and helpful to offer offline resources or design learning and assessment activities that require only low-tech digital tools for those without reliable internet access and with no computers.

A consideration should also be put on the trainer's access to digital tools and the level of digital literacy and E-pedagogy skills. Hence, the above proposed five-step process of blended learning course creation should cater for these different levels of teacher's digital and pedagogical skills when choosing appropriate technology to support the designed blended learning environment.

Accordingly, TSSs are located in different geographical contexts (Rural, Semi-urban and urban) with no reliable digital infrastructure such as computer labs, smart classrooms, and low internet bandwidth. With this in mind, the creation of blended learning courses should consider all these specific contexts to ensure that the proposed blended learning environment can add value for teaching, learning and assessment.

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5.2.2. Imparting practical hands-on skills

In TVET program or course, a crucial emphasis is on practical, hands-on learning activities. Hence, the proposed blended learning course creation framework promotes also structured in-person or simulated sessions for TSS students for practical applications. In addition to hands-on workshops, trainers can for example use the following other teaching approaches:

- **Blended Project works:** Trainers may, for example, assign students to work on projects that integrate both online learning and hands-on work. With this approach, a student in a construction engineering course might design an artefact online using CAD software and then use 3D printers or tools in the workshop to build it.
- **Instructor-led demonstrations:** TSS trainers may perform live demonstrations of complex tasks (e.g., wiring a circuit, fixing an engine, or animal disease treatment) and then allow students to replicate the task in the workshop or at the job-training place.

Additionally, with the availability of immersive technologies, TVET trainers may use tools such as VR, AR, simulation tools, lab demos to enhance the practical experience and acquisition of hands-on skills. Trainers' use of these immersive technologies guarantee that face-to-face learning is also augmented for practical applications, such as lab works, e-portfolios, group-based workshop projects and computer-supported on-the-job training among others.

5.2.3. Industry-relevant and student-job readiness

The proposed blended learning course creation framework must consider that technology, course design and digital content reflect the industry standards for specific TVET trades. Accordingly, learners from different trade fields might use specific EdTech tools and trade-based software for developing and generating practical related skills and competencies for a specific industry.

The creation of blended learning environment for TSSs should also allow flexibility for learners to absorb key concepts that are relevant for the industry as the later evolves. Using industry-based concepts enables TSS students to adapt easily in their specific industry which is also critical for their job readiness. Accordingly, the designed online learning modules can include simulations that mirror real-life scenarios in the workplace.

The proposed five-step process for Blended learning course creation should considers also the collaboration among students through online discussions, group projects, and peer feedback. These mechanisms help TSS students develop essential soft skills, such as communication, teamwork, and problem-solving, which are crucial for success in the workplace

5.2.4. Consideration on skill and competence assessment

In TVET, competency-based training (CBT) and competency-based-assessment (CBA) are critical to equip students with relevant skills and knowledge for the market and real-world application. Therefore, it is important to use both online assessments and practical hands-on assessments to ensure learners meet the required competencies for the technical and vocational job market.

At the implementation and evaluation phases of the proposed framework, trainers should ensure that the assessment of some learning outcomes and for specific courses are competence-based.

5.2.5. Consideration on learner diversity

While creating blended learning courses, trainers should keep in mind that TSS schools receive students with diversities in terms of gender and disability levels. Therefore, the blended learning course creation framework should be able to cater for different students' disabilities and to accommodate diverse learning preferences and learning pace by providing assistive technologies and learning contents that are relevant for all.

6. Proposed Category-based Guides for Blended Learning

This chapter introduces five specific guides for the effective implementation of blended learning in Technical Secondary Schools (TSSs) in Rwanda. It covers key areas including the adaptation of curricula and teaching manuals, digital infrastructure and technology requirements, digital content development and selection, professional development for trainers, and students' readiness for blended learning. These guides provide a structured approach to integrating digital and face-to-face learning, ensuring a seamless transition that enhances both teaching efficiency and student learning outcomes.

6.1. Guides on curricula and manual adaptation to Blended Learning

In line with the curriculum adaptation to blended learning, an analysis of the current CBT/CBA framework has been conducted. Samples of curricula for some trades were collected and explored by considering blended learning requirements such as the integration of digital tools/devices, teaching contents and the LMS, interactivity and learner engagement with digital contents, online learning paths, E-assessment practices and feedback. On top of these considerations, continuous teacher capacity building in digital literacy and E-pedagogy, and students' digital skills requirement to cope within a blended learning environment for TSSs were also considered.

The analysis has focused on TVET curricula with randomly selected trades from level 3 to level 5. This review has indicated that CBT/CBA framework need to be adjusted by adding the followings, as per figure 6 below:

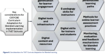
Key considerations for CBT/CBE Curriculum Adaptation for Blended Learning Implementation in TVET Schools
Learning gamification for learner engagement
Digital tools and infrastructure
Digital content and resources
E-pedagogy skills for instructors
Digital skills for trainers and students
Customised/ personalised learning paths
Methods for online learner assessment practices
Monitoring, evaluation and feedback mechanisms for blended learning

Figure 6. Considerations for TVET Curricula Adaptation for Blended Learning

The elements in the figure 6 above are reported as critical for the effective implementation of blended learning in the Rwandan TVET curricula especially for TSSs. A brief description of each element is provided here below:

- Consideration of digital tools and infrastructure: Blended Learning implementation requires a range of digital tools and devices for TVET schools, trainers and students. The current curricula do not explicitly mention the LMS type, setting and features to be available for supporting online/offline teaching, learning and assessment activities. These include computer Labs, Simulation Software, VR/AR/XR tools, Internet access and laptops for Teachers and Students, and virtual collaborative tools to support the implementation of blended learning for CBT/CBA.

- Consideration of digital contents and resources: The current TVET curricula do not explicitly describe the types of multimedia digital content such as videos, texts, infographics, E-books, E-library resources, and interactive simulations to be used in a blended learning environment. The current TVET curricula for TSSs are also silent on how online courses/manuals will be designed.

- Digital skills for trainers and students: The current TVET curricula do not explicitly address the required digital skills for trainers and students to prepare them for effective engagement in a blended learning environment.
- Customised/personalised learning paths: In some parts of the curriculum in Level 3 and 5, there is little mention of personalised or adaptive learning to accommodate students' varied paces and needs, for which the blended learning environment should offer.

- Learners' online assessment methods: Flexibility in online assessment is crucial for effective blended learning. However, the assessment guidelines that are stated in the current CBT/CBA curricula focus mainly on traditional methods (In-class, Workshop and workplace hands-on practical assessments). The current curricula do not describe how computer-based assessments such as online quizzes, e-portfolios, simulations, live demos and virtual presentations can be conducted.

- E-pedagogy training for instructors: Trainers need specific training on how to deliver blended learning courses effectively including instructional design and online pedagogy and the use of digital tools for learner engagement. The current curricula for TVET schools in Rwanda are not clear on how TVET trainers should design courses, engage learners using online collaborative tools and develop interactive learner-centred digital content. It is also not clear how online summative and formative assessments can be conducted.

- Gamifying the learning process: Blended learning environments thrive on engaging and interactive activities by including game-based learning elements or virtual labs to enhance the student experience. The current TVET curricula are not clear on how trainers can use gamification elements to support learners' engagement and motivation.

- Monitoring, evaluation and feedback mechanisms for blended learning: The current TVET curricula lack a structured and well-defined approach for continuous monitoring and evaluation of the blended learning environment for TSSs. Accordingly, it is not clear which online tracking tools or automated feedback systems to be adopted for blended learning evaluation at school, course and individual level. A structured approach should be proposed to assess blended learning focusing on areas such as CBT-related learning outcomes, learner's online/offline engagement, skills development, accessibility and inclusivity, trainers and student readiness, and the level of technology integration among others.

Accordingly, the current TVET curricula adaptation requires updating the TVET-CBC general information template and the module content template with online learning aspects. These two templates and how they have been adapted are explained in later stages.

6.1.1. Curriculum development and adaptation to blended learning

To adapt the current TVET curricula and ensure they can be implemented in a blended learning mode, it is very important to provide guides on the extent to which online and offline teaching, learning, and assessment activities will be conducted. The adaptation of the TVET curricula to the blended learning environment also entails self-paced learner engagement and interaction with trainers, peer-students, and content. Based on the situational analysis conducted at the pilot TSSs and the consultations with different TVET partners in Rwanda, the ratios of offline and online activities need to be assessed for each course considering the differences between practical and theoretical components. The proportion of online versus offline activities may vary depending on the specific trade, curriculum, and course/manual requirements; the availability of digital (blended learning) infrastructure at a given TVET school; and learner diversity, including disability categories, needs, and preferences. Additionally, the resources to implement the CBT/CBA curricula should indicate the technology tools to support blended learning. Annex ii provides a sample of CBT/CBA blended learning-adapted curriculum.

(1) Adaptation of TVET-CBC Curriculum General Information Template

The Competency-Based Curriculum (CBC) Information Template is a structured document that guides the design, development, and implementation of TVET curricula, ensuring alignment with industry needs, educational standards, and the competencies required in various technical and vocational fields. To effectively integrate blended learning within the TVET-CBC Curriculum, the template must be adapted to reflect a balanced combination of online and in-person learning while maintaining the integrity of competency-based training and assessment. The adapted curriculum should outline key components such as program overview, student competencies and learning outcomes, blended module structures, teaching methodologies, required resources, and blended assessment strategies. Additionally, the template should incorporate digital competencies, employability skills, and environmentally responsible ICT practices.

To ensure the effective adaptation of TVET curricula to blended learning, the following guidelines are proposed:

- **Specification of digital tools and infrastructure:** The curriculum should clearly define the necessary digital tools, platforms, and infrastructure required to support a relevant blended learning environment for TVET courses.

- **Structured online and offline content delivery:** The curriculum framework should propose some contents that can be provided online. Eg: which lecture sessions and theoretical concepts can be delivered online, which content requires in-person instruction (e.g., practical workshops or labs), and the aspects designated for on-the-job training.

- **Modular and flexible course design:** Content should be broken into smaller, manageable modules to allow for self-paced learning and flexibility in course delivery.

- **Integration of blended learning assessments:** Assessment methodologies should incorporate a mix of digital and traditional evaluation methods, ensuring that competencies are effectively assessed in both online and offline learning environments.

- **Defined learning activities and assessments:** The curriculum should explicitly indicate which learning activities and assessments will be conducted online and which will be administered offline.

- **Identification of supporting technology resources:** The curriculum should specify the required technology tools and resources that will facilitate blended learning, such as LMS platforms, e-learning content, and digital collaboration tools.

- **Gamification strategies for engagement:** To enhance student motivation and participation, the curriculum should include gamified learning elements, such as interactive challenges, badges, and leaderboards.

- **Monitoring and evaluation framework:** A structured approach should be incorporated to track the implementation of blended learning, ensuring continuous monitoring, feedback mechanisms, and necessary improvements.

- **Integration of blended learning in Existing TVET curricula:** The Rwanda TVET Board (RTB), in collaboration with TVET schools, should initiate the integration of online learning components into existing curricula to facilitate a seamless transition to blended learning.

Moreover, the adapted Curriculum Information Template specify the sections that will have to indicate online and offline facets for a particular TVET course. These sections are:

- The program overview,
- Students' competencies and learning outcomes,
- Module or Unit structure (in blended delivery),
- Teaching and learning strategies,
- Resources (materials and equipment)
- And assessment methods.

In the adapted CBC Curriculum Information Template, these sections include both online and offline aspects.

Note that a sample adapted CBC Curriculum General Information Template integrating digital tools and resources is reflected in annex ii. In that template, sections like employability and life skills, and computer skills for students were adjusted to include digital competencies. These skills include effective online communication, independent work in online settings, and awareness of health and environmental considerations such as ergonomics and green ICT.

(2) Instructional strategies towards curricula adaptation

Ensuring effective blended learning implementation in TVET schools requires the application of appropriate instructional strategies that align with the Competency-Based Training (CBT) and

Competency-Based Assessment (CBA) curricula. These strategies should leverage technology to integrate theoretical knowledge with hands-on practice, ensuring learners develop industry-relevant skills. By adopting a blended learning approach, TVET schools can enhance flexibility, engagement, and accessibility while maintaining the hands-on nature essential for technical education. The following instructional strategies are proposed to effectively blend TVET CBT/CBA curricula:

- **Flexible learning structure:** theoretical content, such as videos, texts, and readings, should be assigned for self-paced online learning, while practical training, problem-solving exercises, and discussions should be conducted in physical settings like workshops or computer labs.

- **Defined delivery modes:** each training manual should specify the mode of delivery for different units, clearly indicating which components will be delivered online, offline, or face-to-face to ensure a structured and seamless learning experience.

- **Balanced online and face-to-face learning:** Theoretical concepts should primarily be delivered online, whereas practical skills training should take place in traditional face-to-face sessions to preserve the hands-on nature of TVET education.

- **Synchronous and asynchronous learning:** Online lecture sessions should incorporate both live (synchronous) and self-paced (asynchronous) methods to allow personalized learning experiences and accommodate diverse learner needs.

- **Utilization of digital platforms:** Trainers should use digital tools such as Learning

Management Systems (LMS) for recorded lectures, online quizzes, and assignment management, as well as video conferencing tools for live sessions. Collaborative tools should also be used for group discussions, peer feedback, and teamwork projects.

- **Engaging multimedia content:** Learning should be enriched with videos, animations, interactive simulations, and digital libraries to make theoretical content more engaging and accessible to all learners.

- **Blended apprenticeships and internships:** Work-based learning should integrate online modules and e-portfolios, allowing students to document and reflect on their experiences while receiving virtual support and guidance.

- **Mobile-friendly learning materials:** Digital content should be optimized for mobile devices, ensuring learners can access course materials anytime, anywhere, whether at school or home.

- **Gamification for engagement:** To enhance motivation and learner participation, gamification elements such as leaderboards, achievement badges, and rewards should be incorporated into the learning process.

- **Adaptive learning based on LMS analytics:** Trainers should monitor learner progress through LMS analytics and adapt instructional approaches accordingly to meet individual learning needs.
- **Advanced immersive technologies:** With advancements in digital learning, Virtual Reality (VR), Augmented Reality (AR), and Extended Reality (XR) could be also integrated into manuals to provide hands-on practical skills training in a safe and controlled environment.

When TSSs implementing these instructional strategies, TVET schools can create an effective blended learning environment that enhances learner engagement, ensures competency development, and aligns with industry demands.

6.1.2. TSS Course Manual Adaptation to Blended Learning

A manual content template is a blueprint that is used by TVET institutions to organize and present the content of a course or module. It is a guide for both instructors and students, ensuring that the TVET course is coherent, comprehensive, and aligned with the learning objectives.

In transition to blended learning in Technical Secondary Schools (TSSs), the course manuals must be adapted alongside the TVET curricula. This adaptation should encompass session plans, trainers' schemes of work, and course content to ensure that both theoretical and practical components are effectively delivered in a blended learning format. The following key actions are necessary for the adaptation of course manuals to blended learning:

- **Integration of digital tools and resources**

- Manuals should include objectives requiring trainers and trainees to use digital tools in teaching, learning, and assessment.
- Clear guidelines on how digital tools and resources will be integrated into lessons must be specified.
- Learning outcomes should explicitly indicate how they will be achieved in a blended learning format.
- **Structuring learning content for blended delivery**

- Manuals must clearly distinguish which learning activities that are possible to be conducted online and those that requires face-to-face interaction.

- Course content should be broken into smaller, manageable units, each with well-defined learning outcomes, activities, and resources.
- Online materials should be interactive, using tools like HSP and SCORM, supported

by PDFs, PPTs, audio, and captioned videos.

• Standardized course content and LMS integration

• All course manuals should follow an RTB-approved template for consistency. Possibly, LMS may have template to be filled for harmonization purpose.
• The course manuals must include a cover page with course details, learning outcomes, prerequisites, and assessment methods.
•Course content should be uploaded to the RTB LMS in a standardized format for accessibility.

• Specification of learning modes and required resources

• Course manuals should indicate whether a unit will be delivered online, offline, face-to-face, or through workplace placements.
• Equipment, tools, and materials necessary for blended learning should be clearly outlined.
• Additional references and resources should be provided in both course syllabi and the LMS.

• Accessibility and optimization for low-bandwidth environments

• Digital content should be optimized for low-bandwidth areas, with compressed multimedia formats (MP4 for videos, JPEG/TIFF/PNG for images).
• Course manuals should promote the use of Open Educational Resources (OER) under Creative Commons licensing.

For TSSs in Rwanda, the Module (Manual) Content Template has been adapted to create guidance to TSS trainers on where to include elements of blended learning in their course. The adaptation of the Manual Content Template focused on revising the learning outcomes. Starting on the later, they need to start with reformulation, to include how these learning outcomes will be achieved in a blended learning mode. Additionally, the section of implementation materials has been also adapted to align with the resources required for achieving the learning outcomes in a blended learning environment.

Accordingly, resources required in terms of equipment, tools and materials for TSS students to achieve learning outcomes have been also proposed in the adapted Manual Content Template to reflect the blended learning approach. The sections of Formative and Summative Assessments have been also adapted with guidance on elements to be considered to adapt the manual with blended learning features. The adapted Module Content Template is provided in Annex vi of these blended learning guidelines.

6.1.3. Adaptation of Scheme of work and session plan for blended learning

Adapting the curricula and manuals for TVET courses need also to be done in line with the review and adaptation of the trainer's scheme of work as well as the session plan template. These two templates are important to highlight online aspects which will guide trainers during the planning and delivery of their courses.

(i) Adaptation of the Scheme of Work for Blended Learning

A scheme of work is a structured plan that helps trainers organize teaching activities in advance. It serves as a forecast of learning activities that trainers consider suitable for a particular class, ensuring that the curriculum is covered effectively within a specific teaching period.

The scheme of work structures content delivery in a timely manner, aligning with the school calendar and curriculum requirements.

Additionally, the scheme of work defines what content, and competencies should be covered within different timeframes, weekly, monthly, per term, or throughout the academic year. It provides a roadmap for trainers to systematically guide students through their learning journey, ensuring progression, consistency, and competency development in technical and vocational education.The current TVET scheme of work template does not explicitly define how online learning activities, digital tools, and technology-enhanced resources should be incorporated into blended learning. To ensure an effective transition to blended learning, the scheme of work must be adapted to include both face-to-face and online learning components. This adaptation ensures that trainers effectively plan, integrate, and utilize digital tools and resources while maintaining the competency-based approach of TVET. To make the scheme of work fully aligned with blended learning, specific sections must be revised to incorporate online and face-to-face elements:

1. Equipment, Tools, and Resources (ETR)

- o Clearly list the digital tools, platforms, and technologies required for blended learning.
- o Specify whether resources will be used in an online setting (LMS, virtual labs, e-books) or in face-to-face practical sessions (workshops, lab equipment, physical tools).

2. Evidence of Assessment

- o Define how formative and summative assessments will be conducted in both online and in-person settings.
- o Identify digital assessment tools such as online quizzes, e-portfolios, and competency-based practical evaluations.

3. Indicative Contents (Key Learning Elements)

- **Learning Activities**
  - Distinguish activities meant for online (interactive videos, simulations, discussion forums, self-paced exercises) from those delivered in face-to-face settings (practical workshops, hands-on skill demonstrations).

- **Learning Resources**

  -Specify digital learning materials, such as SCORM packages, H5P interactive content, PDFs, PowerPoint presentations, videos, and e-library references.
  -Include additional physical materials required for hands-on learning.

- **Learning Place**
  -Define where each learning activity will take place–whether in an online environment (LMS, virtual classrooms) or in a physical setting (workshops, industry placements, school labs).

By explicitly highlighting these blended learning components in the adapted scheme of work in Annex iv, trainers can effectively plan and implement technology-enhanced teaching strategies to ensure a balanced, competence-based learning experience for TVET students.

(ii) Adaptation of the Session Plan for blended learning

A Session Plan is a detailed outline of the teaching activities, strategies, and resources used during a specific learning session.

A session plan is more specific as it covers a shorter time frame such as one class or training session within a broader course. For Blended Learning in TVET, a Session Plan template is designed to guide the delivery of both online and face-to-face components during a particular session, ensuring a coherent and engaging learning experience that blends digital and in- person learning.

A session Plan in Blended Learning for TVET should be designed to serve several critical roles in a Blended Learning environment for TVET:

• **Provides a clear session structure:** It ensures that both the online and in-person components of the session are well-organized, with a clear flow of activities that support the learning objectives.

• **Guides the Trainer:** It acts as a roadmap for the trainer, outlining how to deliver the content, engage students, and assess learning outcomes in both offline and online environments.

• **Promote Engagement:** It ensures that the session is interactive and engages students through a combination of digital tools, hands-on activities, and collaborative learning.

• **Aligns Activities with Learning Goals:** It ensures that activities (both online and offline) align with the learning objectives and contribute to skill-building in a way that mirrors real- world practices.

• **Facilitates Assessment and Reflection:** It includes formative and summative (both online and offline) assessment strategies that help monitor student progress during the session, as well as time for trainer reflection on the session's effectiveness.

Based on the review conducted on the current session plan for TSSs, it was realized that this template does not clarifies on:

- Indicative Content (hard or digital)
- Online and Offline activities for trainers and learners,
- Online and in-class assessment and evaluation activities
- Type of Reflection space (virtual or offline)
- Learner assessment tools (hard versus digital tools)

For better guidance on how TVET trainers will use the session plan template, the adapted template, including clarification on areas to specify online and in-class considerations, is provided in **Annex v.**

6.1.4. Assessment and Evaluation for TVET Curricula and Manual Adaptation

In a blended learning environment for TSSs, conducting learner assessment and evaluation requires integrating both online and offline methods to effectively evaluate theoretical knowledge, practical skills, and workplace competencies. The following are key guides on how schools in Rwanda can assess learners in such a blended learning environment:

- The assessment should be a mixture of online for theory parts and face-to-face assessments for practical components.
- Trainers may use regular, low-stakes quizzes, polls, or reflections to gauge learner understanding.
- Other technology-mediated assessments like VR/AR/XR, simulations and video-based features may be used to assess the practical components.
- For the formative assessments that are administered online, trainers should provide immediate feedback to help learners improve

their learning and preparation for summative assessments.

- Online assessment should follow and respect the normal assessment procedures and standards (moderation, consideration of Bloom's taxonomy, alignment with learning outcomes)
- Anti-plagiarism mechanisms (use of plagiarism checkers) and proctoring tools need to be used as mechanisms to authenticate assessment and evaluation processes.
- For performance-based assessment (practical hands-on), trainers should evaluate learners on real-world tasks, projects, and simulation-based activities.
- Where possible, trainers may use LMS rubrics to assess practical skills consistently
- Learners should be encouraged to create E-portfolios showcasing their work and skills, which will be documented in logbooks.
- Online assessments should be accessed by students with disabilities and different needs to foster inclusion and diversity
- Learners should be encouraged to peer assessment through reflections on their progress and providing constructive feedback to peers. This will help learners in developing learners' critical thinking
- To ensure diversity and inclusion, UDL guidelines should be used to design multiple assessment formats such as (text, video, oral, simulations...etc) with flexibility in deadlines for submission and methods for demonstrating acquired knowledge and skills.
- Accordingly, the design of assessment should enable learners with disabilities to use tools like screen readers, voice-to-text software, or specialized keyboards.

6.2. Guides on digital infrastructure and technology requirements

The implementation of blended learning in TVET schools requires proper planning and cost-effective digital solutions. Proposed digital infrastructure and resources for supporting blended learning in TVET schools are summarised below:

6.2.1. Hardware infrastructure requirements

Hardware devices commonly used in blended learning environments include computers (laptops or desktops), tablets, smartphones, smartboards, document cameras, interactive whiteboards, and sometimes specialised devices like 3D printers or virtual reality headsets; all of which enable students to access online learning materials while also participating in traditional classroom activities.

I. Access to ICT devices

Technical secondary schools wishing to implement blended learning should facilitate each trainer with blended courses to access laptops so that s/he can prepare teaching materials, develop instructional materials, and select or consult digital content at their own pace. Students should have devices such as computers, laptops, tablets or phones to navigate on LMS, access blended course content, attend video calls, and access collaboration and chat. In case they don't have their own devices, the school should be equipped with computer labs to cater for this need. In this case, schools should put in place an internal policy/instruction guiding computer lab access or use and provide a rotation calendar when the number of computers is limited compared to students and staff.

The specifications for a computer used in blended learning may vary depending on the program and the type of work being done. For example, a computer specification for the software development trade compared to that of the animal health trade could vary.

However, the computer needed should be able to run a web browser like Chrome, Safari, Opera, or Firefox, run programs for creating documents, spreadsheets, and presentations, access the internet, have a microphone and speakers for online sessions and a headset to reduce background noise and be able to install subject-specific software. TVET trainers should be provided with laptop and desktop computers to support blended learning activities. The recommended specifications for the laptops (for TVET trainers and students) and computer labs (desktops) are proposed in table 4 below:

Table 4. Proposed specifications for ICT Devices for TSSs

Item	**Level of usage**	**Minimum Specifications**
CPU (Processor)	General Applications and multitasking	Minimum 4 CPUs (hyperthreaded into 8)
	For heavy tasks such as CAD, multimedia editing etc.	Minimum 4 CPUs
RAM (Memory)	For smooth multitasking and running heavier applications	Minimum 4GB
	For heavy tasks	Minimum 8 GB RAM
Storage Capacity	For faster boot and load times	Minimum 256GB SSD
	For storage-intensive tasks (video editing, design, etc.	Minimum 512 GB SSD
Graphics Card (GPU)	For basic tasks	Minimum 2 GPU
	For specific trades (e.g., Graphic Design, Video Editing, 3D Modelling, ...etc) and simulations	Minimum 4 GPU
Display (Desktop Monitor)	For clarity and productivity	Minimum 16"
	For improved workspace	Minimum 21"
Display (Laptop Screen)	Depending on trades	Minimum 13"
Operating System	With support for industry-specific software	Educational latest Windows
VR/AR/XR	Experiment and demonstration	VR headset, motion controllers, haptic device
Interactive whiteboard	Displaying	Android, Chrome, Mac OS, Windows latest versions minimum 55" screen size

In addition to the device specifications for computers, the following should also be considered:

I.1. Storage requirements

For digital storage capacity and considering the school population, the following are recommended:

- The minimum server storage capacity should be 10TB for hosting basic digital content hosting, video resources and interactive digital content, simulations, and other materials.

The recommended TSS servers should have the following specification

- Processor: minimum 16 CPUs
- RAM: Minimum 32 GB
- Storage Capacity: minimum 2TB

- The use of Content Delivery Networks (SDNs) such as YouTube or Vimeo for RTB and TVET schools is highly recommended for offloading heavy digital content on local servers

- TVET schools should implement content archiving regulations to allow moving old or unused content to the backup storage or delete after-a-retention a specific retention period (10 years at least).
- TVET schools should establish content upload quotas by limiting upload sizes for students and teachers to avoid unnecessary storage usage.
- For flexibility and scalability of blended learning with respect to TSS needs, cloud-based storage solutions are recommended with providers such as Smart Education, AoS, Google Cloud, AWS, Microsoft Azure, and others.

I.2. Other important digital devices for consideration

- TSSs may ensure that each class and computer lab have at least a mounted projector.
- Each classroom should be equipped with a desktop computer and an interactive whiteboard for teacher-led demonstrations or collaborative in-class activities
- Computer labs for general purposes shall also be established at all TSSs
- Each TSS school should have a timetable that indicates the sharing of computer labs by trainers and students.
- A Bring Your Own Device (BYOD) approach should be in place to encourage learners to acquire their personal computers through parental support.
- Digital Twins technologies are highly encouraged for TSSs as they will provide a virtual learning environment that allows students to interact in real-time with well-equipped labs from other fellow TSSs.
- TSSs, in partnership with its stakeholders, should integrate digital twin infrastructure for simulating and monitoring physical assets in vocational education and training.
- Digital Twins infrastructure[1] should be piloted at the TVET centres of excellence to replicate real-world systems, processes and machines and then progressively integrate this technology into other TVET schools.
- Where established, Digital Twin technologies should be used for practical skill-building in fields like engineering, construction, and manufacturing.
- The school should collaborate with industries to align digital twin applications with real- world practices.

II. School access to electricity and power supply

Access to electricity is very critical for TSSs to adopt blended learning as it powers the technological infrastructure that supports the online and digital components of blended learning in TSSs. In a blended learning environment, students and trainers engage in a mix of online learning (e.g., digital content, virtual classrooms, e-learning platforms) and face-to-face practical training in classrooms and workshops. Therefore, access to electricity is essential for the functioning of both the online and offline aspects of this blended learning model. The assessment of the pilot 11 TSSs has indicated that electricity is not sufficient enough to support blended learning. Considering that several TSSs are located in areas with limited access to electricity, it is therefore, proposed that:

- TSS should be connected to grid electricity, if it happens that a TSS is not on grid, or the grid electricity is not regular.

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[1] A digital twin is a virtual replica of a physical object, person, or process that can be used to simulate its behaviour to better understand how it works in real life

- Also, TSS is recommended to adopt solar power solutions, power supply and backup options in some schools which do have access to a regular grid power.
- The estimated power connection shall be between 100 to 200kwh depending on the usage and school size in terms of population.
- This proposal is not strict as some schools have power demanding practice machines.
- The power supply shall be sufficient to a TSS school needs for effective adoption of blended learning.
- To ensure a reliable power supply, TSSs should install UPS units to ensure uninterrupted power supply for key equipment such as routers, servers, and switches. This is especially critical for TSSs located in remote areas with disruptive power outages.

III. Reliable Internet Connectivity

In various assessments, from the literature, that were carried out in pilot schools, it was found that a large percentage of TSSs have various connectivity challenges due to different factors. The challenges range from having internet but with a limited campus coverage, issues of internet reliability. At some schools, specifically in remote areas, the internet is at a lower speed because the fiber optic network infrastructure is not yet in those remote areas. The current internet bandwidth connectivity at TSSs is supposedly 25Mbps for Fiber serviced schools and 20Mbps for 4G serviced schools.

In this regard, a preliminary assessment is essential before upgrading the internet connectivity to meet the needs of blended learning in TSSs. This should include an assessment of the current ICT infrastructure, including LAN status, internet speed and network coverage. A technical site assessment should map the existing cabling and network devices, identify the optimal placement of access points, and analyse the reliability of the power supply.

Schools also need to liaise with Internet Service Providers or Mobile Network Operators to assess bandwidth availability and integration with existing networks. Based on the findings, a Bill of Materials should be developed to outline the equipment required. If there is a lack of in-house expertise, a network design consultant should be engaged. This assessment will ensure a structured needs-based approach for upgrading connectivity for effective blended learning.

III.1. Internet and intranet at TSS School

For effective blended learning implementation in Rwandan TSSs, the school intranet should be scalable, cost-effective, and able to handle both digital content delivery, simulation and e-assessment practices. The network infrastructure at each TSS should ensure reliability for both students and TVET trainers. Based on the assessment conducted at the sample pilot TSSs across the country, the current level of network connectivity needs to be upgraded if the school aims to embrace the blended learning model. In order to cover the school intranet, Wi-Fi Access points should be installed at the

TVET school premises (trainers & learning blocks, computer labs, workshop halls and classrooms, and administrative buildings). The detailed specifications for the school intranet are proposed in table 5 below:

Table 5. Minimum internet and intranet Specifications for a TSS

Component	School Connectivity Specifications
Internet Speed	- Minimum 25 Mbps for each school
Wi-Fi Standard	Wi-Fi 6 (802.11ax) or Wi-Fi 5 (802.11ac) for higher device density.
Access Points (.)	- 6-10 APs based on school layout and coverage needs. - Consider both Indoor and Outdoor APs
Ethernet (LAN) Connections	Gigabit Ethernet (1 Gbps) in classrooms, laboratories, and workshops and administrative blocks
Security & Backup	- Firewalls, Intrusion Detection Systems, VPNs. - UPS for power backup, and redundant internet.
Network Monitoring	- Network monitoring tools such as Nagios or Paessler PRTG, Solarwinds..., etc - Issue detection measures.
Device Management	MDM for managing BYOD or school-owned devices securely.

- The recommended bandwidth should be able to provide sufficient internet for streaming video lessons, live classes, online teacher-learner and learner-learner collaboration, simulations, and access to interactive multimedia content.
- Considering the demand for a reliable internet in TSSs, Fiber-optic connection is highly recommended, as it provides high-speed, low-latency, and reliable connectivity. For TSSs with no Fiber-optic coverage, dedicated leased lines or high-speed LTE/5G backup should be highly considered.
- A peak usage approach should also be preferred to enable simultaneous usage by students and teachers such as for video streaming, live lectures, online assessments, E-library access and other browsing). With the peak usage approach, enough bandwidth should be dedicated to these teaching and learning activities so that at least 50% of students and teachers can be simultaneously active users without lag during peak periods.

IV.Network Infrastructure

A school network infrastructure consists of interconnected hardware and software that enable communication, data sharing, and access to digital resources. It includes components such as servers, routers, switches, Wi-Fi access points, and security systems to support teaching, learning, assessment and administration. Some of those are described as follow:

IV.1. Access Points (APs)

Access Point (AP) are networking devices that allows wireless devices to connect to a wired network, essentially acting as bridges between wireless and wired networks, enabling devices to access the internet or other network resources wirelessly. The TSSs should do the following to ensure effective blended learning adoption:

- High-quality access points (APs) should be installed across classrooms, workshops, libraries, and common areas at the TSSs.
- The number of APs to install at school may vary depending on the layout and physical size of the campus. For example, for a school with 50 to 200 active users, 6 to 10 High-Quality APs can provide reliable internet access to ensure fast and uninterrupted service.
- Access points should be 802.11ac or 802.11ax and should support dual-band Wi-Fi (2.4 GHz and 5 GHz) for optimal coverage and performance.

IV.2. Local Area Network (LAN) & Wired Connections

LAN is a computer network that connects devices within a limited area, like a home, office, or building, using wired or wireless connections, enabling them to share resources and communicate whereas wired connection refers to using physical cables and connectors, like Ethernet, to transmit data between devices, offering reliable and fast connections compared to wireless methods. In blended learning environment:

- Classrooms and labs with computers should have at least 1 Ethernet port per device.
- For devices like projectors or large screens that need stable connections, ensure wired connections of at least 1000 Mbps or Gigabit Ethernet.

IV.3. Switches and Routers for TSSs

Routers connect multiple networks and direct data packets between them, while switches connect devices within a single network to facilitate communication among them. For a TSS implementing blended learning:

- It should use Gigabit Ethernet switches for internal network connectivity.
- Layer 3 switches can be used for routing between VLANs, especially for schools with large areas.
- A minimum of 3 switches for a school with more than 200 users and large areas, depending on the number of classrooms, workshops, and labs.
- It should have routers with high performance, capable of handling the traffic from all devices and offering features such as QoS (Quality of Service)

- Routers should be capable of prioritising bandwidth for critical applications (e.g., video conferencing, simulations and online assessments).

IV.4. Wi-Fi Coverage at TSS premises

The WIFI coverage is the geographical area or physical space where a Wi-Fi signal is strong enough to provide a reliable connection to devices. To effectively implement blended learning approach in teaching, learning and assessment practices, TSSs should:

- Ensure complete coverage across all classrooms, laboratories, and common areas.
- Outdoor spaces may require additional APs to optimise the internet coverage and performance for uninterrupted service delivery
- Provide dedicated Wi-Fi zones for instructors in classrooms or administrative offices.

IV.5. Security, Access Control and Redundancy solutions

Internet security strategies have to be put in place to protect schools against external threats. This includes practices, measures and technologies used to protect devices, networks, and data from cyber threats when accessing the school internet access control manages who can access

resources, and Redundancy ensures system availability by having backup systems in place. The Internet access control is also a way to manage, monitor, and restrict access to the internet within a school. For Internet redundancy at a school, this refers to having multiple internet connections or service providers and backup systems in place to ensure that the school's internet access remains reliable, even if one connection fails. In a blended learning environment:

- The school should install firewalls, intrusion detection systems (IDS), and VPNs to protect the school's network.
- TSSs should implement network access controls (NAC) to ensure that only authorised users and devices connect to the campus network.
- To ensure effective device monitoring and security, TSSs should implement Mobile Device Management (MDM) to ensure the security and manageability of student and teacher devices (if BYOD is encouraged).
- Use encryption tools for sensitive data such as student records, E-assessments, grades, and personally identifiable information (PII).
- User Authentication should be established by implementing Single Sign-On (SSO) with multi-factor authentication (MFA) for accessing online learning systems and related systems to enhance security.
- TSSs should ensure redundancy in internet connections by having backup internet service providers or secondary wireless connections.
- It is also important for schools to consider using cloud-based backup solutions for storing important school data to prevent data loss in case of hardware failure.

6.2.2. Internet Bandwidth distribution among Students and Trainers in TSSs

To effectively implement blended learning in TSSs with well-managed internet bandwidth, it is important to allocate reasonable download and upload speeds to users to ensure that both students and trainers can effectively engage in blended learning, e-assessments, simulations and interactive content delivery and access. Teachers generally require more bandwidth than students due to their roles in content creation, live teaching, uploading and downloading content and E-resources, and providing feedback.

However, students must also be provided with reliable internet for engaging in online learning activities such as watching and downloading video lectures, submitting assignments, occasionally joining live lecturers and interacting with the school LMS.

Considering the current context in terms of TSSs' internet capacity in Rwanda, where the maximum share of the internet bandwidth for each school is 25 Mbps, this capacity should proportionally be shared for download and upload levels by students and trainers. Due to their activities in a blended learning environment, trainers will need more internet bandwidth share than students. However, to ensure a sustainable blended learning environment in schools with advanced use of emerging technologies and interactive digital content, it is highly crucial to consider increasing the current internet bandwidth capacity at these TSSs.

6.2.3. Further considerations for TSSs with limited access to internet

It is understood that some TSSs in Rwanda have limited access to internet. This is evident especially for schools located in rural areas. However, this should not stop these schools from adopting blended learning at some levels by relying on creative solutions and a focus on leveraging available resources. The proposed blended guidelines propose some alternative resources that some TSSs may rely on when creating a blended learning environment within a low-resource context.

i. Leveraging offline learning resources

TSSs can adopt a creative approach of pre-loading digital content by downloading and storing educational content, including videos, e-books, and lessons, on local servers or devices (like tablets

or laptops) before students access them offline. This allows students to engage with content even without an internet connection. Offline Learning platforms and apps are also other alternatives for TSSs with limited internet access.

The current version of Moodle (mobile app) for example offers offline access to learning resources and TVET students can engage with resources and assignments, and their work can be synchronised online when there is internet. Other platforms such as Khan Academy, Edmodo, Google Classroom, Coursera and Microsoft OneNote are some of the useful platforms that provide offline modes of teaching and learning, making them particularly useful in areas with limited internet access. These tools allow users to download lessons, watch instructional videos and complete learning exercises offline.

ii. Use Local Networks or Intranet

Using offline access and having school-based servers can tremendously support internet bandwidth usage. TSSs can set up a local network to store educational content (such as videos, e-books, and interactive lessons) on a local server. Students can access these materials within the school without needing internet connectivity. This works particularly well for rural areas where internet speeds are slow or unreliable.

iii. Satellite Internet Solutions

In many rural areas, satellite internet can provide a more reliable connection where traditional broadband or fiber connections are unavailable. TSSs located in rural areas in Rwanda should adopt satellite internet for basic blended learning activities. Although the initial setup cost (for the dish and equipment) can be high for some satellite internet providers, the monthly service fees can be affordable for TSSs. Vendors such as StarLink and Viasat are well-established satellite internet providers offering high-speed internet services, particularly for rural and remote locations.

iv. Use of Radio and TV Broadcasts
In case when the country can launch TVET programs broadcast via radio or television, these can serve as an alternative to online content for some TSSs with limited access. In particular for TSSs in rural areas can flip teaching activities by scheduling times for TVET students to watch or listen to lessons at home and then follow up with classroom discussions with trainers or for assignments.

Recording lessons for broadcast is also another potential alternative where TVET trainers can create lesson content and have it broadcasted on local radio or TV channels, allowing students to access it without internet access.

Furthermore, *the following should also be considered for TSSs with limited internet access:*

- It is important that TSSs advocate for filtering the Internet usage at ISP level as well as at school level to limit unnecessary content which consumes the internet as well as may harm students. Internet filtering approaches like; DNS based filter, Firewall based filter, web proxy filter, browser-based filtering extensions, parental control software, and others can be used.
- As the current TSSs in Rwanda need enough digital infrastructure and resources, implementing blended learning requires strong partnerships and collaboration with funding bodies and telecommunication companies. Existing funding schemes from RTB and its partners should prioritise infrastructure upgrades, especially in remote rural areas.
- In some schools' locations, TSS funding bodies should continue to build network infrastructure to increase internet and connectivity in these areas.
- Accordingly, TSS should be able to apply for grants and crowdfunding opportunities to support digital education through the acquisition of equipment for connectivity, computer labs, smart classrooms and other immersive technologies.

6.2.4. Software requirement for blended learning in TSS

6.2.4.1 Learning Management System (LMS)

Considering the context of technical secondary schools in Rwanda, the Learning Management System to be used on for hosting all the courses of the trades will be centralised at RTB level. The LMS should be able to integrate with other systems such as SDMS, TMIS and others. Accordingly, the RTB LMS will integrate with other collaborative tools such as (e.g. MS Teams, Webex, Google Package). The figure 7 below presents a simplified and centralised LMS structure for TSSs in Rwanda.

TSS should use open source LMS as it comes with several benefits that include free download which reduce licensing cost compared to proprietary systems, and no vendor locking to avoid expensive long-term contracts. As the current LMS being used by TSSs in Rwanda is Moodle, it is important to continue using this platform as the TSSs embark on blended learning mode. However, for the future implementation of blended learning in TSSs, some of the other suggested LMSs could be Open edX, ILIAS and Canvas. Open source LMS allows full customization to fit specific needs from branding to feature modifications, large open sources like Moodle have communities contributing to regular updates, security patches and feature improvements. Users are able to access forums, documentation, and third-party plugins to enhance the platform. Open source LMS can be scaled to accommodate small groups or large institutions, open LMS supports various system integrations such as SDMS, TMIS, and others.

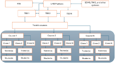


Figure 7. A Simplified LMS Structure for TVET Schools in Rwanda

a) A reliable LMS:
A well-integrated Learning Management System (LMS) is crucial for effective blended learning in Technical Secondary Schools (TSSs). As per figure 7, integrating the LMS with the School Data Management System (SDMS) and the Teacher Management Information System (TMIS) helps to create a unified student and trainer data repository which in turn ensures seamless student and trainer data management, automated course enrollment, and streamlined system operations, preventing data duplication. Best practices from UNESCO and OECD highlight that a centralized LMS enhances access to quality education, improves learning outcomes, and supports competency-based training. This will be made possible by an LMS integrated with other educational systems and even the National ID system.

To maximize its effectiveness, the LMS should include the following features:

- **Scalability & accessibility:** Open-source, cloud-locally based, or hybrid LMS platforms should be prioritized to support low-bandwidth environments and offline learning.

- **AI & digital twins' integration:** AI-driven analytics and digital twins should enhance personalized learning, simulations, and real-time monitoring of physical labs.

- **Universal Design for Learning (UDL):** The LMS should follow accessibility guidelines (e.g., WCAG) to accommodate diverse learners, including those with disabilities.

- **Interoperability with EdTech tools:** Seamless integration with external platforms (video conferencing, gamification, and authoring tools) for an interactive learning experience.

- **Multi-format content support:** Compatibility with various formats, including SCORM, xAPI, H5P, and immersive technologies (AR/VR).

- **Assistive technologies:** Features like text-to-speech, captioned videos, visual aids, and adaptive interfaces should be incorporated.

- **Collaborative & adaptive learning tools:** Providing trainers with synchronous and asynchronous teaching tools such as MS Teams and AI-powered adaptive learning.

- **Device & platform compatibility:** Mobile-first and web-based access to enable anytime, anywhere learning.

- **Offline functionality:** Local server support to ensure uninterrupted access to learning materials.

- **Competency-based learning & assessment:** AI-assisted grading, e-portfolios, automated quizzes, video assessments, and performance tracking.

- **Analytics & early intervention:** Data-driven insights on learner engagement, performance, and predictive analytics to support at-risk students.

- **Single Sign-On (SSO) & Data Security:** Ensuring secure authentication and integration with national education systems and ID databases.

b) Other software and digital solutions for blended learning adoption in TSSs

The adoption and use the right digital tools and software is essential for effective implementation of blended learning in Technical Secondary Schools (TSSs). A well-equipped digital learning environment enhances content creation, academic integrity, hands-on training, collaboration, and inclusivity. It is recommended to integrate digital solutions that support interactive, accessible, and skill-based learning in TVET.

To ensure a comprehensive digital ecosystem, TSSs should consider the following digital solutions:

- **Digital Content Development & Authoring Tools:** Schools may use software such as Camtasia, iSpring, Articulate 360, Adobe Captivate, Canva, and GIMP for graphics creation. Tools like OBS Studio or Rapidmooc, etc. can be used for recording instructional videos.

- **Academic Integrity & Writing Tools:** Institutions could acquire Turnitin, Grammarly or other similar solutions to promote academic honesty and enhance students' writing skills.

- **CAD & Immersive Learning Simulators:** Schools should integrate CAD software and Virtual Reality (VR), Augmented Reality (AR), and Extended Reality (XR) simulators to support hands-on training.

- **Online Collaboration & Video Conferencing Tools:** Online team collaboration and communication such as video conferencing tools and platforms should be acquired by schools. The proposed ones include for example: Microsoft Teams, Trello, Slack, Zoom, Padlet, ClickUp, Asana, Airtable, Miro, Canva for Education and Adobe connect.

- **Real-Time Collaborative Learning:** As TVET education involves hands-on learning, the tools that enable virtual simulations, project design, or video demonstrations such as MS Teams, Zoom or Adobe Connect are particularly beneficial.

- **Accessibility & Assistive Technologies:** Schools must ensure that selected tools are accessible to all students, including those with disabilities, by integrating screen readers, text-to-speech software, and other assistive technologies.

- **Interactive Whiteboards & Visual Collaboration Tools:** Schools should acquire interactive whiteboards and tools like Miro and Jamboard to enhance to allow trainers and students to collaborate and interact during teaching and learning activities in a creative collaboration, visual representation of ideas and workflows. An inclusive learning whiteboard

Technologies resource rooms for TSSs should be equipped with:
- Screen readers, text-to-speech software, and speech-to-text tools.
- Augmentative communication devices, visual, hearing, and mobility aids.
- Specialized educational software supporting diverse learning needs.
- Personalized hardware resources for students requiring adaptive learning tools.

• **Virtual simulations (E.g: CISCO, VR, AR, XR) tools:** Simulators and Virtual Labs tools should be acquired to integrate immersive technologies in TVET schools. Some examples of these tools may include:
- **Labster:** Provides virtual science labs, useful for TVET courses in fields like electronics, engineering, and animal sciences
- **VEX Robotics VR:** A simulation platform for robotics and programming, ideal for TVET students in automation and mechatronics.
- **Kodekloud:** Best platform that provides hands-on labs and real-world scenarios for practical DevOps applications and software development
- **Appsembler-Virtual Labs:** This is a dashboard platform that unifies courses, user management, and virtual labs, improving usability and enhancing curriculum development and adaptation
- **CloudLabs:** Best tool for empowering TVET students with practical learning through CloudLabs Virtual Labs. This tool can be used by TVET schools to improve students' immersive learning experience.

• **Augmented Reality (AR) and Virtual Reality (VR) Tools:** These software applications will support TVET schools in different trades by offering immersive experiences where students can engage in realistic environments without physical limitations. Here are the generic recommended AR and VR tools:
- **Unit:** This software will be used by TVET Schools for creating AR and VR simulations, to be used in trades such as automotive, industrial design, architecture and construction.
- **Microsoft HoloLens:** A mixed reality tool that can be used in schools for immersive training in areas like animal sciences, manufacturing, business and engineering.
- **Wikitude:** This is an AR platform that may help create virtual learning experiences for TVET students in areas such as automation mechanical engineering, architecture or robotics.

• **3D Modeling and CAD Software:** These tools will support TSSs in creating 2D and 3D models in various trades. Few ones are recommended here below:

- **AutoCAD:** This is computer-aided design (CAD) software that will support trades related to electricity, electronics, architecture, construction...etc. It will be used to create 2D and 3D models
- **Solidworks:** This is also CAD software for creating 3D models, which is crucial for TVET students in product design-related courses.
- **TinkerCAD:** This is another user-friendly CAD tool that may be used to teach 3D design and printing, especially in TVET for students learning technical drawing and product prototyping.
- **Cinema4D:** 3D modelling tool that lets you create complex 3D designs in the trades related to animation and multimedia design, graphic design and visual communication, film and video production, architecture and interior design, and industrial design for creating 3D models.
- **SketchUp:** This is also an important 3D modelling tool that will be used to create and manipulate 3D models for all the trades, especially in plumbing, electricity and construction. It can also be important specifically for architecture and interior design-related trades.

• **Assessment Tools and e-Portfolios:** These tools will enable TVET students to document, showcase, and track their academic journeys in a digital format. A few recommended ones for

TVET schools in Rwanda include:

- **Mahara:** This is an open source ePortfolio tool that allows students to create a digital portfolio of their learning progress and achievements. It is easy to integrate with a school LMS
- **Portfoliobox:** This platform can be important in TVET schools in Rwanda for creating and showcasing digital portfolios, which is useful for TVET students to document their hands-on projects.
- **CourseNetworking Platform:** This platform can be integrated with the school LMS to enable TVET students to digitally document their portfolios and easily interact among themselves and with their trainers.

As some of the above-proposed tools and platforms have free versions with limitations, while others require a subscription, it is important to choose tools that offer the appropriate features for specific TVET school and trade needs. The selection and acquisition of particular digital tools should also consider the school budget.

c) Key software to integrate in LMS for improved learner accessibility

As RTB is planning to upgrade its LMS platform, the following software are also proposed to be integrated with the main LMS to ensure accessibility to all learners:

- Screen Readers These tools read aloud on-screen text, menus, and other digital content in Moodle, enabling visually impaired learners to navigate and interact with the platform. Moodle is designed to work well with various screen readers such as NVDA, VoiceOver, Orca, etc.
- Text-to-Speech Tools supports people with reading disabilities (e.g., dyslexia), visual impairments and cognitive challenges by helping users to comprehend text by listening rather than reading. These solutions of text-to-speech tools read Moodle content aloud. E.g.: NaturalReader Online, Balabolka
- Speech-to-Text Tools: these solutions support physical disabilities or temporary injuries affecting typing (e.g., limited hand mobility or paralysis) which enables users to input text into Moodle by speaking.
- Screen Magnifiers: it supports people with low vision or partial sight. It magnifies content on Moodle to make text, images, and interfaces easier to see. For example, Windows Magnifier is a user-friendly digital tool for screen magnifier.
- Moodle Accessibility Block which facilitates visual impairments and learning disabilities by customizing font size and color contrast makes content more accessible and adjustments like high contrast can improve focus and comprehension.
- Note-Taking Tools: These tools support people with cognitive and motor disabilities (e.g., Attention-deficit/hyperactivity disorder-ADHD) to help organize thoughts and materials for easier understanding. Other tools such as libre office or Microsoft OneNote are also useful for note taking.
- WAVE accessibility tools can also be integrated to support teachers to assess TVET learners if their digital content is accessible to individuals with disabilities.

6.3. Guides on digital content development and selection

One of the stages of implementing CBT/CBA in schools is the development and selection of digital content. Some considerations on digital content have been stated above in the section of Manual design. This process requires that the digital content is aligned with curriculum, manual (course), inclusion, accessibility and the available technology among others.

6.3.1. Development and compliance of digital content in TSSs

In this section, we propose some guides to develop school-based digital content. The developed digital content must align with the specific skills, knowledge, competencies, and outcomes defined by the TVET curriculum.

- For in-house development of the digital course content, subject matter experts (TVET trainers) should work collaboratively with instructional designers and multimedia experts in consultation with TVET quality assurance specialists
- Despite the adoption of a blended learning mode, TVET schools should emphasise digital content that stimulates practical, job-oriented learning tasks to prepare learners for the workforce.

- To follow the trade manual structure, the digital content should be developed in small, self-contained units that allow flexibility for teachers and students to access learning materials in parts. (E.g. Short videos, and audios for learner access)
- Course materials should be designed to work efficiently in low-bandwidth environments by for example compressing multimedia content in light formats (Videos in MP4, graphical images in JPEG, TIFF or PNG)
- Trainers should provide easy downloadable versions of content for offline use at school or at home
- The theoretical content should be developed interactively with H5P and SCORM Packages.
- Other resources can be uploaded in the form of presentations, PDF, eBooks, and subtitled video tutorials to ensure inclusivity and diversity of learners.
- TSSs should guide trainers on integrating immersive technologies (VR/AR/XR and AI tools) for continuously creating digital content as per the trades' needs.
- Where applicable, digital content should be created in multiple languages or translations for diverse learner groups to ensure inclusivity.
- Either theoretical or practical digital content from other sources should be selected following the Creative Commons (CC BY 4.0) guidelines (Creative Commons, 2024) and in consideration of different trades' needs.
- The quality assurance personnel should monitor the selection and development of digital content for Schools considering the trade-based needs of the market.
- RTB in collaboration with schools should increase the level of accessibility to all types of digital content.

6.3.2. Selection of Digital content repositories & Digital books (e-books)

A well-organized digital content repository for TVET schools can provide access to a wide range of materials, including video tutorials, interactive learning courses, textbooks, simulations, digital assessments, and more, in both theoretical and practical domains. Tools such as YouTube Education, Alison, VET Training, Turnitin and Moodle Database will be used to support TSSs.

- **Selected YouTube education:** This is a feature and collection of educational content available on YouTube, designed to help learners of all ages access a wide range of free, instructional videos on virtually any subject. This platform will support TVET schools as it hosts a range of curated education materials in all domains of TVET education. YouTube videos 3sx= available on YouTube Education often incorporate multimedia elements like visuals, animations, diagrams, and real-world examples, making complex concepts easier to understand, which is particularly helpful for technical fields.

- **Online learning platform (e.g.: Alison):** This kind of online learning platform can provide free courses, and certificates in a variety of TVET subjects. It provides courses that are available in different formats, including text-based lessons, audio-visual tutorials, and interactive assessments.

- **VET Training Platform:** This is another online system designed to deliver, manage, and support vocational education and training programs, particularly useful in providing industry-specific skills and practical knowledge to learners who are preparing for careers in fields like, architecture, engineering, construction, IT, design, manufacturing, and more. It may also serve as an LMS that helps TSSs to organize, track, and manage their courses, which could be structured through modules, workshops, tutorials, and assessments.

- **Turnitin:** This text-matching tool and plagiarism detector will support TVET schools to improve the quality of learning and promote academic integrity in a blended learning environment. The tool is empowered with an AI writing detection solution which will support TVET trainers and students to ensure academic integrity in their work.

- **E-library databases:** These databases provide access to textbooks, research papers, manuals, technical guides, and multimedia content that support both theoretical learning and practical skills development.

TVET schools will subscribe to E-library providers to enable access to E-books and other electronic resources that support TVET education. RTB should subscribe to E-library systems such as:

- IEEE Xplore Digital Library (For Engineering, Technology and Applied Sciences)
- Vocational Education and Training (VET) Library: Providing resources for vocational training and skills development
- Open Educational Resources (OER) Commons: For free, open-access resources for TVET education
- ScienceDirect (Elsevier) for Engineering, technology, and applied sciences
- SpringerLink (For science, Engineering and other technical fields)
- Taylor & Francis Online (For applied research and industry standards)

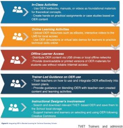
6.3.3. Adoption of Open Education Resources by TSSs

For TSSs with limited funding, trainers should leverage Open Educational Resources (OERs) for existing free and Creative Commons-licensed content. Schools should also opt on using local resources developed by innovative E-champions trainers for content created such as video recordings and lab demonstrations and simulations.

Accordingly, TVET trainers should search and identify TVET-related OER platforms and repositories where they can reuse some resources for teaching and learning. Some of the known TVET-specific platforms include for example:

- **SkillsCommons**
- **UNESCO's TVET OER repository,**
- **PhET Interactive Simulations,**
- **MIT OpenCourseWare.**

Verified and licensed OER resources by Creative Commons should be customised and aligned with the Rwandan TVET Curriculum and TVET standards before being used by TSSs in Rwanda. The following figure shows how OERs should be integrated in blended learning environment for TVET schools:



In-Class Activities
- Use OER textbooks, manuals, or videos as foundational materials for theoretical concepts.
- Create hands-on practical assignments or case studies based on OER content

Online Learning Activities
- Upload OER resources such as eBooks, interactive videos to the LMS for local access
- Use OER simulations or virtual labs demos for learners to practice technical skills online

Offline Learner Access
- Distribute OER content via USB drives or local offline networks
- Provide downloadable or printed versions of OER materials for students use without reliable internet access.

Trainer-Led Guidance on OER use
- Train teachers on how to use and integrate OER effectively into lesson plans.
- Provide guidance on blending OER with teacher-own created content and learning activities

Instructional Designer's involvement
- Search and download relevant TVET- based OER and save them to the School local storage
- Support trainers and learners on selecting and using OER following Creative Commons

Figure 6. Integrating OER in Blended Learning for Technical Secondary Schools

6.3.4. Consideration on copyright of digital content

With TSSs shifting from a traditional to a blended learning environment, this will involve significant changes, especially regarding the use of digital content. Copyright can be challenging because of the wide range of digital resources such as videos, articles, images, software, and more that trainers may want to incorporate into their courses.
For TSSs to cater for copyright in a blended learning environment the following aspects will be important:

i. Administrators and Trainers understanding Copyright Laws

TVET Trainers and administrators should ensure they have a solid understanding of copyright laws that apply to educational content. The shift to blended learning model will go in parallel with trainings

and awareness on copyright issues and management for the digital content to be created and availed online. Trainings and awareness campaigns will for example involve the following:

- **What is copyrighted:** Trainers and administrators should be aware that any original work (e.g., text, audios, images, videos, or software) is automatically protected by copyright once it is created.

- **Fair use and fair dealing:** Trainers and administrators will have to know that the fair dealing approach allows the limited use of copyrighted material for educational purposes without needing to obtain permission. However, the as the extent to which this can be applied varies it will be crucial for TSSs to establish a copyright policy that will guide trainers when reusing others content and teaching resources.

ii. Digital content licensing and permissions

When moving to a blended learning environment, TSSs should secure the appropriate licenses or permissions for digital content to be used across all trades. These include for example the open education resources (OERs) that can be legally used, modified, and shared. In TVET domain, there are many OERs that come with open licenses like Creative Commons, which allows educators to use, adapt, and share materials under specific conditions.

TSSs should also opt for purchasing subscription Services to platforms that provide access to licensed educational content (e.g., databases, journals, e-books). These platforms often offer permission to use content within educational settings.

iii. Attribution and acknowledging sources

When using digital materials, TSSs trainers will have to be trained on how to properly attribute the sources, especially if the content is under a Creative Commons license or if it is used under fair use. Trainers will be able to:

- Cite authors, creators, or sources: Always provide full citations for any content used that's not originally created by the teacher or school.
- Provide links to original sources: If content is used from an online platform, link back to the original website or platform as a way of giving credit.

iv. Trainers' creation of original content

Trainers will also be trained on how to mitigate copyright issues by creating their own educational materials. When creating videos, lesson plans, or other resources, educators can retain ownership of the content and ensure it is freely available to students. However, if external resources are incorporated (like images, videos, etc.), teachers must still consider copyright implications and seek proper licenses with the support of the TSSs.

v. Educate students on copyright

TVET students should be trained on the principles of copyright and intellectual property. In a blended learning environment, students might be more inclined to download and share digital content without proper understanding. Hence, this could inadvertently violate copyright. To avoid this, TSSs should:

- Offer training sessions on copyright and fair use to TVET students.
- Provide contextual and easy-to- use guidelines on how to create and share content responsibly.

vi. Addressing Digital Copyright Tools

Today, there are several digital tools that can help control and manage copyright and plagiarism. Digital Rights Management (DRM) tools such as Google Widevine, Adobe Digital Editions, Microsoft PlayReady and LockLizard may be used to restrict the distribution. These tools also support trainers to use digital content by ensuring that it stays within the intended context (e.g., within LMS of the TSSs). Additionally, plagiarism Checkers Tools like Turnitin can help monitor student submissions for proper citation and avoid unintentional copyright infringement.

6.3.5. Sustainable Content and Curriculum Development

To ensure the sustainability of blended learning in TVET schools, this will highly entail the creation of a balance between online theory-based learning and face-to-face practical skill acquisition. Thus, this will require the allocation of funds for continuous curriculum development and review. The allocation of funds will also be made to revise the current content and materials to be delivered in blended modules or create new practical training resources that incorporate, for example, virtual simulations.

Funds will be invested in partnership with trade-based industry stakeholders to ensure the developed content is current, relevant, and aligned with industry needs and standards. To facilitate hands-on learning and practical exposure of TVE students to the trade-based industry workplaces, financial resources will be allocated to physical labs, workplace placements, and other practical learning spaces that will be used for in-person learning activities. Subscriptions to E-resources and eBooks will be made to support research, teaching and learning at TVET schools.

6.4. Guides on Teacher Professional Development and Capacity building

One of the most important prerequisites for a successful adoption of blended learning into the curriculum is the digital competencies of teachers, mentors, and students. These include not only the technical skills that teachers need to use the appropriate technology but also an understanding of E-pedagogy and the implications of redesigning a blended learning course. Therefore, to better integrate blended learning in TSS in Rwanda, the primary framework of reference should be UNESCO's teacher competency development.

UNESCO (2018) and the EU's DigComp (2019) analysed the needs and presented teacher digital competence which integrates essential knowledge, skills, and attitudes for effective teaching in the digital era. UNESCO's ICT Competency Framework for Teachers (ICT-CFT) highlights six key areas: understanding ICT in education, curriculum and assessment, pedagogy, digital skills, organization and administration, and teacher professional learning. These areas ensure that teachers not only use digital tools effectively but also integrate them into pedagogical strategies to enhance learning outcomes. The EU's DigComp framework, as shown in figure 9, further elaborates digital competence as the confident, critical, and responsible use of technology, covering information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), cybersecurity and digital well-being, intellectual property awareness, problem-solving, and critical thinking. By aligning with these frameworks, teachers can create engaging, technology-enhanced learning environments that prepare students for the demands of an increasingly digital society.

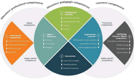

Educators' professional competences
Educators' pedagogic competences
Learners' competences
Digital competences
1 Professional Engagement
Organisational communication
Professional collaboration
Reflective practice
Digital CPD
Subject specific competences
2 Digital Resources
Selecting
(Co-)Creating
Managing
3 Teaching and Learning
Collaborative learning
Self-regulated learning
Teaching
Guidance
4 Assessment
Assessment strategies
Analysing evidence
Feedback & planning
5 Empowering Learners
Differentiation & personalisation
Accessibility & inclusion
Actively engaging learners
Transversal competences
6 Facilitating Learners' Digital Competence
Information & media literacy
Problem solving
Responsible use
Communication
Subject specific competences

Figure 9: Framework for digital competencies of educators (EU,2019)

In addition to the above frameworks, the GROW Model, a widely used coaching and development framework that can be effectively applied to TVET trainers' capacity building, may be adopted as an approach to provide adequate training and mentorship for blended learning adoption in TSSs. The GROW (Goal, Reality, Options, Will) Model is a powerful tool for teacher capacity building as it provides a structured, reflective process for teachers to identify areas of improvement, set actionable goals, and create practical plans to enhance their innovative teaching practices.

Departing from these three frameworks related to digital competencies and capacity building for trainers, specific skills and competencies to be developed for TVET trainers are proposed below.

6.4.1. Develop digital skills for trainers

Digital literacy is crucial for trainers in TSS as it encompasses the ability to use technology effectively in teaching, learning, assessment and engagement with students. Having improved digital skills, trainers will be able to prepare TSS students to succeed in the digitalized working environment. Specifically, for better implementing blended learning in Rwandan TSSs, a range of digital skills needed for TSS trainees has been assessed and categorised in eight categories. These include the technical skills required for teachers to use digital tools and platforms for effective implementation of blended learning in TSSs. Eight types of digital skills are proposed in figure 10 below.

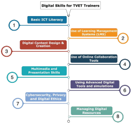

Digital Skills for TVET Trainers
1
Basic ICT Literacy
2
Use of Learning Management Systems (LMS)
3
Digital Content Design & Creation
4
Use of Online Collaboration Tools
5
Multimedia and Presentation Skills
6
Using Advanced Digital Tools and simulations
7
Cybersecurity, Privacy and Digital Ethics
8
Managing Digital Resources

Figure 10: Proposed Digital Skills for Technical Secondary School Trainers

Based on the assessment conducted at the pilot TSSs across Rwanda, not all trainers are at the same level for the above digital skills. Hence, before organising and performing pieces of training on each of these digital skills, a pre-assessment of the training needs should be carried out to map different levels of TSS trainers on each type of digital skill. Mode detailed digital skills for trainers are provided in Annex v.

6.4.2.E-pedagogy skills development for TSS Trainers

E-pedagogy skills are important to enable trainers to design quality online courses, use interactive platforms, multimedia tools, assistive technologies, and online resources and improve their teaching effectiveness. Having E-pedagogy skills helps in making lessons more engaging and accessible for diverse learners. This helps cater to different learning styles and enhances students' understanding of practical hands-on subjects as well as theoretical understanding of their trade-based subjects.

When TSS trainers are well equipped with modern pedagogy, this encourages the use of online

communication tools, which help trainers and students stay connected and engaged in content. Overall, equipping trainers with E-pedagogy skills supports the integration of blended learning in TVET education. A summary of the proposed E-pedagogy skills for effectively blending teaching, learning and assessment using digital tools and EdTech solutions are presented in figure 11.

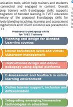

Proposed E-pedagogy skills for TVET Trainers
1
Planning and design for Blended Learning courses
2
Online facilitation skills and virtual classroom management
3
Instructional design and online pedagogy using digital platforms
4
E-Assessment and feedback in online learning environment
5
Online learner support, inclusion and differentiation
6
Integrating emerging/immersive technologies in education
7
Data-driven decision-making through LMS and Learner analytics

Figure 11. Proposed E-pedagogy skills for Technical Secondary School Trainers

Overall, equipping TSS trainers with the above E-pedagogy skills will support the integration of blended learning in Rwandan TSSs. A more detailed description of the proposed E-pedagogy skills is presented in Annex iv.

6.4.3. Approaches and Strategies for Capacity Development of TSS Trainers

TSSs, in partnership with its stakeholders, should use the following strategies and approaches to develop teacher capacity in teaching and assessment within a blended learning environment:

- Hands-on Training and Workshops with face-to-face interactive workshops and simulated classrooms where trainers can explore blended learning tools.

- Introduce industry hands-on training in collaboration with companies to enhance trainers' competencies in industry-relevant skills

- Integrate peer learning, coaching and mentoring for continuous professional development (CPD) into the TSS' professional development framework (onsite or technology mediated coaching and mentoring).

- Implement a structured Training of Trainers (ToT) program to build capacity in digital skills and E-pedagogy.

- Modelling Best Practices through classroom observations and demonstration lessons where expert teachers model blended learning strategies.

- Access to External Experts and Resources so that trainers can get insights into current trends and best practices in blended learning.

- Encourage trainers to have reflective practices and get feedback from students to use this data to refine their teaching practices

- Develop certification and accreditation programs to formally recognize TSS trainers' proficiency in blended learning methodologies and E-pedagogy skills.

- Establish motivation and incentive mechanisms for retaining experienced trainers with exceptional digital and E-pedagogy skills

- Develop and implement advanced CPD programs and certifications in emerging technologies such as AR/VR7XR/AI tools for teaching and learning

6.4.4.Investment in capacity building for blended learning in TSSs

Skilled human resources, both in terms of teaching staff, support staff and students, are a prerequisite for the success of blended learning in TSSs. Investments will be made in the professional development of TSS trainers, technical support staff, instructional designers, peer mentors, and course facilitators or lab attendants for practical lectures.

Funds will be allocated for supporting ongoing professional development programs to train TSS trainers in both technology tools and E-pedagogy. A focus on these investments should be made on training on how to use the LMS, create engaging online content, facilitate virtual classrooms, and blend in-person teaching with online learning effectively.

Depending on the funds' availability, instructional designers will be hired at RTB level or contracted for specific schools to create or adapt course content for online and blended formats, ensuring that it aligns with learning outcomes, practical and theoretical skills and knowledge. Additional funds should be invested in developing industry-specific content and simulations that reflect real-world applications for students.

The effective implementation of blended learning in TSSs will also entail that funds are allocated to hiring IT support staff to manage technical issues such as hardware maintenance, LMS troubleshooting and administration, and integration of LMS with other associated digital platforms. The hired IT support staff will also provide 24/7 technical support to learners and instructors, especially if the blended learning model opted for, relies on asynchronous online learning.

Course facilitators will be hired and trained to support practical-based lectures. Funds will be allocated to ensure sufficient facilitators are available to supervise, guide, and assess students during face-to- face, practical learning sessions. These trainers should be industry-experienced professionals who can relate theory to real-world applications. Accordingly, schools will invest in mentorship programs where experienced learners can support new ones, particularly for practical assignments or challenges faced during early exposure to a blended learning environment.

Accordingly, funds will also be invested to establish student ambassadors who will support peers in a blended learning environment at each TSS. Workshops and training sessions will be supported financially to enable a pool of TSS students to acquire digital literacy and technical skills capable of supporting peer learners in case they later encounter difficulties in using LMS and other digital tools for learning activities.

6.5. Guides on TSS Students' Readiness for Blended Learning Adoption

Ensuring student engagement and providing support services in blended learning environments for TSS schools is crucial for learner success. Here below are some guides for preparing TSS students and supporting them while also promoting their engagement in blended learning activities.

6.5.1. Digital literacy for TSS students

The level of students' digital literacy is important for blended learning implementation in TVET schools. Figure 12 below presents key areas of digital literacy for students.

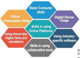

Basic Computer Skills
Virtual Presentation Skills
Digital Device Usage
Skills in using Online Platforms
Using Virtual labs, Digital Twins and simulations
Using Industry-specific software
Skills in using collaborative tools

Figure 12: Digital literacy for students to embrace Blended Learning

A detailed description of the required digital literacy and skills for TVET students to engage in blended learning environment is provided below:

- **Basic Computer Skills:** Equip students with knowledge to use operating systems, file management, and basic software applications

  (e.g., word processors, presentations, spreadsheets, Google Forms, Google Classrooms, browsing and search engines). These skills will help in student engagement in the course content of their trades.

- **Skills on using online platforms:** Ensure students are familiar with LMS such as Moodle or Google Classroom. Training should be organised to equip students with skills:

  - To log in to their LMS accounts
  - Navigating the course dashboard
  - To manage their LMS profiles
  - To access their course materials
  - To participate in online learning activities such as joining and using Online Chats, Discussion Forums, and Group-based learning projects
  - To upload and download course contents and E-books
  - Tracking progress like viewing course grades and feedback from instructors
  - Time Management and self-organization training to TVET students on digital calendars to schedule their learning activities

- **Skills in using collaborative tools:** Students should get used to digital tools for collaboration such as Google Drive, E-portfolio platforms, Google Meet, Dropbox and Microsoft Teams).

- **Digital device usage:** Train TVET students to get knowledge and skills to operate various devices such as laptops, tablets, and smartphones, as well as to troubleshoot basic internet issues and workshop equipment.

- **Virtual presentation skills:** TVET students should be equipped with skills for creating and delivering presentations using tools such as Google Slides, or Prezi, often in a virtual setting and fluently using emails for communicating their learning journey.

- **Using Industry-specific software:** Students from different trades should be equipped with skills in digital tools and applications such as CAD software for engineering, design tools for fashion or graphic design, or simulation programs for automotive, construction, GIS or veterinary fields.

- **Using Virtual labs, Digital Twins and simulation resources:** TVET students should be trained on basic skills to engage with VR/AR/XR tools for learning environments that may be too difficult to replicate physically (e.g., machinery operation, construction, electrical circuits, or welding).

6.5.2. Promoting Student-centred Learning in TSSs

Student-centered learning emphasizes the active role of students in their own learning process, fostering autonomy, critical thinking, and problem-solving skills. In the context of blended learning for TVET context, where there is a combination of online and face-to-face learning, the student- centered approach aligns perfectly to meet the diverse needs of learners. TSSs adopting blended learning will need to coach students and help them to adapt to this new learning environment by promoting the following:

- **Establish personalized learning paths (PLP):** by allowing students to progress at their own pace, offering self-directed learning opportunities (both in-class and online) through adaptable digital interactive content and formats

- **Promote active learning (AL):** Incorporating learning activities that enable students to actively engage with the course materials, such as case studies, problem-solving, case, active role-playing, and hands-on projects. Active learning can be designed to take place both in- class and online through self-directed demonstrations, lab and workshop experiments

- **Learner choice and autonomy:** Providing options for students to choose how they learn or demonstrate learned skills, knowledge and competencies.
Also, this allows students to choose between different project formats, and collaboration channels or work independently or in small groups, while at labs, workshops or apprenticeship places.

- **Peer-to-peer learning:** Prepare and design learning activities that enable self-regulated peer-to-peer learning at their convenience. TVET Schools should also encourage teamwork and peer learning through group projects, collaborative discussions, or problem-solving tasks.

TVET students can benefit from sharing their experiences and knowledge, especially in practical, hands-on-related courses.

6.5.3. Students' readiness on using interactive and engaging content

In the context of using interactive and engaging content in a blended learning environment for TVET education, students' readiness refers to the students' ability and willingness to effectively engage with interactive content. This readiness encompasses a range of factors, from technical skills to motivational aspects, as well as attitudes toward learning in a blended environment. TSS students should therefore be prepared for the following:

- **Using multimedia and interactive tools:** TSS may ensure that students can use a range of diverse contents and materials in different formats such as subtitled audio-videos, quizzes, simulations, and interactive learning activities to make learning more interesting and engaging.

Students should be also trained well on how to engage in practical and hands-on simulations or virtual labs supported for example by digital twins and smart classrooms

- **Engage in gamified learning:** Promote gamified learning by coaching students on using digital tools or in-class learning practices that enable students to learn by playing and making the learning journey more fun and engaging. Approaches such as points, badges, and rewards based on completed tasks or assignments, leaderboards for ranking students in learning activities, can be integrated in the learning process to trigger student engagement in learning contents and materials while contributing to the learning outcomes

- **Align learning with real-world applications:** Students should be prepared to engage in and search the content that is directly aligned with needed skills and knowledge for the job market and their future careers. This can include industry-specific case studies, virtual apprenticeships, and tasks that simulate actual job scenarios.

- **Feedback loops:** TSS trainers should provide timely and constructive feedback on student's submissions both online and in-class activities. Likewise, students should be trained on how to access and interpret trainers' feedback in online environment and how to respond to trainers' feedback

- **Peer Interaction:** While trainers need to create opportunities for students to engage in discussions, share ideas, and collaborate with peers through online forums, group chats, or collaborative projects, students also need to be trained on how to effectively engage in peer collaboration.

6.5.4. Student timely and appropriate support

For students in TSSs to be able to adapt in a blended learning environment, appropriate technical support should be available. These include for example:

- **Online and face-to-face Support:** TVET students should be provided with easy access to both technical support on using LMSs and other digital tools for learning purposes. This can include E-tutoring, mentorship, and peer support on EdTech tools. In-person assistance for technical issues on students' digital devices, computer labs and workshop premises.

- **Students' check-in hours/timetable with instructors:** A clear check-in consultation should be created and shared to TVET students.

- **Detailed contact information & channels:** Students should have access to instructors, technical support staff, and tutors' contact details to be used when support is needed. Different types of communication channels, such as email, messaging apps, and video conferencing tools such as MS Teams, Google Meet, phone numbers and emails should be made available on LMSs and school premises for easy communication.

- **Students E-championship:** TSSs in collaboration with partners should establish Training of Trainers (ToT) programs on digital literacy skills for senior TSS students. A pool of Students' E-champions should be created at each TSS school to enable peer-to-peer technical support and peer coaching in a blended learning environment.

7. Quality, Monitoring and Evaluation of Blended Learning in TSSs

In education, quality assurance is a fundamental and recurring action to continuously evaluate the education system, education project or service to ensure that it meets the required quality standards and achieves the expected outcomes. Hence, the proposed guidelines include the principles and guides for quality assurance to measure blended learning courses in TSSs. This section also includes

the monitoring and evaluation framework that will guide institutions like RTB to assess the level of blended learning integration in TSSs.

7.1. Quality Assurance Framework and Metrics (indicators) for Blended Learning Courses in TSSs

Blended learning courses developed and implemented in TSSs for all the trades, will be continuously undergoing a quality assessment to ensure the learning outcomes are not affected by integrating online learning facets. The blended learning quality assurance framework with indicators and metrics for blended learning courses in TSSs has been proposed in Annex iii. The framework also describes the types of data, the process for data collection and analysis, and the frequency for collecting the data related to blended learning implementation in TSSs. The core categories of quality assurance in blended learning and related key performance indicators (KPIs) that will be used to assess the implementation of blended learning in TSSs are presented in figure 13 below.

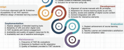

1
Analysis
1. Needs assessment coverage
2. Relevance to industry needs
3. Status of digital tools supporting the course
4. Learning Outcomes through BL
5. Course Content & materials (Soft/Hard)
6. Inclusion for all learners using UDL
2
Design
1. Curriculum alignment with BL Guidelines
2. Accessibility for all TVET learners
3. Effective design of blended learning courses
3
Development
1. Alignment of course manuals with BL principles
2. Adaptation for diverse learning styles as per UDL
3. Quality, access and usability of digital course content
4. Content integration with LMS
5. Inclusion for interactive elements
4
Implementation
1. Teacher adoption of blended teaching tools
2. Reliability of LMS and other digital tools
3. TVET students and trainers engagement
4. Availability and quality of support resources for BL
5. Availability and use of assistive technologies
5
Evaluation
1. Student achievement of course learning objectives
2. Teacher, Learner and stakeholders satisfaction
3. Course completion rates
6
Maintenance
1. Frequency of TVET-BL evaluations
2. Response to feedback and BL adaptation
3. Quality of feedback provided to TVET students

Figure 13. Quality Assurance Framework for Blended Learning Courses in TSSs

As observed in figure 13 above, the proposed framework for quality assurance of blended learning courses will follow a six-step process starting from analysis, design, development, implementation, evaluation and maintenance of the blended learning courses. The measurement metrics, source of data and the proposed data analysis approaches are also proposed in Annex iii.

7.2. Monitoring and Evaluation Framework for BL Integration

In this first version of the blended learning guidelines for TVET Schools in Rwanda, a monitoring and evaluation guide for assessing the level of blended learning integration in teaching, learning and assessment is also proposed (See Annex i). This framework includes 12 categories/levels of assessments, with 25 indicators and 50 sub-indicators. Accordingly, this monitoring and evaluation framework for BL integration in TVET schools includes also some guides on the required data and related sources for conducting the assessment of Blended learning integration and the proposed frequencies of evaluation.

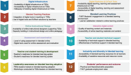

1
Digital Infrastructure
- Availability of digital infrastructure at TSSs
- Accessibility of digital infrastructure at TSSs
- Adequacy of existing digital infrastructure at TSSs
7
Digital Platforms & EdTech Tools
- Availability digital teaching, learning and assessment infrastructure at TSS
- Accessibility of digital teaching, learning and assessment infrastructure at TSS
2
Blended Teaching Practices
- Integration of digital tools in teaching in TSSs
- Use of digital tools and EdTech solutions by teachers
8
Blended Learning Practices
- TVET Students' engagement in a blended learning environment
- Learner satisfaction related to online learning practices
3
Online Instructional Design
- Availability of online instructional designers supporting TSSs
- Capacity building in instructional design and online pedagogy
9
Interactive digital content
- Quality of teaching content and materials
- Accessibility of online teaching materials and content
4
Assessment and examination
- Level of using assessment in blended online
- Digital tools used for online assessment and evaluation
10
Teacher and student technical support
- Availability of technical support in blended learning
- Effectiveness of technical support in blended learning
5
Teacher and student training & development
- Teacher's readiness for blended learning uptake
- Student's readiness for blended learning uptake
11
Inclusivity and diversity in blended learning
- Accessibility of blended learning resources for all learners
- Availability of assistive resources and resource rooms
6
Leadership awareness on blended learning adoption
- TSSs leaders trained on blended learning adoption
- Workshops conducted to TSSs leaders on blended learning
12
Students' performance and outcome
- Practical and theoretical skills acquisition
- TVET graduate employment rates

Figure 14. Monitoring and evaluation framework for Blended Learning integration in TSSs

This framework in figure 14 is recommended to be used at the school level to assess the overall blended learning integration, considering specific trades offered at a particular school. This framework will be important for RTB and school leaders when evaluating the level of school readiness and the creation of a blended learning environment for all types of learners.

8. Continuous improvement, reviewing and updating the BL approaches

To ensure continuous improvement for reviewing and updating blended learning implementation in TVET Schools, a detailed manual of Quality Standards for Blended Learning Courses should be co- creatively developed and validated by RTB and its partners. This manual will be used by TVET schools as they continue to oversee and assess the level of blended learning integration in teaching, learning and assessment at TVET schools. It is recommended that a detailed manual of quality standards for blended learning courses for TVET schools in Rwanda is developed and approved by RTB no later than 2 years after the implementation of the proposed blended learning guidelines.

Accordingly, a blended course implementation checklist should be designed and approved by the quality assurance team at RTB in collaboration with the TVET schools. The approval for this checklist will be granted before its use by TVT trainers. The blended course Implementation Checklist will play a critical role in ensuring that all key elements of a blended learning course are in place and functioning effectively before the course is approved as BL one and launched. This checklist serves as a guideline for instructors, course designers, and quality assurance specialists to ensure that all aspects of the BL course are thoroughly planned, executed, and aligned with best practices for blended learning following the curriculum of each TVET trade. A sample blended course implementation checklist is provided in Annex v.

This blended course implementation checklist will be useful before the course starts, during the course delivery and when it ends. The information to be collected on this checklist will serve as a reference for:

- Course design and course structure,
- Course schedule and timeline with relevant learning activities,
- Assessing the relevance of course content and materials,
- Setting up the appropriate technology to support course delivery, interactions and students' collaboration,
- Compliance of the course and alignment with institutional policy related to blended learning.
- Course alignment with the trade-based industry needs and standards

Also, the blended course review template should be designed and approved by the competent authority. This review template will be used to assess the effectiveness and quality of each blended learning course at TVET school. It will also serve as a tool for evaluating both the online and face- to-face components and course learning activities, by ensuring that the course analysis, design, content development and delivery, and learner engagement are aligned with learning objectives, inclusivity, diversity and trade-industry market needs. A generic template for blended course review template is proposed in Annex 2. This BL course review template will provide feedback from different stakeholders such as instructors, students, and quality assurance specialists and BL course designers that will be used to improve the course and ensure continuous improvement in the blended learning environment in TVET schools. In brief, this blended course review template will serve as a tool for:

- **Evaluate course design and structure by:**
  - Ensuring the course integrates both online and in-person learning coherently and effectively.
  - Assessing the balance between synchronous (real-time) and asynchronous (self- paced) learning activities.
  - Verifying if BL course objectives, assessments, and activities are clearly defined and aligned with the blended learning model adopted by a specific TVET school
- **Monitor learner experience by:**
  - Collecting feedback on student engagement with both online and offline learning materials.
  - Evaluating how well the technology tools and platforms (e.g., Learning Management Systems, E-learning authoring tools and Computer Lab software and VR/AU/XR/simulation software) support learning activities and interactions.

- Assesses if the course promotes active learning and encourages student collaboration and participation (in-class, online, and workplace placement), considering learners' diversities

- **Assess Course Content and Resources by:**
  - Ensuring that the course content (e.g., videos, readings, exercises) is relevant, up-to-date, and engaging for all diverse learners.
  - Reviewing if the resources are accessible to all learners, taking into account different learning styles, technology access and inclusivity aspects.

- **Measure student satisfaction and learning outcomes by:**
  - Gathering insights from students about their overall satisfaction with the course (ease of use, clarity, engagement, and perceived effectiveness).
  - Evaluating how well the course supports the alignment of learning outcomes with trade-based industry competencies, especially in TVET contexts.

9. Blended Learning Coordination Framework for TSSs in Rwanda

The successful implementation of blended learning in Technical Secondary Schools (TSSs) relies on the collaboration of multiple stakeholders, each with a critical role to play in shaping policies, providing resources and ensuring the effectiveness of digital and pedagogical transformations.

This ecosystem consists of government institutions, regulatory bodies, private sector actors, education and training providers, and development partners, all working together to improve the quality of TVET education through technology-enhanced learning approaches. Figure 8 below illustrates a framework for blended learning coordination. A Blended Learning implementation and coordination framework for TSSs is proposed in figure 14 below.

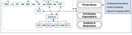

Public Agencies
MINICT
MINEDUC
RISA
UR
REB
RP
NESA
RTB
RTTI
Districts
TSS-1
TSS-2
TSS-3
TSS-n
Key Stakeholders
Development Partners
Private Sector
Civil Society Organisations
Academia & Researchers
- Sector Skills Councils
- Professional Associations
- EdTech Companies
- Telecom Companies (ISPs)

Figure 15. Blended Learning implementation and coordination framework for TSSs

Each of the entities in the above coordination framework will play an important role to ensure the effective implementation of blended learning in TSSs.

- **Ministry of Education (MINEDUC):** It plays a vital role in implementing blended learning by developing education policies, integrating digital tools into the curriculum, and ensuring equitable access to technology. The Chief Digital Officer (CDO) under MINEDUC leads the digital transformation journey by planning, implementing, and managing IT systems to streamline operations, enhance efficiency, and improve service delivery.
- **The Ministry of ICT and Innovation (MINICT):** This entity will play a key role in supporting blended learning by driving digital transformation in different sectors including education. It develops ICT policies, expands digital infrastructure, and promotes innovation to enhance learning experiences. MINICT ensures nationwide connectivity, providing internet access and digital devices for schools.
- **Rwanda TVET Board (RTB):** It plays a crucial role in coordinating blended learning implementation at the technical secondary education level by ensuring the integration and enforcement of the use of digital tools in hands-on vocational training. RTB develops competency-based curricula that incorporate e-learning platforms, virtual simulations, and digital resources to enhance practical skills.
- **The National Examination and School Inspection Authority (NESA):** plays a key role in ensuring quality assurance,

secondary level.

- **The Rwanda Information Society Authority (RISA):** This institution will support blended learning implementation in TSSs by developing ICT infrastructure, ensuring connectivity, digital devices, and cybersecurity for e-learning. It advises government agencies on ICT infrastructure and software by indicating appropriate ones, specifically advising on technical aspects.

- **The private sector** will play a crucial role in strengthening blended learning by aligning education with industry needs and leveraging technology for effective learning delivery.

    - **Sector Skills Councils (SSCs):** Identify industry skill gaps, advise on curriculum design, and support work-based learning through apprenticeships and internships.

    - **Professional Associations:** Set industry standards, certify competencies, and provide continuous professional development (CPD) for trainers and learners.

    - **EdTech Companies:** Develop digital learning platforms, provide e-learning tools, and offer innovative solutions like AI-driven assessments and virtual simulations.

    - **Telecommunication Companies and Internet Service Providers (ISPs):** These will support in establishing network infrastructure and internet access across the country. RTB and TVET Schools will also collaborate with ISPs for zero-rating of the LMS that will be supporting the blended learning environment

- **Districts** play a key role in the proper enforcement of Blended Learning implementation, monitoring and evaluation. Districts will also provide financial support to schools, including school operations, teacher salaries, teacher performance bonus. Through the districts and sectors' inspection mechanisms, districts will ensure quality education in a blended learning environment.

- **Rwanda Basic Education Board: REB** will play a key role in implementing blended learning in TSSs by sharing best practices from the experiences of integrating digital technologies in secondary schools in Rwanda

- **Rwanda Polytechnic: RP/RTTI:** Through Rwanda Teacher Training Institute (RTTI), RP will play a pivotal role in facilitating the training of TVET teachers on E-pedagogy and instructional design for blended learning. RP will also be involved in sharing best practices and experience in TVET education through the use of E-learning systems.

- **Technical Secondary Schools (TSSs):** These entities are responsible for adopting and integrating Blended learning approaches in education delivery. Therefore, TSSs will facilitate in revising their curricula and integrating blended learning in the teaching, and assessment of TVET students, considering industry and trade-specific market needs. School managers and deputy school managers in charge of trainings specifically should support teachers to implement blended learning, conduct monitoring and quality assurance of trainings undergone by their students/trainees.

- **Digital Skills Task Force / Community of Practice (CoP):** For the implementation of blended learning in TSSs, this task force will play a key role in providing advocacy on appropriate digital skills needed by TVET trainers and students to engage in a blended learning environment. Members of this task force will also be participating in planning, designing and offering various training to equip TVET teachers and students with appropriate digital skills. Community of practice which will be made of innovative TSSs trainers, schools administrators and other education stakeholders will allow TSSs to share experiences, strategies, and best practices for continuously implementing a robust blended learning environment. By exchanging ideas, challenges, and solutions, participants can collectively improve the teaching and learning process, making blended learning a culture

across TSSs. Accordingly, a CoP will be also a continuous professional development platform. Through
regular scheduled discussion forums, workshops, webinars, and sharing of resources, TVET trainers will develop the necessary skills and confidence to implement blended learning strategies.

- **Development Partners (DPs):** This category will be very crucial for funding and resource provision for acquiring digital infrastructure (Internet, Computers, Network equipment), learning management systems and tools such as online learning platform, authoring tools,

digital content development software, assistive technologies that are needed for blended learning. Development partners will also provide support in the creation and adaptation of high-quality digital and multimedia learning materials that align with Rwanda TVET curricula. Also, DPs will support in providing advocacy and creation for public-private partnership, promoting inclusivity in BL, design and adaptation of curriculum design, policy advocacy and monitoring, evaluation, research and learning (MERL). DPs will also provide funding support for TVET teacher capacity building for digital literacy, E-pedagogy and immersive technologies for effective blended learning implementation in TSSs.

- **Civil Society Organisations (CSOs):** Based on their areas of interventions, Civil Society Organisations will play a crucial and collaborative role for advocacy for supporting blended learning initiatives in TSSs. They will also serve as intermediaries between funders, the Government and TVET Schools. CSOs will in particular support TSSs in:
  - Capacity building for TVET trainers through mentorship programs
  - Advocacy for blended learning policy and support
  - Facilitating local and international partnerships and resource mobilisation for blended learning in TSSs
  - Piloting and scaling innovations that promote blended learning in TSSs

Partnership and stakeholder collaboration in implementing blended learning in Rwanda TVET Board and Rwanda's TVET individual schools can be strengthened by actively engaging industry partners. Industries play a critical role in ensuring that blended learning programs align with market demands by co-developing curricula, providing internships, and apprenticeships, and sponsoring technology tools. Establishing platforms for industry professionals to teach remotely and provide feedback on students' skills can bridge the gap between education and workforce needs. Additionally, partnerships with technology providers can ensure access to digital tools and reliable internet connectivity, which are essential for effective blended learning. Furthermore, education development partners are key to supporting inclusive education as well as financial support generally.

Community involvement is equally vital in fostering a supportive environment for blended learning. Parents, guardians, and local governments can advocate for and support the initiative by providing resources to learners to access learning from home through bring your own devices (BYOD). Local businesses can contribute by sponsoring training programs or donating equipment, while awareness campaigns can educate communities on the benefits of blended learning in driving economic development. Such grassroots engagement ensures broader acceptance and sustainability of the blended learning model.

Lastly, establishing a blended learning community of practice (CoP) and integrating international best practices can significantly enhance the effectiveness of TVET programs in TSSs. A community of educators and stakeholders can share insights, innovative approaches, and resources through regular workshops and online platforms. International partnerships and benchmarking against global standards can provide valuable insights for curriculum design and capacity building. By aligning with international certifications and practices, Rwanda TVET schools can produce graduates who are equipped with skills that meet global industry demands, making them competitive in both local and international job markets.

10. Sustainability of Blended Learning Environment for TSSs

To preserve a blended learning culture in Technical Secondary Schools in Rwanda, we propose a summarised framework for Blended Learning sustainability in TSSs in Rwanda. This framework presented in figure 16 includes key considerations as TSSs will be implementing blended learning in their curricula

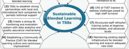

(1) Establishing a system of E-champions (Trainers and Students) at school level for blended learning
(2) TSSs to establish strong partnerships with local and international tech companies for periodic technical support
(3) Create a strong BL monitoring and evaluation system with data analytics and quality assurance mechanisms
(4) Establishing a Community of Practice (CoP) for blended learning culture and continuous improvement
Sustainable Blended Learning in TSSs
(5) Schools will require robust staff retention mechanisms for positive mindset and no resistance to BL
(6) CPD of TVET trainers to address challenges posed by high staff turnover
(7) Structured staff refresher training cycles at beginner, intermediate, and advanced levels
(8) Maintaining existing digital infrastructure for blended Learning and acquire adequate new ones

Figure 16. Framework for Blended Learning Sustainability in Technical Secondary Schools

The sustainability of blended learning in TSSs requires robust staff retention mechanisms. Retaining trained educators ensures continuity and consistency in delivering quality education. Schools can adopt measures such as offering teachers incentives like reducing workload for those ToT of TVET trainers, recognition programs like awards for achievements, and career progression opportunities to motivate instructors and other academic staff. Creating a supportive work environment with clear pathways for professional growth and regular engagement can reduce turnover. Additionally, instructors who feel valued and see long-term opportunities within the school are more likely to remain committed to its goals and, specifically, to continuous blended learning implementation in TSSs.

Continuous professional development (CPD) is crucial to addressing challenges posed by high staff turnover in blended learning environments. Establishing structured training cycles and refresher programs at beginner, intermediate, and advanced levels for blended learning adoption can equip TVET trainers with the skills needed to adapt and use evolving digital learning tools and methodologies. Beginner-level training should focus on introducing instructors to blended learning technologies, while intermediate and advanced levels delve deeper into integrating E-pedagogy with digital platforms, innovative pedagogical practices as well as training on emerging industrial 4.0 technology revolution such as (VR/AR/XR and AI simulation tools). Specialised technological and online pedagogy certification programs aiming at supporting blended learning implementation. At least each school should register more than five certified trainers in specific basic, intermediate and advanced skills in digital literacy, E-pedagogy and advanced emerging technologies every year to ensure that there is a sustainable relevant support to ongoing initiatives related to blended learning implementation at TSS level. Such ongoing development will ensure that even new hires quickly achieve proficiency, minimizing disruptions caused by the well-trained trainers' turnover.

Sustaining the infrastructure for blended learning is equally critical. Regular maintenance of hardware, software, and internet connectivity is necessary to prevent disruptions. Schools should establish partnerships with local and international tech companies for periodic upgrades and technical support. Creating a dedicated maintenance team can ensure timely repairs and updates to the infrastructure. Moreover, fostering a culture of responsibility among staff and students for handling equipment carefully can reduce damages, contributing to the longevity of resources.

Afterwards, establishing a system of digital e-champions can enhance the sustainability of blended learning. These e-champions, selected from both trainers and students, act as peer mentors to support fellow TVET trainers and students in using blended learning tools effectively. Teachers trained as e-champions can assist colleagues with troubleshooting technical issues and adopting innovative teaching strategies, while student e-champions can help peers navigate available digital platforms at the schools. This peer-support network not only fosters a collaborative learning environment but also reduces reliance on external technical support, ensuring the model remains self-sustaining in the long run for promoting blended learning.

11. Risk & mitigation strategies for sustainable Blended Learning in TSSs

Implementing blended learning in TSSs offers significant opportunities for enhancing TVET education and training. However, this initiative also involves some potential risks that need to be addressed to ensure successful learning outcomes. Potential risks to sustainable blended learning implementation are summarised in Figure 17 below. Additionally, a detailed description of these risks and proposed mitigation strategies are proposed in Annex vi.

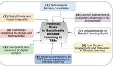

(1) Technological Barriers / unreliable
(2) Digital Divide and Access Inequality
(8) Learner Assessment & evaluation challenges in BL environment
Potential Risks to Sustainable Blended Learning in TSSs
(3) Technology resistance to change and technophobia
(7) Unsustainability of Blended Learning Model
(4) Low Quality and relevance of digital content
(6) Low Student Engagement and Motivation in Blended Learning
(5) Negative perceptions by TVET school leadership on Blended Learning

Figure 17. Potential risks to sustainable blended learning in Technical Secondary Schools

Eight potential risks have been identified for attention to ensure a sustainable blended learning adaptation in TSSs in Rwanda.

- **Technological Barriers, Digital Divide and Access Inequality:**
  - In TSSs it is more likely that there may be students from low-resource backgrounds and in rural areas who do not have access to digital devices and internet. This digital divide may be even among teachers as well.
  - TSSs should have in place some mechanisms for supporting individual students and trainers to enable them to engage in blended learning environment

- **Technology resistance to change and technophobia:**
  - Teachers may resist adopting new technologies or blended learning approaches proposed by TSSs Schools and RTB. Tech is usually apparent This phenomenon may be similar to students as well as some individuals may have no experience in using digital tools.
  - As said earlier, TSSs may keep organising professional development and mentorship programs should be established for knowledge transfer and sharing among the school community.

- **Lack of Student Engagement and Motivation in blended learning:**
  - Some students may be less or not motivated to engage in online learning activities which may affect their performance and then lead to negative perceptions towards a blended learning environment.
  - TSSs may strategize to implement small, engaging and interactive learning activities which require less effort. This approach will motivate learners as they will perceive that learning is fun in online learning environment
  - TSSs may also create and communicate personalized learning pathways to cater for the diverse needs and pace of students with different diversities

- **Low Quality and relevance of digital content:**
  -Some TSSs may lack updated industry-relevant content which may reduce the effectiveness of blended learning in preparing TSS students for employment.
  - TSSs are strongly recommended to work with trade-based industry partners during the development and update of the digital content aligned with the skills and competencies required in the TVET related job market

- **Learner Assessment and evaluation challenges**
  - AT some TSSs, it may be difficult to assess practical, hands-on skills through E- assessments. Also, this may increase possibilities of students' cheating which affect the academic integrity.
  - TSSs are encouraged to use authentic assessments such as projects, simulations, and case studies that reflect real-world applications and assessment of specific learner skills.

- **Negative perceptions by TVET school leadership on Blended Learning:**
  - At some TSSs, there may be a resistance from school leaders, especially regarding changes in curriculum, manuals, resources, and pedagogy. This may also lead to lack or poor coordination of blended learning initiatives at the school level
  - It would be highly important to establish school collaboration and mentorship about the benefits of blended learning in TVET programs.
  - TSSs should also establish blended learning steering committees responsible for overseeing the transition to blended learning
  - Communities of practices at School should also be initiated to foster co-creation with the school leadership for the integration of Blended Learning at TSSs.

- **Financial unsustainability of Blended Learning Model:**
  - Some TSSs may lack funding to support blended learning initiatives such as training of trainers, acquisition of digital infrastructure and internet.
  -TSSs should therefore initiate and organise fundraising and sponsorship from its partners. Collaborations should also be established by TSSs with Tech Companies and Civil Society organisations.

Additionally, TSSs should opt for home-grown solutions for local training and knowledge transfer among their staff to keep blended learning integration a reality in TSSs.

12. Blended Learning Implementation Roadmap

The adoption of blended learning in TSS is a multi-step process that will involve different phases and activities following the implementation plan. In this document, we propose a summary of the detailed

implementation plan for blended learning integration in Rwandan TSS It contains summarised activities and sub-activities. It is important to read the M&E framework for BL integration in TSSs in Rwanda, which is in Annex x. of this document. The proposed implementation roadmap for blended learning in TSSs is spanned in three phases.

- **Immediate Phase:** For the effective transition from traditional to blended learning environment by TSS, this first phase will focus on laying the groundwork of assessment and audit of current status of TSS in terms of policies, infrastructure and systems in place to support blended learning integration in TVET curriculum. At this phase, TSSs will be also addressing infrastructure gaps, and establishing teacher capacity needs and initiating basic training for developing digital literacy for teachers and TSS students. This phase is planned for 2 years period.

- **Short-term phase:** This stage of Blended Learning implementation will involve refining the approach through pilot testing, improving content quality, developing interactive and engaging content, and ensuring feedback loops are established. Trainers' mentorship programs for E-pedagogy skills development and student E-learning ambassadors will also be developed and implemented at this stage. The LMS and other advanced digital tools and assistive technologies will be acquired to support more specific trades in implementing blended learning in teaching, learning and assessment. The short term will also take 2 Years.

- **Long-term phase:** This is the last phase of the BL implementation roadmap which will include advanced approaches to BL adoption. This phase will be started during the 5th Yeat of implementation of the proposed guidelines. At this level, blended learning will be expanded nationally across all TSSs. Best practices from

At this level, blended learning will be expanded nationally across all TSSs. Best practices from TSSs that will have been established as centres of excellence may be institutionalised at each TSS across the country. Ongoing updates on blended learning uptake across the country will be incorporated for the sustainability and resilience of TSSs in Rwanda. At this phase, immersive technologies such as VR/AR/XR and simulation tools will be acquired and integrated into teaching, learning and assessments in several trades where applications can support innovation and resilience of the blended learning environment in TSSs. Also, advanced training in E-pedagogy and instructional design will be organised in the form of training of trainers (ToT) across all TSSs. Communities of Practice for advanced blended learning activities will be also established across all TSSs. Digital assessments (both formative and summative) will be standardised at all TSSs and a centralised system for continuous monitoring and evaluation of blended learning in TVET education will be established.

Activities to be undertaken throughout these three phases of the blended learning implementation plan are summarised in figure 18 below:

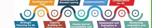

Digital Infrastructure Development for TVET
Digital content development of Blended Learing
Pilot testing of Blended Learning implementation
Partnerships and collaboration for BL
1
2
3
4
5
6
7
8
9
Strategic Planning for BL implementation in TVET Curricula
Capacity Building for TVET Trainers and students
Assess learner accessibility and support
Assessment and Evaluation in Blended Learning
Monitoring, evaluation and feedback mechanisms

Figure 18. Proposed Phased Implementation Roadmap for Blended Learning in TSSs

This phased approach will ensure a manageable, scalable, sustainable, and resilient transition to blended learning in TSSs in Rwanda. A more detailed phased implementation plan with activities, sub-activities and related phases can be found in Annex viii.

13. Resource Allocation for Blended Learning Implementation in TSSs

For an effective implementation of blended learning in Rwandan TSSs, concerned institutions need to wisely plan and allocate resources. The planning and allocation of resources for blended learning implementation should consider for example the technology infrastructure and digital resources, the capacity building of human resources in both digital and pedagogical skills, instructional design and the availability of instructional resources that will be required for a silver-tongued and effective creation of blended learning environment and students' experiences. Considering all the above resources that are needed for blended learning implementation in TSSs, a guide on a detailed breakdown of key resource allocations is proposed below.

13.1. Further Investments in technology adoption

A. Technology Infrastructure and Tools

In TSSs, blended learning implementation requires state-of-the art technology to support online teaching and learning activities while still providing the necessary tools for practical, hands-on learning as well as adequate data storage capacity. It is also important to provide a reliable internet and other network infrastructure

such as switches and routers at TSSs to ensure easy access to learning resources and to seamlessly conduct synchronous teaching and learning activities. Funds should also be allocated on purchasing, licensing and or upgrading an LMS that can support both online learning modules (e.g., theory-based courses, video lessons, quizzes) and host and manage face-to-face learning activities such as lab and workshop-based generated digital contents for further use by instructors and students. Financial resources will also be needed to acquire hardware devices such as laptops or tablets for students and trainers and enable them to teach and learn resources. Computer labs and smart classrooms will also cost some funds to ensure increased access to technology for blended learning implementation.

B. Digital content development and tools

Funds should be allocated in content development and acquisition of related tools. These include for example authoring software like Articulate, Adobe Captivate for creating interactive online courses, Video editing tools, and simulation tools. A considerable amount of funds should be also invested in developing multimedia-rich content that is industry-relevant and aligned with both theoretical and practical traits of the curricula.

C. Acquisition of VR/AR and XR tools

As technology advances, technical secondary schools will need to invest robust financial resources for acquiring VR/AR/XR tools to support hands-on simulations. Funds allocated to these emerging technologies will be used for acquiring for example the VR headsets, AR devices, and associated virtual reality labs and software. Establishment of technologies such as Digital Twins will also be made where necessary to enable equitable use and access to teaching resources remotely, using this new technology.

13.2. Continuous Monitoring and Evaluation of Blended Learning Implementation

In order to sustain the blended learning programs in Rwandan TSSs, funds will be allocated to the activities of monitoring and evaluating the established blended learning programs and recommend proper improvements for its continuous effectiveness. Accordingly, some budgets will be allocated to regular surveys to both students and instructors that will be conducted to gather feedback on the effectiveness of the adopted blended learning model. Investments will also be made in acquiring and installing survey tools for collecting and analysing the data from TSSs and partners in line with the blended learning implementation.

TSSs and its partners will have to allocate resources for ongoing curricula evaluation to ensure that the blended learning adoption is meeting learning objectives and generating 21st skills for the trade- based industry market. For example, resources will be allocated to periodic review meetings, seminars, workshops and webinars with trainers, instructional designers, industry experts, students and school leaders.

A steering committee will be in place and will meet every quarter to evaluate the implementation of these blended learning guidelines. This committee will be chaired by the director general of RTB, with members from RP, MINEDUC, NESA, REB and TSS representatives. The evaluation of these guidelines will base on the proposed implementation roadmap (See annex i)

14. Conclusion:

The literature and practice related to ICT in education suggest that the keys to the seamless delivery of blended learning with engaged learners and trainers are (i) reliable infrastructure, (ii) technical support, (iii) effective trainers/instructors training both on digital and E-pedagogy skills, (iv) a reliable technology in place and (v) a high-level leadership commitment on blended learning implementation (Trotter & Qureshi, 2023). Accordingly, the proposed blended learning guidelines for Technical Secondary Schools in Rwanda are developed considering these aspects and in alignment with the context of the Rwandan education sector. The proposed guidelines are inspired by national strategic policies such as the Rwanda Vision 2050, the National Strategy for Transformation 2 (NST 2). Education sector strategic plan (ESSP), the TVET policy and other key national policies that support TVET programs in Rwanda. Both primary and secondary data have been collected in the pilot 11 TSSs to inform these proposed blended learning guidelines. A desk review with other relevant blended learning policies and scientifically published articles was conducted to inform the proposed blended learning guidelines.

In this first version of the BL guidelines for TSSs in Rwanda, an adaptable blended learning model has been proposed to serve as a core guide to deliver education in both face to face and online environments considering offline and online teaching, learning and assessment. In addition to the proposed adaptable blended learning model for TSSs in Rwanda, 5 specific guides have been also proposed.

These include:

1. Guides on curricula and manual adaptation to blended learning,
2. Guides on digital infrastructure and technology requirements for blended learning
3. Guides on digital content development and selection,
4. Guides on trainer professional development and capacity building
5. Guides on students' readiness for blended learning adaptation

Mechanisms and a framework for quality assurance, monitoring and evaluation of blended learning implementation in TSSs in Rwanda have also been proposed. To this point, a monitoring and evaluation framework with a clearly defined matrix of indicators has been proposed in Annex i. To ensure effective quality assurance, monitoring and evaluation of blended learning in TSSs, key components for consideration should include but not limited to (1) Infrastructure and access to digital

tools, (2) Blended Teaching and Learning Practices, and (3) Blended Learner Assessment and examination. (4) Contents and materials, (5) Learner assessment & examination practices, (6) Trainers and Student training & development, (7) Teacher and Student Technical Support and (8) Inclusivity in Blended Learning adoption.

Furthermore, for a review, updating and continuous improvement of these BL guidelines and the curricula adaptation in schools, other guides and frameworks have also been proposed in this document. These include for example the blended course implementation checklist, the Manual of Quality Standards for blended learning courses, a guide for monitoring and evaluation of Blended Learning integration in TSSs in Rwanda, and a blended learning implementation roadmap which span for 5 years (See Figure 18).

The present BL guidelines also propose the blended learning implementation and coordination framework indicating key potential players for its implementation in TSS. More specifically, a framework with strategies for blended learning sustainability in TSSs has been also proposed to guide schools and its partners for planning and further investments in blended learning development in TSSs.

Therefore, it is worth emphasizing that there is no one-size-fits all-model for blended learning to be adopted by all TSSs in Rwanda due to their different contexts. Hence, the proposed adaptable blended learning model can serve as a reference when a specific school implements a blended learning approach. Hence, the proposed blended learning model (See figure 3) provides possibilities for flipping and rotating in classrooms, workshops, workplaces, labs and in an online learning environment for teaching, learning and assessment activities at each TSSs. Also, the model suggests that TSSs can share resources such as digital contents and digital infrastructure such as labs, workshops and virtual labs powered with Digital Twins technologies. Accordingly, each TSS can integrate blended learning activities in the curricula depending on the specific context in terms of digital infrastructure, trainers and students' readiness and its trades.

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Appendices

- ***Annex i.*** Monitoring and Evaluation Matrix for BL Adoption in TVET Schools in Rwanda
- ***Annex ii.*** Adapted TVET-CBC-Curriculum General information template with BL Aspects
- ***Annex iii.*** Quality Assurance Framework for blended learning courses in TVET Schools
- ***Annex iv.*** Adapted CBTA-Scheme of Work with BL Consideration
- ***Annex v.*** Adapted CBT-CBA-QA Session Plan with Blended Learning
- ***Annex vi.*** Adapted TVET-CBC-Module Content Template with BL Aspects
- ***Annex vii.*** Sample Blended Learning Course Review Form
- ***Annex viii.*** Proposed Blended Learning Implementation Plan and Roadmap for TSSs

Blended Learning Guidelines
for TSSs in RWANDA

Annex i. Monitoring and Evaluation Framework for BL Integration in TVET Schools in Rwanda

Rwanda TVET Board (RTB)

Monitoring and evaluation Matrix: BL integration in TVET Schools in Rwanda							
Core category	***Indicator #***	***Indicator***	***Sub-indicator #***	***Sub-indicator***	***Required data***	***Data source***	***M&E Frequency***
Digital Infrastructure	*1*	Availability, accessibility, and adequacy of digital infrastructure	1.1	# of teacher owning computers / digital devices	Registered teacher-computer record	School IT data	Quarterly
			1.2.	# of teachers with internet access at home	Access to router or smartphone at home	Teachers' survey	Quarterly
			1.3.	Teacher's home Internet bandwidth speed and stability	Internet speed data (Mbps)	Internet service provider records	Quarterly
			1.4.	# of students owning computers, tablets, and other digital devices	# of students with their own digital devices	Students survey	Quarterly
			1.5.	Students-computer ratio	# of students and # of available computers	School IT data	Quarterly
			1.6.	# of students with internet access at home	Access to router or smartphone at home	Students' survey	Quarterly
			1.7.	Student's home Internet bandwidth speed and stability	Internet speed data (Mbps)	Internet service provider records	Quarterly
			1.8.	School Internet bandwidth speed and stability	Internet speed data (Mbps)	Internet service provider records	Quarterly
			1.9.	Access to electricity in classrooms	# of classrooms with reliable electricity	School infrastructure records	Annually
			1.10.	# of available computer labs, smart classroom	Computer lab/ smart classroom computer record	School IT data	Quarterly
			1.11.	Level of access to computer labs, smart classrooms	Student's Access	School IT calendar for accessing computer lab/smart classroom	Quarterly
			1.12.	# of available of VR/AR/Simulation Labs	Computer lab/ smart classroom compute VR/AR/Simulation Labs r record	School IT data	Quarterly
			1.13.	Level of access to VR/AR/Simulation Labs	Student's Access	School IT calendar for accessing VR/AR simulation lab	Quarterly
			1.14.	Maintenance of digital equipment	Frequency of maintenance activities	Maintenance logs	Quarterly
	2	Availability and access to digital teaching, learning	2.1.	Availability of Learning Management System (LMS)	Online hosted LMS	School IT data	Quarterly

Monitoring and evaluation Matrix: BL integration in TVET Schools in Rwanda

Core category	*Indicator #*	*Indicator*	*Sub-indicator #*	*Sub-indicator*	*Required data*	*Data source*	*M&E Frequency*
Digital Platforms & EdTech Tools		and assessment infrastructure at TVET schools	2.2.	Availability of technical design tools (Autocad, Archicad, RStudio, SPSS, Matlab, Cropwat, SolidWorks, ADAM, ePortfolios, Android Studio,etc)	# of licenced tools	School IT data	Annually
Blended Teaching Practices	3	Integration and use of digital tools in teaching	3.1	% of teachers using digital tools during lessons	# of teachers using digital tools vs. total teachers	Classroom observation reports	Monthly
			3.2.	Types of digital tools used (e.g., multimedia, learning management systems-LMS, VR, AR, Assistive tools, etc)	List of tools used	Teacher surveys	Bi-Annually
			3.3.	Adaptation of traditional lessons to blended formats	# of courses adapted for blended learning	Course syllabi from LMS and teacher reports	Bi-Annually
			3.4.	Teacher participation in professional development	# of teachers attending workshops or training on digital tools	Teacher training records	Annually
Blended Learning Practices	4	Student engagement in blended learning Student satisfaction in blended learning	4.1.	% of students registered on LMS	# of students registered on LMS per all students	School registration record from School data management system (SDMS)	Monthly
			4.2.	# of students (all types) accessing digital learning resources	Frequency of resource access by students	Digital learning platform analytics	Monthly
			4.3.	% of students participating in online discussions	# of students engaged in online activities	Student activity logs on LMS or LMS dashboard reports	Monthly
			4.4.	Student satisfaction with blended learning methods	Feedback on student satisfaction	Student surveys	Quarterly
Online Instructional Design	5	Availability of online instructional designers	5.1.	# of online instructional designers for courses	Designers per courses category	School academic data	Quarterly
Interactive digital content	6	Quality and availability of interactive learning materials	6.1.	# of courses accredited to be blended	List of all accredited courses	NESA data or Competency Based Training program data	Annually
			6.2.	# and % of interactive digital units available per course and are available on LMS	List of interactive resources (videos, quizzes, e-books)	Educational content records	Quarterly

Monitoring and evaluation Matrix: BL integration in TVET Schools in Rwanda

Core category	***Indicator #***	***Indicator***	***Sub-indicator #***	***Sub-indicator***	***Required data***	***Data source***	***M&E Frequency***
			6.3.	Student usage of interactive materials	Frequency of use of interactive resources	Learning management system data	Monthly
			6.4.	Feedback on the quality of materials	Student and teacher feedback on interactivity	Survey results	Annually
			6.5	Availability of quality assurance of BL courses	# of content quality assurers	NESA/ RTB/ Schools	Quarterly
Assessment and examination	7	Use of blended learning for assessment	7.1.	# of digital assessments conducted	Frequency of online exams and quizzes	Assessment records	Quarterly
			7.2.	Type of assessment tools used (e.g., automated quizzes, software design, assignments, etc)	List of tools used for online assessment	Assessment design documents and rubrics	Quarterly
			7.3.	Student performance in digital assessments	Results of online exams and quizzes	Formative and summative exam results	Quarterly
			7.4.	Feedback on digital assessment methods	Feedback from students and teachers	Survey results	Quarterly
Teacher and Student training & development	8	Teacher and student readiness for blended learning	8.1.	# of teachers trained in blended learning methodologies	# of teachers completing training programs	Training records/ TMIS	Quarterly
			8.2.	Teacher knowledge of digital tools	# of teachers proficient in digital tools	Teacher proficiency assessments by qualified pedagogical inspectors	Quarterly
			8.3.	Teacher confidence in integrating digital tools	Self-reported teacher confidence levels	Teachers' surveys	Quarterly
			8.4.	Student confidence in using digital tools for learning	Self-reported students' confidence levels	Students' surveys	Annual
Teacher and Student Technical Support	9	Availability and effectiveness of technical support	9.1.	# of technical support staff/ E-champions available (teachers)	Ratio of support staff / champions to students/teachers	School data	Quarterly
			9.2.	Time taken to resolve technical issues	Average resolution time for reported issues	Support logs record	Weekly
			9.3.	Teacher/student satisfaction with technical support	*Feedback from teachers/ students on technical assistance*	Teacher/ students surveys	Quarterly
			9.4.	Frequency of technical support provision	*# of technical support requests resolved*	School support data record	Monthly
			9.5.	# students trained as E-champions	*# of E-learning ambassadors at TSSs*		Annual
			9.6.	Level of satisfaction on peer-to-peer support in online learning	Recorded students' satisfaction from peer support	LMS data and Survey on students	

Monitoring and evaluation Matrix: BL integration in TVET Schools in Rwanda

Core category	*Indicator #*	*Indicator*	*Sub-indicator #*	*Sub-indicator*	*Required data*	*Data source*	*M&E Frequency*
Inclusivity and diversity in Blended Learning	10	Accessibility of blended learning for all students.	10.1.	Availability of assistive technologies (e.g., screen readers, text captions)	*List of assistive technologies provided*	School records	Annually
			10.2.	% of students with disabilities participating in blended learning	# of students with disabilities using digital tools	Student enrollment and participation records	Annually
		Availability of assistive resources and resource rooms	10.3.	Level of adaptations for diverse learning needs and assistive tools	# of learning resources adapted for inclusivity	Curriculum and content review documents	Annually
			10.4.	Feedback from students on inclusivity	Student satisfaction on inclusive learning practices	Student surveys	Annually
			10.5.	Availability of special education needs specialist and instructional designers	# of special needs instructional designers at TVET School	School data/ Academic	Annually
			10.6.	# of resource rooms available	Level of assistive resources usage	School data	Annually
Leadership awareness on Blended Learning	11	Awareness of TSSs leaders on Blended Learning	11.1.	# of TSSs leaders trained on integrating blended learning	Trainings on leaders	School data	Annually
			11.2.	Workshops conducted for TSSs leaders on Blended learning	Workshop data	School data	Annually
Students' performance and outcome	12	Practical and theoretical skills acquisition	11.1.	# of students demonstrating practical skills through digital assessments	% of students completing practical online tasks or simulations	Student assessments, Skills, Certification records	Annually
			11.2.	% of graduates from trades and employed in relevant fields	Employment rates of graduates from blended learning programs	Graduate employability surveys, Alumni networks	Every three years

Curriculum General information template

Logo of MINEDUC

Logo of
authoring
institution

CURRICULUM STRUCTURE

QF LEVEL

Image
reflecting
the trade

TVET CERTIFICATE…
in
…………………………………(trade name)

TVET CERTIFICATE…
in
…(trade name)

Curriculum code

City, Publication date (mm,yyy)

Logo of authoring
institution

CURRICULUM CODE-TVET CERTIFICATE....

……. (Trade name)

RQF Level ......
CURRICULUM

Logo of technically and
financially supporting
institution(s)

Author's Note Page

Authoring institution

Copies available from:

Authoring institution's Address

Publication Date: mm/yyy

Copyright

Table of contents

List of Abbreviations

Acronym	Full text
BL	Blended learning
VLE	Virtual Learning Environment

Acknowledgments

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………

………………………

Production team

Coordination

Name, Position, Institution

Facilitation

Name, Position, Institution

Editing

Name, Position, Institution

Curriculum Development Team

No	Names	Organization	Position
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Sponsor (Only if available)

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FOREWORD

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Name of Competent person

1. GENERAL INTRODUCTION

The general Introduction section should be updated to reflect the blended learning approach, emphasizing the integration of digital tools and resource. This section should explain that curriculum/programme will be implemented in blended learning mode where a combination of face-to-face and online learning will be applied. In addition, it should include guidelines for accessibility (e.g., captioned videos, screen reader-friendly content, and multilingual support) and gender inclusion in blended learning environment.

2. QUALIFICATION DETAILS

2.1. Description

Title: TVET Certificate …….
Level: RQF Level…….
Credits: …………
Sector: ……………………………………….
Trade: ……………………………………………
Issue date: mm, yyy

……

At the end of this qualification, qualified learners will be able to:

1. Collaborate in virtual teams for planning and presenting a basic construction project, integrating safety standards and project timelines using digital project management tools. (E.g.: **TVET Trade:** ***Construction)***
2. Analyze and diagnose common animal diseases using virtual simulations and digital diagnostic databases and submit their diagnosis reports via online course portal on the LMS. (E.g.: **TVET Trade:** ***Animal Health***)
3. Evaluate and debug source code using digital debugging tools and peer-reviewed feedback through collaborative online platforms. (E.g.: **TVET Trade:** ***Software Development***)
4. Design and present a digital travel itinerary for a selected destination using online planning tools and multimedia resources. (E.g.: **TVET Trade:** ***Tourism and Hospitality***)

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2.2 Minimum entry requirements

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2.3 Information about pathways

Pathways into the	**Pathways from the**
Preferred pathways for candidates ente ring this qualification include:	Progression route of candidates achieving this qualification include:
■ ……………………………………	■ ………………………………………………
■ ……………………………………	■ ………………………………………………
■ ……………………………………	■ ………………………………………………

2.4 Rationale of the Qualification

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2.5 Job related information

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Possible jobs related to this qualification

- ……………………………………
- ……………………………………
- ……………………………………
- ……………………………………

2.6 Employability and life skills

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Communication

- Clearly and effectively using online communication tools such as Email, Moodle Forums, Microsoft Teams, Google Meet, Slack, … etc.
- Ability to use collaborative tools such as Google Workspace, Padlet, Miro, Jamboard, Miro, Zoom, Slack, Flip, … etc.
- ……………………………………………………………
- ……………………………………………………………

Teamwork

- The ability to work independently with minimal supervision in online learning environment such as on RTB-LMS.

- Collaboration and team-oriented work, especially in interdisciplinary or cross-sector teams in a virtual environment.
- Flexibility in adapting to different roles within a team in online learning environment.

Integration of the workplace

- … Students apply industry-relevant skills and safety standards in a simulated environment to solve real-world problems and meet workplace expectations……………………………………
- ……students get exposed to online demonstrations and use virtual labs before practicing (on-the-job-training) ……………………….…
- …………………………………………………………

Health, hygiene and safety

- Awareness and understanding of health and environment (ergonomic, green ICT, global impact of digital technology)
- …………………………………………………………
- …………………………………………………………
- …………………………………………………………

Problem solving

- Students will be able to identify, analyze, and solve complex problems using digital tools and collaborative platforms in a blended learning environment………………………………………………………
- …………………………………………………………

Computer skills

- Students will be able to operate essential computer applications (e.g., word processing, spreadsheets, presentation tools) to perform and complete learning tasks and assignments.
- Students will be able to demonstrate the ability to navigate and utilize a learning management system (LMS) for accessing course materials, submitting work, and participating in online discussions.
- Students be able to apply digital communication tools (e.g., email, chat, video conferencing) to effectively collaborate with peers and instructors in both virtual and face-to-face settings
- Students will be able to responsibly use digital devices and follow cybersecurity and data privacy best practices in a blended learning environment.
- ………………………………………………………………

Initiative and enterprise

- ………………………………………………………………
- ………………………………………………………………
- ………………………………………………………………
- ………………………………………………………………

Self-management

- ………………………………………………………………
- ………………………………………………………………
- ………………………………………………………………
- ………………………………………………………………

Learning

- ………………………………………………………………

- ………………………………………………………………
- ………………………………………………………………
- ………………………………………………………………

Technology

- Ability to use trade-based industry specific software

- ………………………………………………………………

- ………………………………………………………………

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Languages other than KinyaRwanda

- ……………………………………………………………
- ……………………………………………………………
- ……………………………………………………………
- ……………………………………………………………

2.7 Information about competences

No	Code	Complementary competences	Credit
1			
2			
3			
4			
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n			
Total			…..

In a TSS curriculum to be delivered in blended learning environment, students develop both topic-related competences (trade-specific skills) and blended learning technological tools-related competences (digital learning skills). This dual focus ensures learners gain practical expertise while effectively using technology to support their education.

Examples:

Topic-Related Competences:

- Interpret and apply technical drawings in construction projects.
- Operate and maintain trade-specific tools and equipment safely.
- Design simulated products in animal health projects for real-world applications

Blended Learning Technological Tools-Related Competences:

- Use a Learning Management System (LMS) to access lessons and submit assignments.
- Use online collaborative tools and software for group-work learning projects and virtual demonstrations
- Participate in virtual simulations or digital labs to practice technical procedures.

Core Competences:

In the CBC framework of TSS or TVET, student learning in relation to core competencies which are directly related to the technical trade which is also enhanced through the integration of blended learning tools and methods. Core competencies focus on the mastery of trade-specific knowledge, practical skills and professional behaviours required in the workplace.

Topic-related learning:

- Apply safety standards and procedures while operating technical equipment.
- Produce quality work based on industry specifications in a specific trade (e.g., masonry, welding, or software development).

Blended Learning tools-related:

- Use virtual labs or simulations to practice technical tasks before hands-on application in workshop or at the workplace.
- Access and apply trade-specific digital content and online tutorials to reinforce practical learning.

No	Code	Core competences	Credit
1.			
2.			
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.			
.			
.			
.			
n.			
Total			…….

❖ Number of competences: ….

❖ Core competences :…..

❖ Complementary competences: ..

❖ The total number of Credits: ….

2.8 Allocation of Learning Hours

In a blended TVET environment, learning hours should be balanced between theoretical and practical components across both face-to-face and online settings. Face-to-face learning includes theoretical classroom instruction, practical workshop/lab sessions, and workplace attachments for real-world experience whereas online learning involves theoretical content through digital platforms and practical simulations using virtual labs and project-based tasks

NO	Module name	Learning outcome	Theoretical hours	Delivery Mode (F2F vs Online)	Practical hours	Delivery Mode (F2F vs Online)	Total hours
1							
Total hours module 1			....hours		...hours		....hours
2							
Total hours module 2			...hours		....hours		....hours
.							
n							
Total hours module n			...hours		....hours		....hours
Total hours for all modules			....hours		....hours		.....hours

3. TRAINING PACKAGE

The training package includes the competencies chart, the flowchart, the modules, the course structure, and the assessment guidelines.

3.1 Course structure

The course structure describes the learning outcomes for each learning unit. These learning outcomes are the essential skills and knowledge to be acquired. The contents to be covered for each learning outcome are prescriptive. The Learning Activities contain a series of suggestions, usually with several options, that will guide the learner and the trainer.

3.2 Competences chart

The competencies chart is a table that presents an overview of the specific competencies, the general competencies, the work process and the time allocated to each competency. This table provides an overall view of the competencies of the training program and allows identification of the logical sequence of the learning of these competencies.

The competencies chart shows the relationship between general competencies and specific competencies that are particular to the occupation, as well as the key stages of the work process. It shows the links between the elements in the horizontal axis and those in the vertical axis. The symbol (o) marks a relationship between a general competency and specific competency. The symbol (Δ) indicates a relationship between a specific competency and a step in the process of work. When the symbols are darkened, it indicates that the link is taken into account in the description of the specific competency.

The competencies chart allows the trainer to consider the complexity of the competencies in the organization of the progress of learning. Therefore, the vertical axis shows the specific competencies in the order they should be acquired.

This is the starting point of the presentation of the competences in the flowchart presented in the following pages:

<table>
<tr><td colspan="3">Occupation tittle</td><td colspan="5">PROCESS</td><td colspan="4">GENERAL AND COMPLEMENTARY COMPETENCES</td></tr>
<tr><td colspan="2">SPECIFIC COMPETENCES</td><td>Duration (Hrs)</td><td>Step 1</td><td>Step 2</td><td></td><td></td><td>Step n</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">#</td><td rowspan="2">Duration (Hrs)</td><td rowspan="2" colspan="6"></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>Competence</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Competence</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>n</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">YEAR 1|TOTAL CREDITS</td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">NOTIONAL LEARNING HOURS</td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
</table>

Table ……: Competencies chart

Between the process and particular competencies	Between general and particular competencies
▲: Functional link application	●: Functional link application
∆: Functional link existence	o: Functional link existence

3.3 Flowchart

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Figure ……: Flowchart

4. ASSESSMENT GUIDELINES

4.1 Assessment Methodology

The assessment will contain formative and summative assessments that can be conducted in both face-to-face and online environments.

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4.2 Portfolio

Use e-portfolios/digital tools to document trainees' progress and showcase their skills.

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Formative Assessment

- Use online quizzes, polls, and discussion forums for formative assessments.
- Provide immediate feedback through the LMS to help trainees improve their understanding.
- Allow students to perform virtual presentations using collaborative tools such as MS Teams, Webex Google Workspace or Google Meet

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Summative/Integrated Assessment

Hybrid projects (e.g., e-portfolios + practical demonstrations and simulations for TSSs with such technologies)

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Annex iii: *Quality Assurance Framework for blended learning courses in TSSs*

Phase	Indicators	Metrics and Measurement	Source of Data	Frequency	Data Analysis
Analysis	Needs assessment coverage	# of industries assessed	Industry reports	Annually or before course redesign	Thematic and statistical analysis of data
	Relevance to industry needs	Industrial gap aligned	Industry surveys		Gap-trend analysis
	Status of digital tools supporting the course	Quality and quantity of technology in place	School reports		Content and statistical analysis
	Learning outcomes through BL (TVET skills, knowledge and competencies)	Structured learning outcomes and alignment with skills, knowledge and competencies	Quality Assurance units' reports		Content analysis of pre-defined learning outcomes
	Content & materials (Soft/hard)	Quality, Quantity of course contents	Quality Assurance units' reports		Content analysis of content data
	Inclusion for all learners	Diversity inclusion rate	Surveys and Focus groups		Gap analysis
Design	Curriculum alignment with BL guidelines	Alignment based on analysis phase output	Course design documents	Per course iteration	Analysis of rubrics' results and storyboards
	Accessibility for all learners	Accessibility compliance	Survey		Accessibility testing
	Effective design of blended courses	Teachers, learners, and other stakeholders' satisfaction rate	Survey		Teachers, learners, stakeholders feedback scoring
Development	Alignment of course manuals with blended learning principles	% of courses with blended learning components	Curriculum review documents, Course syllabi	Annually	Online and face to face ratios

Phase	Indicators	Metrics and Measurement	Source of Data	Frequency	Data Analysis
	Adaptation for different learning styles and needs as per UDL standards	# of courses with inclusive design (e.g., videos with subtitles, screen readers)	Course syllabi, teacher reports	Annually	Extent to which courses are aligned to diverse learners
	Quality and usability of content	Peer reviewed content score	Quality assurer and Peer reviews and LMS review	During development	Error detection rates
	Content Integration with LMS	Error-free content rate			
	Inclusion for interactive elements	Interactive component ratio	LMS reports		Usability feedback synthesis
Implementation	Teacher adoption of blended teaching tools	% of teachers using digital tools in teaching	Teacher surveys, Classroom observations, LMS usage data		Extent to which teacher training on BL contributes to BL implementation
	LMS and other Systems reliability	LMS uptime rate	LMS analytics	Weekly	Statistical tracking of uptime and engagement trends
	Learner and trainer engagement	Learner participation percentage	Support logs		
	Availability of support resources	Support ticket resolution time	School report		
	Availability and use of assistive technologies	Resource rooms capacity	School report	Quarterly	Evaluating the check list of assistive technology resources
Evaluation	Student achievement of TVET course learning objectives	Pre/post assessment scores	Learner assessments	Quarterly/Every end of term	Comparative scoring
	Teachers, Learner and	Course feedback and	Surveys / Interviews/		Analyse Satisfaction

Phase	Indicators	Metrics and Measurement	Source of Data	Frequency	Data Analysis
	stakeholders' satisfaction	satisfaction scores	Discussion forums		rate and behaviours
	Course completion rates	Completion percentages	LMS data		performance correlations
Maintenance	Frequency of TVET-BL program evaluations	Number of internal or external evaluations of blended learning programs	Evaluation reports, Program review meetings	Annually	Trend analysis of updates
	Response to feedback and BL adaptation	Percentage of changes or adjustments to blended learning programs based on feedback	Survey results, Feedback logs		Frequent requested updates
	Platform optimization	LMS performance metrics	LMS Analytics		comparison of platform performance pre/post updates
	Quality of feedback provided to students	Timeliness and usefulness of feedback from TVET trainers	Student surveys, Teacher reports	Weekly	Students' feedback trends

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TQUM
TVET Quality Management Project

CBT/CBA/QA Implementation

ADAPTED TOOLS (Templates) FOR BLENDED LEARNING

2025

SCHEME OF WORK CHECKLIST

No	Criteria	Indicator	(Yes/No)	Comments
1.	School details	Logo is mentioned		
		School name is indicated		
		School address is indicated		
2.	Qualification Information	Sector is indicated		
		Sub-sector is indicated		
		Level is indicated		
		Qualification title is indicated		
3.	Module details	The code and title of the module is indicated		
		Learning outcomes (LOs) are clearly stated and aligned with blended tasks.		
		Number of classes are indicated		
		Total learning hours (split into online/offline) are indicated.		
4.	Delivery timeline	The weeks the module will be delivered are indicated		
		Duration of each learning outcome is mentioned and Synchronous (live) vs. asynchronous (self-paced) activities are planned.		
5.	Indicative contents	Learning activities are indicated		
		Learning resources are indicated		
		Learning place distinguishes online vs. in-person venues.		
		Digital and physical resources (e.g., LMS, tools, software) are listed.		

6.	Assessment	Formative assessment evidences (e.g., online quizzes, polls, peer reviews) are detailed.		
		Summative assessment for specific modules(Task, consumables, assessment place) is planned		
7.	Observation	Observation place for each indicative content is provided		

Checked by:

Signature:

Date:……/………/…………

School details (Logo, Name, adress)

SCHEME OF WORK

Sector:		**Trainer:**	
Trade:		**School Year:**	
Qualification Title:		**Term:**	
RQF Level:		**Module details**	
		Module code and title	
		Learning hours:	
		Number of Classes:	
Date:		**Class Name:**	

Term: 1

Weeks	**Competence code and name**			**Learning Activities**	**Resources (Equipment, tools, and materials)**	**Evidences of formative assessment**	**Learning Place**	**Observation**
	Learning outcome (LO)	**Duration**	**Indicative content (IC)**					
1	LO1:		IC1.1:	Mix of synchronous (live sessions) and asynchronous (self-paced) tasks. For asynchronous: Pre-recorded lectures, virtual simulations, discussion forums, self-paced quizzes.	This include the Digital tools such as LMS (e.g., Moodle), Zoom, Google Classroom, Padlet, Kahoot, virtual labs,	For asynchronous: Pre-recorded lectures, virtual simulations, discussion forums, self-paced quizzes.	This include the Digital tools such as LMS (e.g., Moodle), Zoom, Google Classroom, Padlet, Kahoot, virtual labs, Simulation software (e.g., Cisco Packet Tracer).	

				Face-to-face: Hands-on lab tasks, group discussions, Practical demonstrations	Simulation software (e.g., Cisco Packet Tracer). Physical materials for face-to-face such as computers, projectors that are needed to achieve the learning outcome.	Face-to-face: Hands-on lab tasks, group discussions, Practical demonstrations	Physical materials for face-to-face such as computers, projectors that are needed to achieve the learning outcome.	
			IC1.2:					
			IC1.3:					
2	LO2:		IC2.1:					
			IC2.2:					
			IC2.3:					
3	LOn:		ICn.1:					
4	Integrated Assessment (for specific module)			Hybrid projects (e.g., e-portfolios + practical demonstrations and simulations for TSSs with such technologies)	-E-portfolio tools like google sites -Simulations like cisco packet tracer, etc -Computers -Internet -Projector -Recording tools		In blended mode: |Workshop Online Classroom	

			like flipgrid -Online Collaborative tools			

Trainer’s name and signature:

Term: 2

Weeks	Competence code and name			Learning Activities	Equipment, tools, resources (ETR)	Evidences of formative assessment	Learning Place	Observation
	Learning outcome (LO)	**Duration**	**Indicative content (IC)**					
1	LO1:		IC1.1:					
			IC1.2:					
			IC1.3:					
2	LO2:		IC2.1:					
			IC2.2:					
			IC2.3:					
3	LOn:		ICn.1:					
4	Integrated Assessment (for specific module)			Task	Consumables		workshop	

Trainer’s name and signature:

Term: 3

Weeks	Competence code and name			Learning Activities	Equipment, tools, resources (ETR)	Evidences of formative assessment	Learning Place	Observation
	Learning outcome (LO)	**Duration**	**Indicative content (IC)**					
1	LO1:		IC1.1:					
			IC1.2:					
			IC1.3:					
2	LO2:		IC2.1:					
			IC2.2:					
			IC2.3:					
3	LO3:		IC3.1:					
4	Integrated Assessment (for specific module)			Task	Consumables		workshop	

Prepared by: ***(Name, position and Signature)***

Verified by: ***(Name, position and Signature)***

Approved by: ***(Name, position and Signature***

CBT/CBA/QA Implementation

ADAPTED TOOLS (Templates) FOR BLENDED LEARNING

2025

RTB | RWANDA TVET BOARD

NYANZA TECHNICAL SECONDARY SCHOOL
www.nyanzatss.ac.rw
etogitarama@gmail.com
(+250) 788309436
P.O. Box: 60 Ruhango

SESSION PLAN QUALITY CHECKLIST

No	Criteria	Indicator	(Yes/No)	Comments
1.	School information	School logo is indicated		
		school name is mentioned		
		school address is indicated		
2.	Module specification	The code and name of the module are mentioned		
		Sector, trade, and level are mentioned		
		Learning outcome is indicated		
		Indicative content is indicated		
3.	Details of the Session	Topic of the session is identified		
		Range is defined		
		At least 3 SMART objectives are formulated		
		Activities are timed and specify mode (online/in-person).		
		Identified resources include digital tools (e.g., LMS, virtual labs) and physical materials are relevant		
		Facilitation techniques include blended strategies		
4.	Introduction of the Session	Trainer's activities are defined and include setting up online tools (e.g., LMS, polls).		
		Learner's activities are defined and include accessing pre-session materials (e.g., videos, demos, readings).		
5.	Development of the Session	Trainer's activities are defined and include live demonstrations + asynchronous support (e.g., forum moderation).		
		Learner's activities are defined and include offline and online tasks (e.g. supervised virtual collaborative tasks, engage with simulation content)		
6.	Session Conclusion	Summary activities are planned and include online tools (e.g., quizzes, e-portfolios) and/or in-person tasks.		
		Assessment is Planned (e.g., online quiz, CAT, Lab Projects,)		
		Session evaluation activities are planned (E.g. Google Form, Polls, Online Evaluation Form)		
7.	References	Text Book; APA referencing is respected and ind include digital sources that are OER.		
		Web page; APA referencing is respected		
		At least three (3) references are given (Including E-resources)		
8	Appendices	Relevant Handouts are attached (Including hard and soft copies uploaded on LMS)		
		Relevant Task sheets are attached		
		Relevant Assessments tools are attached		

9	Reflection	Reflection reporting space is provided		

Checked by:

Signature:

Date: ……/………/…………

School Logo and School information

SESSION PLAN

Sector :	**Trade :**	**Level :**	**Date :**
Trainer name :			**School year:** **Term :**
Module (Code&Name):	**Week :**	**No. Trainees:**	**Class(es):**
Learning Outcome	Align with blended activities, e.g., Apply [skill] using virtual simulations and in-person practice.		
Indicative content			
Topic of the session:			
Range:	**Duration of the session:**		
Objectives: Example: Learners will submit a virtual lab report through the LMS.			
Facilitation technique(s): Blended learning techniques such as Synchronous, flipped classroom, etc should be clearly defined			

Introduction	**Resources**	**Duration**
Trainer's activity: Must indicate trainers' activities that can include blended learning activities. Example: Share pre-session video via LMS. **Learner's activity:** Should include blended learning activities based on the nature of the course. Example: Watch pre-session video and post questions on the forum.	Include digital tools such as LMS	
Development/Body		
Step 1:	**LMS, Collaborative Tools such as MS Teams, Webex, Google Meet, E-**	

Trainer's activity: **Organise Virtual Group Works, Live Demos** **Learner's activity: Engage in interactive contents such as SCORM or H5P contents, Peer-to-peer discussions via LMS..etc** **Step n:** **Trainer's activity:** **Learner's activity:**	**Portfolios, Computer Labs, Simulations, etc.**	
Conclusion		
Summary:		
Assessment/Assignment	Include assessment to be conducted and done by students using digital tools such as quizzes, forums, live demos, virtual presentations etc…	
Evaluation of the session:		
References:		
Appendices:		
Reflection:		

Session delivery self-reflection guide

No	Criteria	Indicator	Yes/No/Not Applicable (NA)	Comment
1	Achievement of objectives	Objectives related to Cognitive domain (Knowledge) are achieved		
		Objectives related to Psychomotor domain (Skills) are achieved		
		Objectives related to Affective domain (Attitudes) are achieved		
2	Resources	Vocational materials are effectively used		
		Teaching aids are effectively used Digital teaching aids (e.g., interactive videos, virtual whiteboards) enhanced learning.		
3	Learning activities	Used online facilitation techniques are adapted to the topic and suited for blended learning		

		Learners engaged equally online and in-person (e.g., forum posts, hands-on participation).		
4	Learners understanding	Opportunities for learners to ask questions during the session and across platforms are provided.		
		Learners' questions are effectively handled		
		Opportunities for formative assessment are provided and immediate feedback (e.g., auto-graded quizzes, peer reviews) was provided		
		Opportunities for receiving learners' feedback is provided		
		UDL principles were applied (e.g., materials in text, audio, video formats).		

SESSION DELIVERY MONITORING CHECKLIST

Trainer's name: **Date:** **Period:**

Sector: **Trade:** **Level:** **Class:**
Number of trainees:

Module (Code &Name) conducted during class observation:
Learning Outcome:
Indicative Content:
Topic of the Session:

Criteria	**Indicator/observation**	0 (Not available)	**1** (very poor)	**2** (poor)	**3** (Good)	**4** (Very good)	**5** (Excellent)	**Observation**
Pedagogical documents	Scheme of work is respected							
	Session plan integrates digital tools (e.g., LMS, virtual labs) and is followed.							
	Class diary is available and it include blended learning activities and up to date.							
	Class attendance list is effectively used							
	Trainer masters the subject by providing clear explanation,							

Session delivery	typical and relevant examples where needed							
	Facilitation techniques (Variation; Relevance; Quality of handling questions) including blended learning activities like (e.g., breakout rooms, polls). is applied							
	Teaching aids blend digital (e.g., simulations, videos) and physical resources are used (Variation; Relevance; Quality; Effectiveness)							
	Didactic materials are available of offline/online used (Variation; Relevance; Quality; Effectiveness)							
	Trainer's self-presentation (Proper work attire, appropriate use of language, appropriate use of body language)							
	Class is well managed (Handling interruptions;)							
	Didactic materials are accessible online/offline (e.g., captioned videos, e-books).							
	Learning environment is conducive (Organization; Safety precautions, Cleanliness of the learning place)							
	Sub/Total							/
Average(sum of all rate/number of indicators)								
Strength:								
Area of improvement:								
General Observation: ***Excellent*** ☐ ***Very good*** ☐ ***Good:*** ☐ ***Poor*** ☐ ***Very poor:*** ☐								

Teacher's ***comments:***

………
……

TVET Teacher's names & signature: **Evaluated by:**

Name, Position & Signature

Date: ………/………/………. **Date: ………/………/……….**

Module Content template

Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

Module Code

Module Tittle:……………….

Competence Tittle:……………….

Competence

RQF Level: ………………

Learning Hours: ………………

Credits: ………………

Sector: ………………………………..

Trade: ………………………………………

Module Type: Specific/General/Complementary

Curriculum: ………………………………………..

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Issue Date: MM/YYY

<table>
<tr><td>Purpose statement</td><td colspan="6">……………………………………………………………………………………
……………………………………………………………………………………</td></tr>
<tr><td rowspan="7">Delivery modality</td><td colspan="2">Training delivery</td><td>100%</td><td colspan="2">Assessment</td><td>Total 100%</td></tr>
<tr><td colspan="2">Theoretical content</td><td>30%</td><td rowspan="4">Formative assessment</td><td>30%</td><td rowspan="4">50%</td></tr>
<tr><td colspan="2">Practical work:</td><td rowspan="3">70%</td><td rowspan="3">70%</td></tr>
<tr><td>Group project and presentation</td><td>….%</td></tr>
<tr><td>Individual project /Work</td><td>….%</td></tr>
<tr><td colspan="5">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competency and Performance Criteria

<table>
<tr><th>Elements of competency</th><th>Performance criteria</th></tr>
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Course content

Learning outcomes	At the end of the module the learner will be able to: Examples: ● Describe basic measurements in physics using online simulations and virtual labs, and demonstrate these concepts in face-to-face lab sessions. ● Edit photos using Adobe Photoshop through online tutorials and apply these skills in face-to-face design workshops. ● Export files in various formats using online guides and demonstrate this process during practical lab sessions. ● Manipulate data with JavaScript using online coding platforms and apply these skills in face-to-face coding workshops. .... …
Learning outcome 1: …	Learning hours: …
Indicative content	
Based on performance criteria and the extend at which learning outcome is. *(What, Up to, and How):*	
Resources required for the learning outcome	
Equipment	● Laptops/Computers ● Projectors ● Interactive whiteboards ● Printers ● Workshop tools (e.g., soldering kits, design tools) ● Assistive devices (e.g., screen readers, Braille displays)
Materials	● Online course modules ● Video lectures ● Interactive content created with H5P ● Interactive quizzes ● E-books and PDFs ● SCORM packages ● Captioned videos ● Printed handouts ● Lab manuals

	● Physical prototypes ● Workshop materials (e.g., wires, circuits, fabrics) ● Accessible course materials (e.g., large print, Braille) ● Simplified instructions
Tools	● RTB Learning Management System (LMS) ● Video conferencing tools (e.g., Zoom, MS Teams) ● Interactive platforms (e.g., H5P, Kahoot) ● Coding platforms (e.g., CodePen, JSFiddle) ● Virtual labs (e.g., Labster, PhET Simulations) ● Design software (e.g., Adobe Photoshop, Illustrator) ● Coding software (e.g., Visual Studio Code, GitHub) ● Simulation tools (e.g., AutoCAD, SolidWorks) ● Presentation tools (e.g., PowerPoint, Prezi) ● Accessibility tools (e.g., text-to-speech software, speech-to-text tools) ● Captioning tools (e.g., YouTube captions)
Facilitation techniques	● Self-directed study: Students will learn on their own offline and online on RTB e-learning platform. ● Online facilitation: Students will be facilitated in learning activities on the RTB e-learning platform by doing quizzes, and responding to discussion forums. ● Use live virtual classes (e.g., Zoom, Teams) for real-time discussions, Q&A, and collaborative activities.
Formative assessment methods /(CAT)	● The formative assessment will include online quizzes (auto-graded), peer feedback in forums,polls during live sessions, draft project submissions, peer reviews either online or in person.

Learning outcome 2: …	Learning hours: ….
Indicative content	
Based on performance criteria and the extend at which learning outcome is. *(What, Up to, and How):*	
Resources required for the indicative content	
Equipment	
Materials	

Tools	
Facilitation techniques	
Formative assessment methods /(CAT)	

Learning outcome N:….	Learning hours: ….
Indicative content	
Based on performance criteria and the extend at which learning outcome is. *(What, Up to, and How):*	
Resources required for the indicative content	
Equipment	
Materials	
Tools	
Facilitation techniques	
Formative assessment methods /(CAT)	

Tools	
Equipment	
Materials/ Consumables	

Integrated/Summative assessment (For specific module)

Integrated situation

Text for integrated situation:

For integrated situations, hybrid projects (e.g., e-portfolio + practical demonstration) as well using simulations will be done. …………………………………………………..

………………………………………………………………………………………………..

………………………………………………………………………………………………..

Resource

- E-portfolio tools like google sites
- Simulations like cisco packet tracer, etc
- Computers
- Internet
- Projector
- Recording tools like flipgrid
- Online Collaborative tools such as Google Package (Word, Excel, PPT, Forms, ..etc)

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
Learning outcome 1: (30%)		Ind.1			
		Ind.2			
		Ind.3			
		Ind.1			
		Ind.2			
		Ind.3			
Learning outcome 2: (40%)	2.1.	Ind.1			
		Ind.2			
		Ind.3			
	2.2.	Ind.1			
		Ind.2			
		Ind.3			
Learning outcome 3: (30%)	3.1.	Ind.1			
		Ind.2			
		Ind.3			
	3.2.	Ind.1			
		Ind.2			
		Ind.3			
Total marks		100			
Percentage Weightage		100%			
Minimum Passing line % (Aggregate): 70%					

References:

APA Format

Glossary

Term 1: meaning/definition in this curriculum

Term 2: meaning/definition in this curriculum

Term 3: meaning/definition in this curriculum

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Term n: meaning/definition in this curriculum

Author’s Note Page

Authoring institution

Copies available from: Authoring

institution’s Adrress

Rwanda TVET Board
TVET School Name:
Academic Year: …../……..

Blended Learning Course Peer Review Form

This form is to be approved by the RTB Quality Assurance Unit. It is used to review the components (in-class materials and online materials) of each blended learning course.

Course Name:	**Course Instructor Name:**
Reviewer Name:	**Review Date:**
% Face-to-Face delivery:	**% Online delivery:**

Key

Exemplary = a model implementation for this criterion
Accomplished = excellent implantation, comparable to others
Promising = good implementation but lacking in some aspects
Incomplete = good start but only partial implementation
Missing = no evidence of this criterion
Not **A**ppropriate = this criterion is not relevant for the course reviewed

Course Expectations

Criteria	E	A	P	I	M	NA
Instructions are provided to students on how to start the course Some possible options: • In-class orientation session • Online orientation materials (e.g., screencasts, diagrams, documents, etc.)						
The relationship between online and face-to-face expectations/activities is stated clearly to students						
Protocols for course communications between students and instructor are provided (e.g., general "Netiquette," best venue for questions, procedures for conducting discussions, etc.)						
All materials required for the course are delineated for students (e.g., texts, equipment, software, web access, etc.).						

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Notes:

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Learning Objectives

Criteria	E	A	P	I	M	NA
Course-level learning objectives/outcomes are written clearly in student-friendly wording						
Learning objectives/outcomes for each sub-division of the course (e.g., modules, lessons, weeks, chapters, etc.) are written clearly in student-friendly wording						
Learning objectives/outcomes align with multiple levels of Bloom’s Taxonomy of Educational Objectives as appropriate						
Notes:						

Learning Activities/Content

Criteria	E	A	P	I	M	NA
Learning activities align with stated learning objectives/outcomes						
Learning activities contain clear, detailed instructions for students						
Learning activities promote peer-to-peer interaction						
Learning activities promote instructor-student interaction						
Learning activities promote student-to-**content** interaction						
Content presentations support learning activities						
Content presentations align with learning objectives/outcomes						
All web links and embedded media elements included in content presentations are functional						
Content availed on the LMS are inclusive and accessible						
Content (OER) borrowed from external links and resources are clearly indicated						
Notes:						

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Learning Assessments

Criteria	E	A	P	I	M	NA
A variety of learning assessments is provided to students						
Learning assessments align with stated learning objectives/outcomes						
Course documents state the contributions toward the final course grade of each graded learning assessment						
Written scoring criteria are provided to students for each human-scored learning assessment						
The online testing environment is safe with proctoring tools						
Course documents include statements detailing when and where grades will be posted						
Informal assessments are incorporated when appropriate						
Notes:						

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Technology Tools

Criteria	E	A	P	I	M	NA
All required technology tools (within Course Management System or from other sources) have a clearly stated purpose related to course goals						
All required technology tools have clear student usage instructions						
Technical support contact information is provided for all required technology tools						
Online chats and discussion forums are provided to allow online interaction						

Notes:

Ethical/Legal Compliance

Criteria	E	A	P	I	M	NA
Course materials provide information about how students with disabilities may be accommodated and supported						
Course materials/activities show evidence of universal design principles (e.g., video captioning online/face-to-face; "clicker buddies" pairing two students with one personal response device; alternative text for images in online materials, etc.)						
Course materials contain statements clarifying ownership and usage rights where appropriate (e.g., "…used with permission…;" "…falls within Fair Use guidelines…;" "…used under the terms of a Creative Commons Attribution 3.0 license…;" etc.)						
Instructor takes steps to protect students' educational records/privacy rights (e.g., no personal information used in public posting of student grades; encouraging student aliases in online public interactions; etc.)						
Course materials provide written definitions of and consequences for student behaviors that constitute plagiarism and/or academic misconduct.						

Notes:

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Implementation of Blended Learning Course

Note: Requires observation of Face-to-Face and online settings during the course term.

Criteria	E	A	P	I	M	NA
Instructor is active in guiding students through the course (e.g., issuing reminders, clarifying instructions, etc.)						
Instructor ensures her/his accessibility by students in both f2f and online contexts						
Instructor solicits feedback from students						
Instructor is responsive to student questions/concerns						
Instructor works to maintain a consistent integration between f2f and online contexts						
Instructor adapts design of the course to meet emergent needs as appropriate						
Students are engaged appropriately in both f2f and online contexts						

Notes:

General Notes:

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Annex viii. **Proposed Blended Learning Implementation Plan and Roadmap**

No	Activity	Sub-Activity	Pilot Phase (1-2 Year)	Short Term (3-4 Years)	Long Term (5 Years)
1	Strategic Planning for BL implementation in TVET Curricula	Form a national steering committee for blended learning in TSSs.	♦		
		Select a few TSS schools/trades/courses for piloting BL implementation	♦		
		Conduct a needs assessment for BL in TSSs in technological infrastructure, skills, teaching/learning tools for TSSs.	♦		
		Update the Teacher Qualification Framework (TQF) by integrating BL competences	♦		
		Map existing TVET-CBT-CBA curricula to be blended.	♦		
		Create Schools' BL implementation plans aligned with national priorities and NQF.	♦	♦	
		Adapt pilot TVET curricula to blended learning modes and develop appropriate digital tools.	♦		
		Develop a national blended learning policy/guideline for TSSs.	♦		
		Integrate blended learning approaches into training plans and manuals for pilot TSSs.	♦		
		Establish TSSs as centres of excellence with highest technological innovation in blended learning approach.		♦	♦
		Develop a case for blended learning scale up to all TSSs in Rwanda		♦	
		Put in place a full plan and implementation for the Blended Learning scaling up across all TSSs.		♦	
		Ensure continuous Blended Learning curriculum updates match with evolving industry requirements for all trades.		♦	♦
2		Conduct an infrastructure/ connectivity audit to identify gaps across pilot TVET schools	♦		
		Acquire necessary ICT equipment and upgrade internet to implement BL in Pilot Schools	♦	♦	

	Digital Infrastructure Development	Continuously upgrade infrastructure of centres of excellence such us internet to 100 – 200 Mbps to full adopt immersive technologies etc.		♦	♦
		Equip TVET centres of excellence with modern technology focussing on integrating digital tools (LMS, smart & interactive tools, simulations & AR/VR/XR), AI, and industry-specific technologies (Robotics, automation, 3D printing, additive manufacturing tech & IoT), along with fostering digital literacy and cross-disciplinary skills needed for digital economy needs.		♦	♦
		Through partnerships, mobilize funds and establish collaboration with EdTech Companies to develop immersive technologies (VR, AR and Simulations) for different trades.		♦	♦
		Implement partnership with EdTech Companies for VR/AR/ and Simulations tools for TSSs		♦	♦
		Expand VR/AR/XR labs, smart classrooms and computer labs for Centres of Excellence.			♦
3	Capacity Building for TVET Trainers and students	Conduct skills needs assessment for BL training in pilot TSSs	♦		
		Provide digital literacy training for TVET trainers and students	♦	♦	
		Plan and conduct training workshops on E-pedagogy, LMS use, and digital content development for selected TSSs trainers and related certification	♦	♦	
		Establish TSS trainer mentoring programs, E-champions and certifications	♦	♦	
		Establish students E-learning ambassadors at all TSSs and trades		♦	
		Train BL master trainers to ensure continuous professional development on BL environment.			♦
		Introduce TVET trainers CPD framework and certifications in consideration of BL	♦		
4	Digital Content Development	Align available manual content with TVET blended curricula and create additional digital contents for all trades.	♦	♦	♦
		Pilot testing multimedia materials for practical skills training.		♦	
		Create and outsource advanced resources (VR/AR/XR, simulation content).		♦	♦
		Establish partnerships for co-creating industry-based digital content.		♦	♦

5	Assess Learner Accessibility and Support	Conduct school accessibility and gender inclusive audit and identify learners with special needs	♦		♦
		Provide assistive technologies and resource rooms to TVET Schools		♦	♦
		Customize digital content using Universal Design for Learning (UDL) principles.		♦	
		Create multilingual digital resources for inclusion and diversity.		♦	♦
		Implement ongoing accessibility enhancements in all TSSs.			♦
		Evaluate and scale inclusive practices for digital content and LMS access			♦
6	Assessment and Evaluation in Blended Learning	Develop tools for online formative and summative assessments including hybrid methods for assessing practical skills.	♦		
		Conduct regular BL quality assessment at school, trade and course (manual) level		♦	♦
7	Partnerships and Collaboration for BL Implementation	Identify and engage different partners such as development partners, Telecom companies, industries, NGOs, CSOs, FBOs, EdTech companies to support and roll out BL innovative initiative in TSSs	♦	♦	♦
		Establish long-term stakeholder collaboration to ensure sustainability of blended learning initiatives in TVET.		♦	♦
8	Monitoring, Evaluation and Feedback Mechanisms	Develop a monitoring and evaluation framework to track implementation progress.	♦		
		Train staff on data collection tools for BL monitoring and evaluation.	♦		
		Conduct regular reviews of BL implementation progress through learner and teacher feedback for improvement.		♦	♦
		Establish a centralized Data Management System for continuous monitoring and reporting on BL implementation in TSSs.		♦	♦
		Publish annual reports on blended learning outcomes.		♦	♦