TECHNOLOGY - ENABLED COLLABORATIVE CLASSROOM 4.0

DigitalEyez

A GUIDELINE FOR PRACTICE AND SUSTAINABILITY

"Immersive technologies in education can bridge the gap between theoretical knowledge and practical application, providing a deeper understanding and retention of subjects. This is how we prepare students for the complexities of the future workforce."

Ginni Rometty, former CEO of IBM, on the transformative power of immersion

TECHNOLOGY - *enabled*
COLLABORATIVE CLASSROOM 4.0

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BAHAGIAN INSTRUKSIONAL & PEMBELAJARAN DIGITAL

JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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PREFACE

Why a Guideline

“As Malaysian Polytechnics embrace the digital age, the implementation of these guidelines is paramount to ensure the seamless integration of technology into pedagogy and infrastructure.”

The Technology-enabled Collaborative Classroom – TeCC 4.0 Digital Learning Space guidelines for Malaysian Polytechnics represent a pivotal step towards transforming educational practices and enriching learning environments across the nation. As Malaysian Polytechnics embrace the digital age, the implementation of these guidelines is paramount to ensure the seamless integration of technology into pedagogy and infrastructure.

These guidelines serve as a comprehensive roadmap for educators, administrators, and stakeholders involved in the design, implementation, and utilization of digital learning spaces within Malaysian Polytechnics. By providing clear directives and best practices, the guidelines aim to optimize the potential of TeCC 4.0 environment, fostering innovation, collaboration, and student engagement.

Importantly, the guidelines emphasize the importance of aligning digital learning spaces with the needs and aspirations of users and stakeholders. In today's fast-paced world, where technological advancements continue to reshape the way, we learn and work, it is crucial for educational institutions to stay abreast of these changes.

The TeCC 4.0 Digital Learning Spaces Guidelines equip Malaysian Polytechnics with the tools and strategies needed to create dynamic and future-ready learning environments that prepare students for success in the digital era.

Prepare to revolutionize the way we learn!

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CHAPTER 1.0
TeCC INTRODUCTION

Base on the readings provided below, these are **the institution's recommended responsibilities**:

i. *Understand thoroughly the overview and objectives of the Learning Spaces (TeCC 4.0), to be able plan and execute its purpose effectively. This can be done via Further Research, Academic Talks, Seminars and Visitations.*

ii. *Disseminate, via a Roadshow/Exhibition, the Objectives of the Learning Spaces to stakeholders to enable their buying-in and support in ensuring its success.*

iii. *Occasionally Create engaging and interactive presentations, demonstrations, and displays to effectively communicate the objectives and benefits of the learning spaces to stakeholders, fostering understanding and buy-in.*

iv. *Engage key opinion leaders, influencers, and advocates within the stakeholder community to endorse and promote the learning spaces' objectives, leveraging their credibility and influence to garner broader support and buy-in.*

v. *Develop a comprehensive communication plan outlining the key messages, channels, and tactics for Promoting the learning spaces' objectives to stakeholders and ensuring that information is disseminated effectively and consistently across all relevant platforms.*

1.1 TVET and The Digital Era

As we navigate through the 21st century, the landscape of Technical and Vocational Education and Training (TVET) is undergoing a significant transformation, propelled by the Fourth Industrial Revolution (4IR) and its ground-breaking technologies. The traditional TVET learning experience, once characterized by manual techniques and face-to-face instruction, is now evolving to embrace digital advancements, signalling a pivotal shift towards Digital TVET. This evolution is not just a response to technological progress but a necessary adaptation to ensure that TVET remains relevant, engaging, and effective in equipping learners with the skills required for the modern workforce.

1.2 Main Objectives of the Technology - enabled Collaborative Classroom (TeCC).

"Ownership of TeCC is to be collectively assumed by the entire institution, not relegated to any singular department."

Technology-enabled Collaborative Classrooms (TeCC) is a unique Learning Space, and it is part of the Malaysian Polytechnic TVET DIGITAL Agenda. TeCC aims to revolutionize the educational landscape by prioritizing six main objectives: enhancing learning outcomes, fostering innovation, supporting collaboration, integrating technology, skills based training and digital literacy. These goals underscore the commitment to creating an engaging and interactive learning environment that prepares students for the future. By leveraging advanced technology, TeCC initiatives seek to not only improve academic performance but also encourage creative problem-solving, facilitate seamless collaboration, and make quality education more accessible to a broader audience. It is important to note that ***Ownership of TeCC is to be collectively assumed by the entire institution, not relegated to any singular department.*** This holistic approach to education emphasizes the importance of adapting to digital advancements while maintaining a focus on student and faculty needs.

The integration of Technology-enabled Collaborative Classrooms (TeCC) into TVET signifies a strategic move to align educational practices with the needs of the 21st-century economy. TeCC aims to provide learners with a more interactive, immersive, and practical learning experience. This approach is crucial for developing the complex problem-solving abilities, digital literacy, and collaborative skills that are in high demand across industries today.

Moreover, the shift towards TVET Digital acknowledges the importance of preparing students not just for the jobs of today, but for the careers of tomorrow. It reflects an understanding that the future workplace will be increasingly digital, interconnected, and dynamic, requiring a workforce that is adaptable, technologically savvy, and capable of continuous learning. By changing with the times and embracing 4IR technologies, TVET is positioning itself at the forefront of education for the future, ensuring that its students are not just ready for the workforce, but are poised to lead it. The objective of the TeCC initiative are as follows:

Table 1.1: Objectives of TeCCs

Objective	Description
1. Enhance Learning Outcomes	*Improve student engagement and comprehension through interactive and collaborative technology.*
2. Foster Innovation	*Encourage creative problem-solving and innovative thinking among students and faculty.*
3. Support Collaboration	*Facilitate seamless collaboration among students, educators, and external partners.*
4. Integrate Technology	*Seamlessly incorporate cutting-edge technology into the curriculum to allow the learning experience to break away from traditional borders.*
5. Skill-Based Training	*Utilize virtual reality (VR) and augmented reality (AR) to simulate real-world environments for hands-on skill development in a safe, controlled setting.*
6. Digital Literacy	Integrate digital literacy into the curriculum to ensure students are proficient in using technology and can navigate digital environments effectively.

1.3 Introduction to TeCC 4.0

"This state-of-the-art facility is crafted to support Immersive Investigation or I_2, a multidimensional learning activity that emphasizes Visualization, Exploration, Simulation, and Game Learning."

TeCC 4.0 emerges as a visionary development in the educational ecosystem of Malaysian Polytechnics, embedding Virtual Reality (VR) technology at its core to redefine learning experiences. This state-of-the-art facility is crafted to support Immersive Investigation or **I_2**, a multidimensional learning activity that emphasizes Visualization, Exploration, Simulation, and Game Learning. Through the immersive capabilities of VR, TeCC 4.0 encourages students to engage in collaborative learning endeavours, guided by facilitators, and harnesses the power of 4IR tools to elevate their educational journey.

I_2 within TeCC 4.0 is a strategic blend of learning methodologies designed to immerse students in their subjects like never before. Visualization through VR offers a dynamic, three-dimensional perspectives that transforms abstract concepts into tangible experiences. This method enhances comprehension and retention by allowing students to 'see' the subject matter from every angle, breaking down the barriers of traditional learning.

Exploration takes on a new dimension in TeCC 4.0, where VR environments simulate real or hypothetical scenarios. This immersive exploration gives students the freedom to discover and interact with detailed settings, from historical sites to futuristic landscapes, providing a rich, contextual backdrop for learning.

Simulation, a cornerstone of TeCC 4 .0, enables students to replicate and engage with real-world processes and situations in a virtual setting. This approach is invaluable across various disciplines, offering a practical, hands-on experience without the constraints or risks associated with physical trials. Students can experiment, learn from mistakes, and understand complex systems through direct interaction, all within the safety of a virtual environment.

Game Learning infuses the educational process with elements of gamification, transforming learning into an exciting, interactive experience. This method leverages competition and collaboration, motivating students to achieve higher learning outcomes through challenges, rewards, and a sense of achievement. The playful yet purposeful environment fosters a deeper engagement with the material, making education both enjoyable and impactful.

TeCC 4.0, with its emphasis on VR and the **I_2** framework, presents a novel approach to education in Malaysian Polytechnics, moving away from traditional didactic methods towards a more engaging, interactive form of learning. It not only equips students with critical 21st century skills but also inspires a lifelong passion for discovery and innovation. By integrating VR technology into the curriculum, TeCC4.0 sets a new standard for educational excellence, preparing students to navigate and contribute to a rapidly evolving digital landscape.

Immersive Investigation or I_2

1.4 TeCC 4.0 Brand Name: DigitalEyez

"This name symbolizes the program's commitment to providing an immersive learning experience, allowing students to 'see' and interact with digital simulations that closely mimic real-world scenarios."

The learning space TeCC 4.0 will be known as "**DigitalEyez**". It encapsulates the innovative vision behind TeCC 4.0, a futuristic initiative aimed at revolutionizing Technical and Vocational Education and Training (TVET) through Virtual Reality (VR) technology. This name symbolizes the program's commitment to providing an immersive learning experience, allowing students to 'see' and interact with digital simulations that closely mimic real-world scenarios.

By leveraging VR, DigitalEyez aims to enhance vocational training by offering hands-on experience in a virtual environment, making complex concepts more accessible and engaging. It reflects a forward-thinking approach to education, where technology is not just an aid but a transformative tool, enabling learners to explore, practice, and master skills in a safe, controlled, yet highly realistic setting. Through DigitalEyez, TeCC 4.0 aspires to equip students with the digital literacy and technical skills necessary for the modern workforce, emphasizing the importance of visual learning in mastering technical vocations.

1.5 Coping with Limitations of Technology Use in TeCC:

“Despite the advancements these platforms represent, it's critical to address the inherent limitations of relying heavily on technology in learning spaces.”

The integration of technology in educational settings, as exemplified by TeCC 3.0 and TeCC 4.0, underscores a revolutionary shift towards collaborative and interactive learning environments. These platforms embody the cutting edge of educational technology, offering tools that facilitate immersive learning experiences, such as virtual reality and collaborative digital workspaces. TeCC 3.0 and TeCC 4.0 are designed to foster innovation, critical thinking, and a deeper understanding by seamlessly integrating technology into the learning process.

Despite the advancements these platforms represent, it's critical to address the inherent limitations of relying heavily on technology in learning spaces. The digital divide, a significant concern, becomes evident when comparing the accessibility of TeCC 3.0 and TeCC 4.0 across different demographics, potentially exacerbating educational inequalities. Furthermore, the risk of diminished interpersonal skills and over-reliance on digital solutions can hinder the development of critical thinking and problem-solving abilities.

Balancing the use of TeCC 3.0 and TeCC 4.0 with traditional teaching methods, ensuring equitable access, and fostering a culture of digital literacy and cybersecurity awareness are essential steps to maximize the potential of these technologies. By acknowledging and addressing these challenges, TeCC 3.0 and TeCC 4.0 can serve as powerful tools in crafting future-ready learning environments that are both inclusive and effective, preparing students for the complexities of the modern world.

Table 1.2: Key strategies to address the limitations mentioned in the context of integrating technologies TeCC into learning spaces

Strategy	Description
1. Equitable Access	*Ensure that all students, regardless of their socioeconomic background, have access to the necessary technology and internet connectivity to use TeCC 3.0 and TeCC 4.0.*
2. Balanced Integration	*Combine traditional teaching methods with TeCC 3.0 and TeCC 4.0 to enhance learning without completely replacing essential interpersonal and problem-solving skills.*
3. Digital Literacy	*Educate students and faculty on digital literacy to navigate online platforms safely and effectively, maximizing the benefits of TeCC 3.0 and TeCC 4.0.*
4. Personalized Learning	*Utilize TeCC 3.0 and TeCC 4.0's capabilities to tailor educational content to meet individual student needs, accommodating diverse learning styles and paces.*
5. Continuous Evaluation and Feedback	*Implement regular assessments of the effectiveness of TeCC 3.0 and TeCC 4.0 in the learning environment, adjusting strategies based on feedback from students and educators.*

CHAPTER 2.0
TeCC LEARNING SPACE, EQUIPMENT & LAYOUT

Base on the readings provided below, these are **the institution's recommended responsibilities:**

i. *Gain a comprehensive understanding of the purpose behind the TeCC's recommended plan/layout, with a particular focus on its design as a collaborative learning space. Inform users on how to utilize the spaces and technology to their fullest potential*

ii. *Provide ongoing coaching and mentoring support to faculty and staff who require additional assistance in mastering technology skills, ensuring that all users have the opportunity to enhance their proficiency over time.*

iii. *Create user-friendly guides, manuals, and tutorials for the equipment and technology available in the learning spaces, providing faculty and staff with easy access to step-by-step instructions and troubleshooting tips*

iv. *Prepare a strategy for maintaining the use of the space, equipment, and its technology regularly.,*

2.1 Specialized Spaces and Learning:

"These spaces are meticulously designed to cater to specific learning needs, fostering deeper engagement and understanding among students."

Specialized spaces within educational environments play a crucial role in enhancing focused learning experiences. These spaces are meticulously designed to cater to specific learning needs, fostering deeper engagement and understanding among students. By providing dedicated zones such as collaboration areas, maker spaces, and immersive investigation areas, educational institutions empower learners to immerse themselves fully in their studies. This targeted approach encourages exploration, experimentation, and collaboration, ultimately enabling students to develop essential skills and competencies relevant to their fields of study. Thus, the symbiotic relationship between specialized spaces and learning in focus cultivates an environment conducive to academic excellence and innovation.

2.2 Understanding TeCC 4.0 Equipment:

"It is essential to emphasize not just the purchase but also the responsible operation and maintenance of these tools, ensuring they serve their purpose as catalysts for learning and innovation in an ever-evolving digital landscape."

TeCC 4.0 stands at the forefront of Digital TVET, embedding Virtual Reality (VR) and Interactive Investigation (***I_2***) activities into the heart of contemporary learning spaces. The following points underscore the vital role of understanding and maintaining TeCC 4.0's cutting-edge equipment:

i. **Immersive Learning Environments**: Mastery over VR devices, digital wall panels, and software for interactive 3D VR elevates the learning experience to new heights. Such technology enables educators to transcend traditional teaching methods, offering students a compelling, immersive journey through educational content.

ii. **Technical Skill Acquisition**: Engaging with advanced equipment like green screens combined with motion capture technology, students hone in-demand technical skills. This hands-on interaction not only enhances their understanding of theoretical concepts but also sparks creativity and innovation.

iii. **Resource Management**: Proper usage and diligent maintenance of equipment ensure optimal performance and longevity. Cultivating a culture of maintenance among users reduces operational hitches, ensuring continuous, uninterrupted access to these invaluable learning tools.

iv. **Cost-Effectiveness**: Attentive care and maintenance protocols extend the life span of sophisticated equipment, mitigating the financial burden of frequent replacements. This foresight in resource management allows for a sustainable approach to incorporating cutting-edge technology in education.

v. **Safety First**: A thorough understanding of equipment operation and maintenance is critical for ensuring user safety, particularly when dealing with complex machinery like laser cutters or prototyping machines. Educating

users on safe practices is paramount to maintaining a secure learning environment.

vi. **Adaptability & Innovation**: Familiarity with the capabilities and care of TeCC 4.0 equipment fosters an environment where problem-solving and adaptability are second nature. This readiness not only ensures smooth educational processes but also prepares participants for the technological challenges of the future.

In summary, the integration of TeCC 4.0 equipment is a transformative step towards redefining educational paradigms. It is essential to emphasize not just the acquisition but also the responsible utilization and maintenance of these tools, ensuring they serve their purpose as catalysts for learning and innovation in an ever-evolving digital landscape.

Table 2.1: The generic list of equipment

Equipment	Description
Smart TV c/w Stand	*A mobile and versatile display solution, perfect for showcasing educational content, interactive applications, or VR explorations in high definition. The stand facilitates easy relocation, making it ideal for dynamic classroom layouts.*
Workstation	*High-performance computing stations designed to support the intensive requirements of VR and interactive 3D applications. These workstations facilitate seamless running of complex simulations and design software, essential for immersive learning experiences.*
VR Devices	*Cutting-edge virtual reality hardware that allows users to dive into fully immersive 3D environments for exploration, simulation, and interactive learning. These devices are central to experiencing virtual reality's full potential in education.*

Equipment	Description
Green Screen c/w Active Sound System + Motion Capture + Studio Lighting	*A comprehensive setup for creating immersive virtual content, including video production and interactive VR simulations. The green screen enables background customization, motion capture records precise movements, and studio lighting ensures optimal visibility, all complemented by high-quality sound.*
Software for Interactive 3D Virtual Reality (VR)	*Specialized software platforms that allow educators and students to create, manipulate, and experience 3D virtual environments. These tools are crucial for developing interactive VR content tailored to specific learning objectives.*
Wireless Presenter	*An essential tool for educators, facilitating smooth navigation through presentations and interactive content. It enhances the delivery of lessons and presentations, allowing for a more engaging and fluid educational experience.*
Video Presentation Module	*A dedicated setup for creating and displaying video presentations of projects, findings, or educational content. This module supports multimedia learning, enabling students to express their ideas visually and audibly.*
Computer Tables and Chairs	*Ergonomically designed furniture that provides comfortable and supportive seating for students and educators, optimizing engagement and productivity during long hours of learning and project development.*
Discussion Magnetic Wall Glasses	*Innovative spaces for brainstorming and collaborative work, these magnetic glass walls support visual thinking and creative problem-solving, allowing ideas to be visually mapped out and shared.*

Equipment	Description
Digital Wall Panel	*An interactive display that enhances learning through touch and engagement, allowing users to interact with digital content in a tactile manner. It serves as a dynamic tool for instruction and collaboration.*
Artificial Grass for Time-Out Area	*A designated relaxation area featuring artificial grass to create a calming, natural environment within the educational space. This area is designed to offer students a mental break, promoting wellbeing and creativity.*
Discussion Table set	*A furniture set designed to facilitate group discussions and collaborative work, enhancing the interactive learning experience. The layout encourages open communication and teamwork among students.*
Ergonomic Seat	*Comfortable and health-conscious seating options that support proper posture and reduce strain during extended periods of study or project work, essential for maintaining focus and well-being in an educational setting.*

Figure 1: Oculus Quest 2, Virtual Reality Device

2.3 TeCC 4.0 Layout

"TeCC 4.0, reimagines conventional floor plans by seamlessly integrating VR capabilities across various zones."

The TeCC 4.0 learning space layout design unveils an exciting vision for the future of education, propelled by virtual reality (VR) technology. TeCC 4.0, reimagines conventional floor plans by seamlessly integrating VR capabilities across various zones. From the Immersive Investigation Area to the Collaboration Zone and Presentation Arena, each space is meticulously crafted to foster dynamic and interactive learning experiences. This introduction offers a glimpse into a transformative journey where physical and virtual realms converge to enhance education.

The Immersive Investigation ($\mathbf{I_2}$) Area serves as a hub for experiential learning, allowing students to explore virtual environments and engage with simulations that deepen their understanding of complex concepts. In the Collaboration Area, learners converge to brainstorm ideas, solve problems, and undertake group projects in virtual settings, transcending geographical barriers. Meanwhile, the Presentation Area provides a platform for showcasing work, facilitating interactive discussions, and delivering immersive presentations that captivate audiences.

Table 2.2: Summary of the spaces and its objectives

Space	Objectives
Immersive Investigation Area (I_2)	*Facilitate experiential learning through virtual environments and simulations, enhancing students' understanding of complex concepts.*
Collaboration Area	*Enable virtual collaboration among learners for brainstorming, problem-solving, and group projects, fostering teamwork and transcending geographical constraints.*
Presentation Arena	*Provide a platform for showcasing work, facilitating interactive discussions, and delivering immersive presentations to engage and captivate audiences.*

TeCC 4.0 revolutionizes education by seamlessly integrating virtual reality (VR) technology into its floor plan, fostering dynamic and interactive learning experiences across various zones.

Figure 2: The suggestion TVET DigitalEyez learning areas

2.4 TeCC 4.0 – DigitalEyez Signage

Each institution must prominently display the TeCC 4.0 brand name: DigitalEyez, within their learning spaces. The branding, crafted by BIPD, DPCCE, should be visible and legible, with a preferred size of 10x150cm. This ensures consistent recognition and awareness of TeCC 4.0 initiatives, promoting a unified identity across educational settings. By adhering to these guidelines, institutions affirm their commitment to digital learning advancements and contribute to the visibility and credibility of the TeCC 4.0 brand.

Figure 3 : TeCC 4.0 brand name signage

CHAPTER 3.0
TeCC GOVERNANCE, POLICIES, RULES & REGULATION

Base on the readings provided below, **these are the institution's recommended responsibilities:**

i. *Establish a governance committee to oversee the management and execution of TeCC in accordance with its intended objectives.*

ii. *Define clear policies, rules, and regulations governing the use of TeCC facilities, resources, and technologies, outlining expectations for conduct, safety protocols, and intellectual property rights.*

iii. *Develop several comprehensive governance frameworks outlining the roles, responsibilities, and decision-making processes of the committee tasked with overseeing TeCC management and execution.*

iv. *Align governance policies, rules, and regulations with industry best practices, standards, and guidelines, ensuring that they reflect current trends and developments in governance and organizational management.*

v. *Establish a timeline for conducting regular reviews and evaluations of governance policies, rules, and regulations, ensuring that they remain effective, relevant, and aligned with organizational goals and objectives.*

3.1 TeCC Governance:

> *"Through clear policies, guidelines, and oversight mechanisms, governance establishes a framework for accountability, transparency, and responsible decision making within TeCCs "*

As Return of Investment (ROI) is an important factor moving forward, having a proper governance is paramount for the success and sustainability of TeCCs (Technology-enabled Collaborative Classrooms). It ensures that these educational spaces operate efficiently, effectively, and ethically. Through clear policies, guidelines, and oversight

mechanisms, governance establishes a framework for accountability, transparency, and responsible decision-making within TeCCs. Effective governance fosters trust among stakeholders, including students, faculty, administrators, and the wider community, by ensuring that resources are utilized wisely, conflicts are resolved fairly, and objectives are aligned with educational goals.

The TeCCs should be governed by an Empowering Digital Learning Committee, chaired by the Deputy Director, to oversee their strategic direction and implementation. This committee should comprise key stakeholders including selected Heads of Departments, eLearning Officers (eLOs), Multimedia & Resource Officers (MAROs), and representatives from various departments.

The committee's primary responsibility is to set policies, guidelines, and priorities for the TeCCs in alignment with the institution's educational goals. This includes determining the scope of services offered, resource allocation, and technological infrastructure requirements. The committee should also establish mechanisms for monitoring and evaluating the effectiveness of TeCCs in enhancing teaching and learning outcomes.

Furthermore, the committee plays a crucial role in fostering collaboration and innovation within the TeCCs ecosystem. By providing opportunities for knowledge sharing, professional development, and interdisciplinary collaboration, the committee ensures that TeCCs serve as vibrant hubs for digital learning and creativity. Transparency, accountability, and inclusivity should be core principles guiding the governance of TeCCs. The committee should actively engage with stakeholders to solicit feedback, address concerns, and ensure that decisions are made in the best interests of the entire institution.

Overall, the Empowering Digital Learning Committee serves as a driving force behind the successful governance of TeCCs, ensuring that they remain at the forefront of digital education and innovation within the institution.

Table 3.1 : Governance of Technology-enabled Collaborative Classrooms (TeCCs)

Aspect	Description
Importance of Governance	*Ensures efficiency, ethical operation, and accountability through clear policies, guidelines, and oversight.*
Empowering Digital Learning Committee	*Chaired by the Deputy Director, includes eLearning Officers, Multimedia & Resource Officers, and department representatives to oversee TeCCs' strategic direction.*
Responsibilities	*Set policies, guidelines, priorities, determine service scope, resource allocation, technological needs, and evaluate TeCCs' effectiveness.*
Promotion of Collaboration and Innovation	*Fosters knowledge sharing, professional development, and interdisciplinary collaboration within the TeCC ecosystem.*
Governance Principles	*Transparency, accountability, and inclusivity are central to engaging stakeholders and making informed decisions.*
Objective	*Ensure TeCCs lead in digital education and innovation within the institution.*

3.2 Why are Policies Important:

"… policies are essential for creating a structured and conducive environment within TeCCs, where users can effectively collaborate, innovate, and learn."

Policies are crucial for the effective functioning of TeCCs (Technology-enabled Collaborative Classrooms) for several reasons:

i. **Guidance and Direction**: Policies provide clear guidance and direction on the purpose, objectives, and acceptable use of TeCCs. They help establish a framework for users to understand the expectations and boundaries within the space.

ii. **Safety and Security**: Policies outline safety protocols and security measures to ensure the well-being of users and the protection of equipment and resources within TeCCs. By establishing guidelines for safe usage, policies mitigate risks and prevent accidents or injuries.

iii. **Resource Management**: Policies for resource allocation help manage the availability and utilization of equipment, facilities, and other resources within TeCCs. This ensures fair and equitable access for all users and prevents misuse or hoarding of resources.

iv. **Compliance and Accountability**: Policies ensure compliance with relevant regulations, standards, and legal requirements governing educational spaces and facilities. They provide a framework for accountability, outlining the responsibilities of users and administrators within TeCCs.

v. **Intellectual Property Protection**: Policies related to intellectual property rights clarify ownership and usage rights of projects developed within TeCCs. By establishing guidelines for the protection and dissemination of intellectual property, policies safeguard the interests of creators and collaborators.

vi. **Community Engagement**: Policies promote a culture of collaboration, communication, and community engagement within TeCCs. By fostering opportunities for knowledge sharing, networking, and interdisciplinary collaboration, policies enhance the educational experience and promote innovation.

vii. **Continuous Improvement**: Policies include mechanisms for gathering feedback and suggestions from users to identify areas for improvement within TeCCs. By soliciting input from the community, policies facilitate continuous refinement and enhancement of services and facilities.

Overall, policies are essential for creating a structured and conducive environment within TeCCs, where users can effectively collaborate, innovate, and learn. They provide the necessary framework for ensuring safety, accountability, fairness, and continuous improvement, ultimately contributing to the success and impact of TeCCs as educational spaces.

By organizing the policies into a table format, it enhances readability and clarity, making it easier for stakeholders to understand and reference the guidelines for effective and safe utilization of TeCCs.

Table 3.2 : Types of Policies recommended.

Policy Area	Description
Usage Guidelines	*Clearly outline the purpose and scope of TeCCs, specifying that they are technology-enabled collaborative classrooms open to the public. Define acceptable uses of the facilities, such as research, collaborative projects, and workshops.*
Access Control	*Establish protocols for accessing TeCCs, including registration procedures and user authentication. Ensure that access is granted to individuals or groups with legitimate educational or research purposes.*
Safety and Security	*Implement strict safety measures to prevent accidents and mitigate risks. This includes regular maintenance of equipment and facilities, safety inspections, and providing appropriate safety training to users.*
Equipment Usage Policy	*Define rules for the use of equipment and resources available within TeCCs. Specify proper handling procedures, maintenance responsibilities, and restrictions on unauthorized modifications or alterations to equipment.*
Resource Allocation	*Develop protocols for resource allocation to ensure fair and equitable access for all users. Establish reservation systems for high-demand equipment or spaces and implement policies to prevent hoarding or misuse of resources.*
Code of Conduct	*Establish a code of conduct outlining expected behaviour and etiquette within TeCCs. Prohibit disruptive or disrespectful behaviour, harassment, and any activities that may compromise the safety or well-being of others.*
Intellectual Property	*Clarify ownership and intellectual property rights related to projects developed within TeCCs. Ensure that users understand their rights and obligations regarding the use and dissemination of intellectual property.*
Community Engagement	*Foster a sense of community and collaboration among users of TeCCs. Encourage knowledge sharing, networking, and interdisciplinary collaboration through workshops, seminars, and networking events.*
Feedback Mechanism	*Establish channels for gathering feedback and suggestions from users to continuously improve the services and facilities provided by TeCCs. Encourage open communication and transparency in addressing concerns or issues raised by the community.*
Compliance and Regulations	*Ensure compliance with relevant regulations and standards governing educational spaces and facilities. This includes adherence to health and safety regulations, data protection laws, and any other legal requirements applicable to the operation of TeCCs.*

3.3 Drafting a policy:

Drafting a policy involves structuring the document in a clear and organized manner to effectively communicate the intended guidelines and procedures. Here is a detailed breakdown of how to draft a policy, elaborated using a table format:

Table 3.3: Detailed breakdown of how to draft a policy

Section	Description
Title	*Clearly indicate the title of the policy, which should succinctly describe its subject or purpose.*
Introduction	*Provide a brief overview of the policy's purpose, importance, and applicability within the organization.*
Policy Statement	*Clearly state the policy's objectives, principles, and the expected behaviour or actions it mandates.*
Scope	*Define the boundaries and applicability of the policy, specifying which individuals or areas it covers.*
Definitions	*Clarify any terms or concepts used within the policy that may require explanation or interpretation.*
Procedures	*Outline the step-by-step processes or actions to be followed to comply with the policy.*
Responsibilities	*Assign specific roles and responsibilities to individuals or departments for implementing the policy.*
Enforcement	*Detail the consequences for non-compliance and the mechanisms for monitoring and enforcing the policy.*
Review	*Specify the frequency or conditions under which the policy will be reviewed and potentially revised.*
Approval	*Indicate the approval process, including the relevant authorities or individuals responsible for approval.*
Appendices	*Include any additional documents, forms, or references that support or supplement the policy.*

In drafting each section, it is essential to use clear and concise language, avoid jargon or ambiguous terms, and maintain consistency throughout the document. Additionally, consider incorporating feedback from stakeholders and legal experts to ensure accuracy and compliance with regulations.

3.4 General Policy

i. **Purpose**

The purpose of this policy is to outline the guidelines and expectations for the use of the DigitalEye, which includes virtual reality equipment, ensures a safe and productive learning environment.

ii. **Authorized Use**

DigitalEye and its virtual reality equipment are intended for educational purposes only. Authorized users include students and staff who have received proper training and permissions.

iii. **Safety Guidelines**

a. Users must follow all safety instructions and guidelines provided by the manufacturer and,any additional instructions given by the educational institution.
b. Proper care and handling of virtual reality equipment is essential to prevent damage or injury.
c. Users should take regular breaks to avoid discomfort or fatigue caused by extended use of virtual reality equipment.

vi. **Responsible Use**

a. Users must adhere to the code of conduct and acceptable use policies of the educational institution.
b. Do not use DigitalEye equipment for illegal or unauthorized purposes.
c. Users are responsible for any content they create or share using the equipment and should respect intellectual property rights.

v. **Equipment Maintenance**

a. Users must report any equipment malfunctions, damage, or concerns to the designated technical support team.
b. Only authorized personnel should perform maintenance or repairs on DigitalEye equipment.

iv. **Compliance and Consequences**

a. Failure to comply with this use policy may result in the suspension or revocation of access to DigitalEye and its virtual reality equipment.
b. Violations may also be subject to disciplinary action in accordance with the educational institution's policies and procedures.

Please note that this is just a suggested arrangement, and you may need to adjust the specific hours based on your DigitalEyez requirements, user preferences, and availability of staff members.

3.5 Institutional Policy

These guidelines are institution-specific and may vary depending on the policies of the educational institution implementing DigitalEye learning spaces.

i. Committee Setup

Each institution needs to set up a committee to ensure the implementation of DigitalEye is under control. The committee should involve the eLearning officer, TVET DigitalEye Manager, technical support team, trainer, and user. *(Refer Figure 4)*

ii. **Timetabling Planning**

The DigitalEye needs to be used effectively based on its purposes. The institution must do maintenance every week to prevent the equipment from being damaged. Sometime can be allocated for activities that can be used for the community and so on. *(Refer Table 4.3)*

iii. **Key Handling**

Institutions need to appoint a reliable person to handle key management to prevent the loss of any property in this DigitalEye. The appointed person must always be at the location to launch the handover of keys. (*Refer Figure 5)*

iv. **Involvement**

The involvement of lecturers in all departments is encouraged for maximum use. Equipment usage training should be provided to users at the beginning of the semester so that they are proficient in operating the equipment to access I_2 content. Trainers should be appointed among the lecturers to assist the users throughout the semester.

V. **Safety Issue**

Regularly review and update health and safety guidelines. Ensure user take regular breaks to minimize issues like eye strain or motion sickness

The Immersive Investigation (I_2), TeCC 4.0 guidelines and policy established to ensure educational, and safe environment for all users. By following these guidelines, we collectively foster a culture of respect, creativity, and responsible engagement within the Immersive Investigation (I_2). This immersive journey of learning and discovery, let us embrace the opportunities that VR technology offers inclusivity, ethical content usage, and consideration for others.

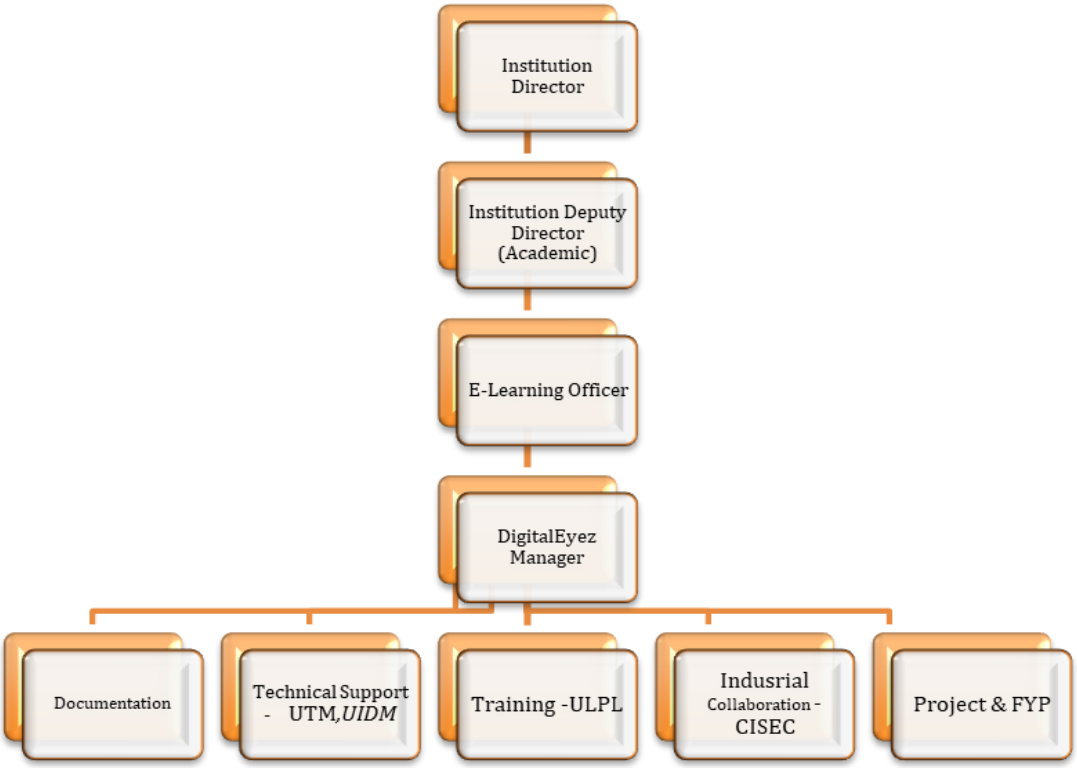

Figure 4: The Immersive Investigation (I_2) Committee Setup

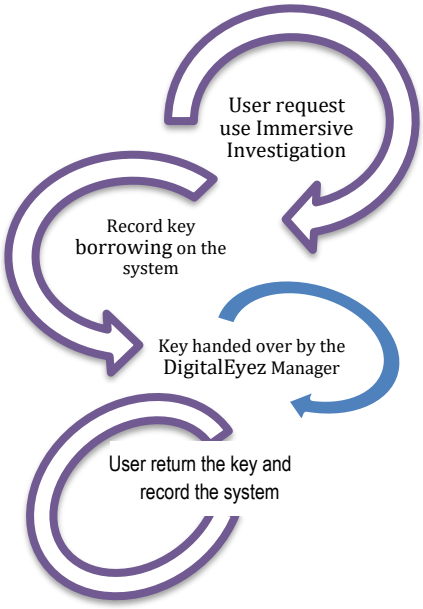

Figure 5: The process of handling the Immersive Investigation learning space key

CHAPTER 4.0
TeCC CONVENTIONS AND PRACTICES

Base on the readings provided below, **these are the institution's recommended responsibilities:**

i. *Develop a comprehensive understanding of the intended use and functionality of each designated learning space, including its purpose, capabilities, and limitations.*

ii. *Implement training programs and resources to equip faculty, staff, and students with the knowledge and skills needed to engage in positive practices within the learning spaces, ensuring that everyone has the tools to contribute to a positive learning environment.*

iii. *Provide ongoing support and guidance to faculty and staff responsible for overseeing the learning spaces, offering resources, feedback, and assistance to help them implement and maintain positive practices effectively.*

iv. *Establish a timeline for implementing new positive practices within the learning spaces, including deadlines for training, pilot programs, and full-scale implementation, to ensure that they are rolled out in a timely manner and with minimal disruption.*

v. *Implement these practices proficiently and effectively to achieve all intended outcomes.*

4.1 TeCC 4.0: Introduction to Immersive Investigations (I_2)

"TeCC 4.0 introduces Immersive Investigations (I_2) …leverages virtual reality (VR) and other immersive technologies to provide students with hands-on, experiential learning opportunities."

TeCC 4.0 introduces "Immersive Investigation (I_2)" as a cutting-edge approach to learning within Technical and Vocational Education and Training (TVET). I_2 leverages virtual reality (VR) and other immersive technologies to provide students with hands-on, experiential learning opportunities. By simulating real-world environments and scenarios, I_2 allows learners to explore, visualize, and interact with complex systems and concepts in a controlled, risk-free setting.

This methodology not only enhances understanding and retention of information but also fosters critical thinking and problem-solving skills. Through various types of I_2, such as Visualization, Exploration, Simulation, and Game Learning, TeCC 4.0 aims to revolutionize TVET education by making it more engaging, effective, and aligned with the needs of the modern workforce.

Figure 6: Walking interaction experience environment for questionnaire experiment, *Source: Lee, 2017*

Table 4.1: Types of Immersive Investigation (I_2) in TeCC 4.0

(I_2) Type	Technology Use	Suggested Use/Subjects
Visualization	VR	*VR visualization is used to simulate real-world environments for immersive learning, enhancing student engagement and understanding of complex subjects, e.g.* *Architectural Designs, FYP,* *Major Project Presentations*
Exploration	VIDEO 360 / i360	*VR is used in education as an explorative learning tool by enabling students to virtually visit and interact with places or scenarios that are otherwise inaccessible or impractical, fostering immersive and experiential learning, e.g.,* *Intro to Industries,* *Pre-Industrial Visits, "LI"*
Simulation	IVR	*Habitualization (getting accustomed) of a built environment or of an equipment, Workshops, Learning Spaces, Pre-Field Work. e.g.,* 1) *Using a Welding Tool* 2) *Using a Field Survey Equipment* 3) *Learning to conduct an Experiment*
Game Learning	IGVR	*Theory Classes* *Investigating a theoretical scenario via game approach, e.g.,* *Data driven Architecture-Structure Game*

Figure 7: Immersive Investigation (I_2) exploration

Figure 8: Immersive Investigation (I_2) use VR set

4.2 Types of Immersive Investigation (I_2)

Academic Immersive Investigation (I_2) in TeCC 4.0 represents a curriculum-based learning activity that integrates various immersive techniques like Exploration, Visualization, Simulation, and Game Learning into the educational process. This approach leverages VR technology to provide students with an interactive and engaging learning experience, closely aligned with the curriculum's objectives. By simulating real-world scenarios and environments, Academic I_2 enhances students' understanding of complex subjects, fosters critical thinking, and promotes problem-solving skills. It is distinct from non-academic I_2, which includes Community/Industry I_2 or Personal I_2, focusing instead on delivering non-structured educational content that does not directly supports academic goals and outcomes. This method not only makes learning more impactful and memorable but also prepares students for the practical applications of their knowledge in future careers.:

1. Academic I_2
2. Non-Academic I_2

Table 4.2: Types of Immersive Investigation (I_2)

Category	Type	Description
Academic I_2	FYP I_2	*Curriculum-based immersive projects focused on Final Year Projects (FYP), integrating VR for in-depth exploration and presentation.*
	Non-FYP I_2	*Curriculum-based immersive learning activities not part of FYPs, e.g., theory-based simulations, Industrial space explorations etc.*
Non-Academic I_2	Community I_2 or Industry I_2	*Projects that engage with external communities and industries, aiming to address real-world challenges or improve industry practices through immersive technologies.*
	Personal I_2	*Personal immersive projects allowing individuals to explore personal interests or hobbies within the immersive technology framework, promoting personal growth and innovation.*

4.3 TeCC 4.0 Timetable

"An inclusive timetable fosters an environment where all students and external participants have the opportunity to engage with VR and AR technologies, enhancing the learning experience and fostering innovation across disciplines."

Creating a structured timetable for TeCC 4.0 usage is crucial for maximizing the benefits of immersive technologies in education. By allocating specific slots for Academic and Non-Academic Immersive Investigations (**I_2**), institutions can ensure a balanced and equitable access to these innovative resources. This scheduling enables a diverse range of activities, from Final Year Projects (FYP **I_2**) and curriculum-based immersive learning (non-FYP **I_2**) to community engagement (Community/Industry **I_2**) and personal exploration (Personal **I_2**). An inclusive timetable fosters an environment where all students and external participants could engage with VR and AR technologies, enhancing the learning experience and fostering innovation across disciplines.

Table 4.3: Sample of TeCC 4.0 Usage Timetable

Day/Time	8:00-11:00	11:00-13:00	14:00-16:00	16:00-17.00
Monday	FYP I_2 (Academic)	Non-FYP I_2 (Academic)		Personal I_2 (Non-academic)
Tuesday	Non-FYP I_2 (Academic)	FYP I_2 (Academic)		
Wednesday	Community/Industry I_2 (Non-Academic)			
Thursday	FYP I_2 (Academic)			Non-FYP I_2 (Academic)
Friday	Maintenance		Personal I_2 (Non-Academic)	

Sample timetable allocates specific periods for both Academic and Non-Academic Immersive Investigation (**I_2**) activities, ensuring a comprehensive and inclusive utilization of TeCC 4.0 resources throughout the week. (*refer table 4.3)*

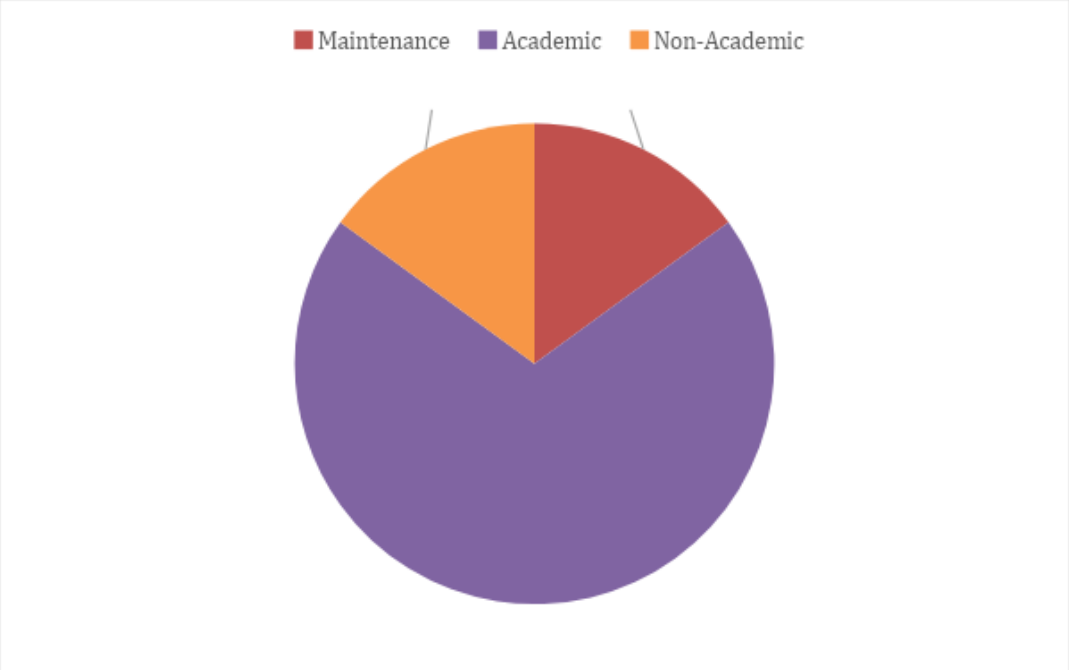

Figure 9: The suggested percentage for Immersive Investigation (I_2) usage

For TeCC 4.0, focused on Immersive Investigation ($\mathbf{I_2}$) utilizing VR and AR technologies for education, a significant portion of time is dedicated to Academic I2 activities to reflect their critical role in enhancing the learning experience. Maintenance ensures the technology and space are always ready for optimal use. The remaining time is equally divided between Community/Industry $\mathbf{I_2}$ and Personal $\mathbf{I_2}$ projects, allowing for engagement with external partners and personal exploration, thereby fostering a comprehensive ecosystem of innovation and learning.

***Please note that this is just a suggested arrangement, and you may need to adjust the specific hours based on your DigitalEyez requirements, user preferences, and availability.*

CHAPTER 5.0
TeCC INSTRUCTION AND PEDAGOGIES

Based on the readings provided below, **these are the institution's recommended responsibilities:**

i. *Implement a variety of instructional methodologies tailored to meet the diverse learning needs of students within designated Learning Spaces.*

ii. *Integrate real-world applications and experiential learning opportunities into instructional methodologies within the designated Learning Spaces to enhance relevance and student engagement.*

iii. *Utilize data-driven insights and student feedback to adapt instructional methodologies and pedagogies to better meet learner needs in the designated Learning Spaces.*

iv. *Engage in ongoing professional development opportunities to remain informed about emerging instructional methodologies and pedagogical approaches relevant to the designated Learning Spaces.*

v. *Collaborate with colleagues to share best practices and innovative pedagogies for optimized learning outcomes in the designated Learning Spaces.*

5.1 Pedagogy for TeCC 4.0

"TeCC Learning Spaces emphasize the importance of adaptive instruction and pedagogical strategies tailored to the unique learning environments offered by TeCC 3.0 and 4.0."

The integration of instructional methodologies and pedagogical practices is paramount in TeCC type Learning Spaces, shaping the foundation of effective learning experiences. Pedagogues leverage these spaces to facilitate active learning, encouraging exploration and experimentation among students. In TeCC 4.0, where virtual reality (VR) technologies are seamlessly integrated, instruction becomes instrumental in guiding learners through immersive experiences, while pedagogues utilize VR environments to simulate real-world scenarios, enhancing understanding

and engagement. TeCC Learning Spaces emphasize the importance of adaptive instruction and pedagogical strategies tailored to the unique learning environments offered by TeCC 3.0 and 4.0. By prioritizing effective instruction and pedagogical approaches, these spaces maximize the potential for transformative learning experiences, preparing students to thrive in an ever-evolving technological landscape.

5.2 Types of Pedagogy for TeCC Learning Spaces

TeCC is a collaborative space hence its “Pedagogy” should reflect this intention. Its pedagogy should differ from traditional classroom approaches to leverage the unique capabilities of technology and collaborative spaces. Unlike traditional classrooms, TeCCs offer access to advanced digital tools, resources, and interactive technologies that can enhance learning experiences. By adopting innovative pedagogical approaches tailored to TeCCs, educators can foster active learning, creativity, and collaboration among students. Additionally, TeCCs provide opportunities for hands-on experimentation, project-based learning, and real-world simulations that may not be feasible in conventional classrooms. By embracing a pedagogy tailored to TeCCs, educators can better prepare students for the demands of the digital age.

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5.3 Suggested Types of TeCC 4.0 Pedagogy:

Below are different types of pedagogy along with explanations of how each may be suitable for TeCC 4.0, emphasizing the use of Virtual Reality (VR) in Digital TVET

Table 5.1: Different types of pedagogy along with explanations

Pedagogy	Explanation
Virtual Reality (VR) Learning	*VR learning immerses students in simulated environments, allowing for experiential and hands-on learning. In TeCC4.0, VR can be utilized to provide realistic training scenarios for technical skills development, such as equipment operation, maintenance procedures, and troubleshooting. Students can interact with virtual machinery and environments, enhancing engagement and retention.*
Project-Based Learning (PBL)	*PBL involves students working on real-world projects to explore and solve complex problems. In TeCC4.0, PBL can be combined with VR to create immersive project experiences. Students can collaborate in virtual teams to design and prototype digital solutions, applying their technical skills in practical contexts and fostering innovation.*
Experiential Learning	*Experiential learning emphasizes hands-on experiences and reflection to deepen understanding. In TeCC4.0, VR can facilitate experiential learning by providing simulations of real-world scenarios, allowing students to practice skills in a safe and controlled environment. VR-based simulations can enhance the authenticity of learning experiences and prepare students for diverse workplace challenges.*
Flipped Classroom	*The flipped classroom model involves students engaging with instructional content independently outside of class, while class time is dedicated to active learning activities. In TeCC4.0, VR can support the flipped classroom approach by providing immersive pre-class experiences, such as virtual lectures or tutorials, followed by in-class discussions, simulations, or collaborative projects.*
Adaptive Learning	*Adaptive learning uses technology to personalize instruction based on students' individual needs and preferences. In TeCC4.0, VR can be integrated into adaptive learning platforms to deliver customized learning experiences. VR simulations can adapt to students' skill levels, learning styles, and progress, providing targeted feedback and scaffolding to support their learning journey.*

Pedagogy	Explanation
Game-Based Learning	*Game-based learning incorporates elements of gaming, such as challenges, rewards, and competition, into educational activities. In TeCC4.0, VR can be used to create immersive educational games that engage students in hands-on learning experiences. VR games can motivate learners, foster collaboration, and reinforce technical concepts and skills in a dynamic and interactive manner.*

Each of these pedagogical approaches offers unique opportunities for leveraging VR technology in Digital TVET within TeCC4.0. By integrating VR effectively into teaching and learning practices, educators can enhance student engagement, skill acquisition, and overall learning outcomes in the digital era.

5.4 TeCC 4.0: Student's Role

The following are expected roles of students in TeCC 4.0, emphasizing the use of Virtual Reality (VR) in learning:

Figure 10: Students Use VR in learning

Table 5.2: Roles of students

Student Roles	Description
VR Explorer	*Students in TeCC 4.0 are VR explorers, utilizing virtual reality technology to immerse themselves in simulated environments and experiences. They navigate virtual landscapes, interact with objects, and explore concepts in a realistic and engaging manner, enhancing their understanding and retention of subject matter.*
Collaborator	*Collaboration is fundamental in TeCC 4.0, and students actively engage with their peers, educators, and industry partners in virtual reality environments. They collaborate on VR projects, participate in virtual group discussions, and work together to solve challenges, fostering teamwork skills and leveraging the immersive nature of VR.*
Digital Learner	*As digital learners in TeCC 4.0, students embrace virtual reality as a tool for learning and skill development. They utilize VR simulations, interactive modules, and virtual Learning Spaces to deepen their understanding, acquire new knowledge, and engage in self-directed learning experiences tailored to their individual learning styles and preferences.*
VR Creator	*Students in TeCC 4.0 become VR creators, designing and developing immersive experiences and content using virtual reality technology. They create VR environments, scenarios, and interactive simulations that facilitate learning and exploration, showcasing their creativity and technical skills in the digital realm.*
Problem Solver	*TeCC 4.0 empowers students to become effective problem solvers by utilizing VR technology to tackle complex challenges and scenarios. They analyse problems, make decisions, and test solutions within virtual environments, honing their critical thinking and decision-making skills in realistic and dynamic simulations.*
VR Ethicist	*Students in TeCC 4.0 cultivate ethical awareness and responsibility in virtual reality environments. They reflect on the ethical implications of VR technology, consider issues such as privacy, representation, and accessibility, and advocate for ethical practices and considerations in the design and use of VR experiences and content.*

These roles highlight the unique opportunities and capabilities of virtual reality technology in TeCC 4.0, enabling students to explore, collaborate, learn, create, solve problems, and engage responsibly in immersive virtual environments.

5.5 TeCC 4.0: Educator's Role

The Following are preferred roles of educators in TeCC 4.0:

Table 5.3: Roles of educator

Educator Roles	Description
VR Facilitator	*Educators in TeCC 4.0 act as VR facilitators, guiding students through their learning journey within virtual reality environments. They create immersive learning experiences, provide guidance on navigating VR simulations, and facilitate discussions and activities that leverage the capabilities of VR technology.*
VR Mentor	*As VR mentors, educators offer personalized support and guidance to students as they explore virtual reality environments. They provide feedback, encouragement, and assistance in navigating VR experiences, helping students overcome challenges, deepen their understanding, and maximize the educational value of VR learning.*
VR Content Developer	*Educators play a key role in developing VR content and experiences tailored to the learning objectives and needs of students. They design VR simulations, create interactive modules, and curate virtual environments that facilitate learning, engagement, and exploration in virtual reality settings.*
Collaborator	*Collaboration is essential in TeCC 4.0, and educators actively collaborate with colleagues, industry partners, and students in designing and delivering VR-based learning experiences. They collaborate on VR projects, share best practices, and contribute to the creation of a vibrant VR learning community within TeCC 4.0.*
VR Innovator	*Educators serve as VR innovators, exploring new pedagogical approaches and methodologies that leverage the immersive capabilities of virtual reality technology. They experiment with VR applications, integrate emerging technologies, and pioneer innovative practices that enhance teaching effectiveness and student engagement in VR learning environments.*
VR Advocate	*Educators advocate for the adoption and integration of virtual reality technology in education, promoting its benefits and potential to enhance teaching and learning outcomes. They champion VR-based learning initiatives, share success stories, and advocate for the necessary resources and support to facilitate the effective implementation of VR in educational settings.*

These roles highlight the diverse responsibilities and contributions of educators in TeCC 4.0, where they leverage virtual reality technology to create immersive, engaging, and transformative learning experiences for students.

5.6 TeCC 4.0: Industry/Community Roles:

The following are expected roles of industry and community in TeCC 4.0:

Table 5.4: Roles of Community

Community Roles	Description
Technology Provider	*Industry partners play a crucial role in TeCC 4.0 by providing access to cutting-edge technology and virtual reality (VR) equipment. They supply VR hardware, software, and peripherals, ensuring that TeCCs are equipped with the latest VR tools and resources to support immersive learning experiences.*
VR Expert	*Industry professionals with expertise in virtual reality (VR) technology serve as VR experts in TeCC 4.0. They offer guidance, training, and technical support to educators and students in leveraging VR technology effectively for teaching, learning, and research purposes. VR experts share best practices, provide troubleshooting assistance, and facilitate workshops or training sessions on VR applications and development.*
Content Partner	*Industry partners collaborate with TeCCs as content partners, contributing VR content, simulations, and educational resources to enrich the VR learning experience. They develop interactive modules, immersive experiences, and VR applications that align with curriculum objectives and provide students with hands-on learning opportunities in diverse subject areas.*
Mentor	*Industry professionals serve as mentors to students in TeCC 4.0, offering insights, advice, and guidance on career pathways, industry trends, and real-world applications of VR technology. Mentors share their experiences, provide feedback on student projects, and offer networking opportunities, helping students develop essential skills and competencies for success in the digital workforce.*
Collaborator	*Industry and community partners collaborate with educators and students in TeCC 4.0 on joint initiatives, projects, and research endeavours. They contribute expertise, resources, and support to VR-based learning initiatives, fostering collaboration, innovation, and knowledge exchange between academia and industry/community. Collaborative partnerships enrich the educational experience and prepare students for real-world challenges and opportunities.*

Advocate	*Industry and community partners serve as advocates for VR-based education, promoting its benefits and impact within their respective networks and communities. They advocate for the adoption of VR technology in education, highlight success stories, and champion the role of industry-community partnerships in advancing digital learning initiatives such as TeCC 4.0.*

These roles highlight the valuable contributions of industry and community partners in TeCC 4.0, where they provide expertise, resources, and support to enhance the VR learning experience and prepare students for success in the digital era.

CHAPTER 6.0
TeCC STAR RATING

Base on the readings provided below, **these are the institution's recommended respon*sibilities:***

i. *Achieve a minimum of 4-star rating the first three years of TeCC 4.0's existence.*

ii. *Introduce 3 VR Curriculum Modules Enhancements to enrich immersive learning experience, aiming for a 4-star "Teaching and Learning" rating within the next three academic years. Students work is highly encouraged.*

iii. *Organize monthly workshops and seminars on emerging technologies and methodologies, targeting a 5-star rating in "Teaching and Learning" within two years.*

iv. *Develop a system to assess VR educational outcomes within a year, aiming for a 5-star "Teaching and Learning" rating by refining VR learning effectiveness.*

v. *Initiate at least two international/national collaboration projects within the two next years to enhance global learning opportunities and community engagement, aiming for a higher star rating in "Community Engagement".*

"Achieving a distinguished star rating boosts TeCC 4.0's credibility and reputation within the educational sector, indicating adherence to high standards and a commitment to providing an exceptional learning environment. "

The TeCC Star Rating System is a critical evaluation tool for TeCC 4.0, designed to quantify the quality and performance of educational Learning Spaces. By assigning stars based on comprehensive criteria, the system not only highlights the lab's excellence but also aids institutions in making well-informed decisions. This recognition system underscores the significance of TeCC 4.0, serving as a benchmark for quality, effectiveness, and the overall value of its facilities and educational

programs. High star ratings signal TeCC 4.0's standout capabilities and its appeal as a premier destination for advanced learning.

Achieving a distinguished star rating boosts TeCC 4.0's credibility and reputation within the educational sector, indicating adherence to high standards and a commitment to providing an exceptional learning environment. This acknowledgment propels TeCC 4.0 into the spotlight, enhancing its visibility, competitiveness, and ability to attract collaborations and projects.

> *"A higher rating signifies a Learning Space's superior performance and quality in these areas. Publicly displayed ratings offer transparent insights into the lab's standards and achievements, affirming its dedication to excellence."*

Star ratings are determined based on key operational aspects of TeCC 4.0, including teaching and learning effectiveness, space management, and community engagement. A higher rating signifies a Learning Space's superior performance and quality in these areas. Publicly displayed ratings offer transparent insights into the Learning Spaces' standards and achievements, affirming its dedication to excellence.

6.1 Star Ratings in DigitalEyez

Star rating criteria are specific factors or attributes used to evaluate the use and management of DigitalEyez throughout the year. The criteria used are based on DigitalEyez management at each institution to ensure the objective of usage is achieved.

The TeCC Star Rating System thus plays a vital role in recognizing and celebrating TeCC 4.0's contribution to education, showcasing its commitment to fostering a high-calibre learning experience.

6.2 Best Practices for Star Ratings in DigitalEyez

The number of star rating elements can vary based on the complexity of the evaluation and the level of detail desired. It may include:

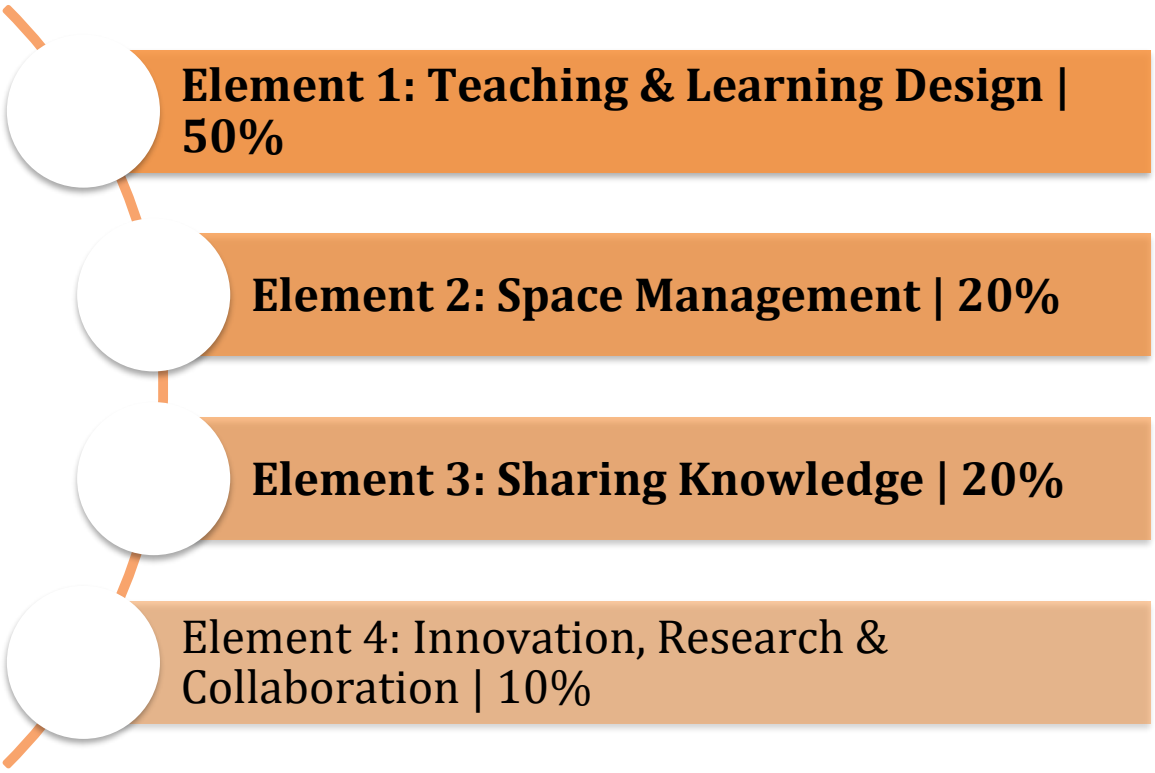

Figure 11: Star Rating Elements

Element 1: Teaching & Learning Design | 50%

- Course Outline/Lesson Plan
- Teaching Method
- Integration Technology Usage
- Teaching and Learning Observation

Element 2: Space Management | 20%

- Organizational Implementation Chart
- Planning on Usage
- Annual calendar
- Usage schedule
- Standard Operating Procedures (SOP) for equipment usage
- Maintenance monitoring (record of damages, usage)

Element 3: Sharing Knowledge | 20%

- DigitalEyez Space usage briefing/orientation
- Number of activities in DigitalEyez Space (Departments, Institutions, Ministry, and Communities).
- Platform for disseminating DigitalEyez Space activities (Website or any social media)

Element 4: Innovation, Research & Collaboration | 10%

- Content development
- Contribution to any innovation / research involvement
- Collaboration / achievement / appreciation

Below is the Scoring Rubric for the Star Rating Implementation as a guide for e-learning officers:

Table 6.1: Star Rating Implementation

BIL.	ITEM	MARK (%)	OVERALL, MARK
	Element 1: Teaching & Learning Design		
1	Course Outline/Lesson Plan	10	50%
2	Teaching Method	40	
3	Integration Technology Usage	40	
4	Teaching and Learning Observation	10	
	Element 2: Space Management		
5	Organizational implementation chart	20	20%
6	Planning on Usage	20	
7	Annual calendar	10	
8	Usage schedule	20	
9	Standard Operating Procedures (SOP) for equipment usage	20	
10	Maintenance monitoring (record of damages, usage)	10	
	Element 3: Sharing Knowledge		
11	Immersive Investigation (I_2) Space usage briefing/orientation	40	20%
12	Number of activities in Immersive Investigation (**I_2**) (Level: Departments, Institutions, Ministry, and Communities)	30	
13	Platform for disseminating Immersive Investigation (**I_2**) activities (Website or any social media)	30	
	Element 4: Innovation, Research & Collaboration		
14	Content development	60	10%
15	Contribution to any innovation/research involvement	30	
16	Collaboration/achievement/appreciation	10	
		TOTAL	**100%**

CHAPTER 7.0
TeCC GROWTH AND SUSTAINABILITY

Base on the readings provided below, **these are the institution's recommended responsibilities***:*

i. Execute a strategy to achieve Status BEACON within the recommended time

ii. Develop a comprehensive sustainability plan to promote the designated Learning Spaces.

iii. Provide ongoing training and professional development opportunities for staff and faculty responsible for managing and maintaining the designated Learning Spaces, ensuring that they have the skills and resources needed to support sustainability efforts effectively.

iv. Engage students, faculty, and staff in sustainability initiatives within the designated Learning Spaces, fostering a culture of environmental stewardship and collective responsibility for the long-term viability of learning environments.

v. Create innovative strategies to ensure that the designated Learning Spaces are constantly relevant and attractive to stakeholders

7.1 The Importance of Growth and Sustainability

> *"…growth enables TeCCs to expand their reach, impact, and influence, thereby maximizing their potential to empower learners, foster innovation, and drive positive change."*

Sustainability and growth are paramount for the long-term success of TeCC 3.0 and TeCC 4.0. Sustainability ensures the continued availability of resources and the ability to meet the needs of current and future learners without compromising environmental, social, or economic wellbeing. It fosters resilience and adaptability, allowing TeCCs to evolve in response to changing educational landscapes and technological advancements. Additionally, growth enables TeCCs to expand their reach, impact, and influence, thereby maximizing their potential to empower learners, foster innovation, and drive positive change within educational communities and beyond. Together, sustainability and growth form the foundation for a thriving and future-ready TeCC ecosystem.

7.2 The Future of TeCC 4.0

The sustainability and growth of TeCC 4.0 are paramount for its continued success and relevance within Malaysian Polytechnics. This cutting-edge facility, centered around Virtual Reality (VR) technology and the Immersive Investigation ($\mathbf{I_2}$) concept, represents a significant advancement in educational methods. Ensuring its ongoing development and adaptation to emerging technologies is crucial for maintaining its position at the forefront of innovative learning environments.

As TeCC 4.0 continues to evolve, it must remain responsive to the changing dynamics of technology and education. This includes regular updates to VR equipment and software, as well as continuous training for facilitators to harness the full potential of immersive learning experiences. The aim is to keep the curriculum and teaching methodologies in sync with the latest advancements, thereby enhancing the educational experience for students.

"As a BEACON, an institution sets a benchmark in educational standards, inspiring others to elevate their own practices."

Achieving the status of BEACON should be the ultimate goal for institutions hosting TeCC 4.0. This esteemed level signifies not only excellence in technological integration and educational innovation but also a commitment to preparing students for success in a digitally driven world. As a BEACON, an institution sets a benchmark in educational standards, inspiring others to elevate their own practices. The pursuit of this status underscores the importance of ambition, vision, and continuous improvement in cultivating an environment where technology and learning converge to shape the future.

7.3 TeCC 4.0 Achievement Status

"… through five distinct stages—Amber, Spark, Kindle, Flame, and Beacon—illustrates an institution's journey from the initial adoption of VR technologies to achieving a benchmark of excellence in immersive learning."

The "STATUS TeCC 4.0" framework presents an evolutionary pathway for integrating Virtual Reality (VR) technology into Technical and Vocational Education and Training (TVET) learning experiences. This structured progression through five distinct stages—Amber, Spark, Kindle, Flame, and Beacon—illustrates an institution's journey from the initial adoption of VR technologies to achieving a benchmark of excellence in immersive learning. Each stage signifies a deeper integration and sophistication in using VR to simulate real-world scenarios, enhance skill acquisition, and foster an innovative learning environment.

This approach not only aligns with the educational goals of providing hands-on, experiential learning opportunities but also emphasizes the importance of continuous improvement and adaptation to emerging technologies. Through this framework, institutions are encouraged to progress towards becoming a Beacon of light in VR-enhanced TVET education, showcasing the transformative power of immersive technology in enriching the learning experience.

	Growth Status	Philosophy	*Highlights of Practice – Based on Star Ratings (SRT)	Achieving Mechanism - Based on Star Ratings (SRT)
1	**AMBER**	**Amber of Aspiration:** This phase is A-Ready-to Ignite environment, where the ecosystem is being finetuned to begin its purpose. **Expected achievement, 0-2 years from first date of operation**	▪ No rearrangement/addition of original layout ▪ Type visitors per year are mainly Domestic ▪ 0% of Immersive Investigation (I_2) experience are Self-made (All Off the Shelf contents) ▪ 1Star Rating	Achieving a 1 SRT or More within a timespan of two (2) years in a row
2	**SPARK**	**Spark of Awareness:** This phase is like the first flicker of flame from a spark. It represents the moment of awakening, where there is a newfound awareness or realization that ignites the quest. **Expected achievement, 2-3 years from first date of operation**	▪ 5% rearrangement/addition of original Layout ▪ Type visitors per year are mainly Domestic ▪ 10% of Immersive Investigation (I_2) experience are Self-made ▪ 2 Star Rating	Achieving a 1 SRT or More within a timespan of two (2) years in a row

3	**KINDLE**	**Kindling/Kindle of the Spark:** After the spark, the journey enters a phase of gathering and kindling. This phase involves actively seeking knowledge, wisdom, and experiences that fan the flames of curiosity and desire for growth. It's a time of exploration, learning, and opening up to new ideas and possibilities. **Expected achievement, 3-4 years from first date of operation**	▪ 10% rearrangement/addition of original layout ▪ Type visitors (per year) are mainly External ▪ 20% of Immersive Investigation. ▪ (I_2) experience are Self-made ▪ 3 Star Rating	Achieving a 3 SRT or More within a timespan of two (2) years in a row
4	**FLAME**	**A Steady Flame:** As the search continues and the individual integrates their learnings, the flame becomes steady and strong. This transformational phase is marked by the burning away of old beliefs, habits, and illusions that no longer in practice. The steady flame represents a stable and growing understanding. **Expected achievement, 4-5 years from first date of operation**	▪ 20% rearrangement/addition of original layout ▪ Type visitors (per year) are mainly External ▪ 20-50% of Immersive Investigation (I_2) experience are Self-made, focusing more on simple Game Learning ▪ 4 Star Rating	Achieving a 4 SRT or More within a timespan of three (3) years in a row
5	**BEACON**	**A Beacon of Light**: With a strong and steady flame, the practice becomes a beacon of light, not just for themselves but for others. This phase involves integrating the insights and wisdom gained into daily life, shining light on the path for oneself and serving as a guidepost for others. **Expected achievement, above 5 years from first date of operation**	▪ 30% rearrangement/addition of original layout ▪ Type visitors (per year) are mainly External/International >50% of Immersive Investigation ▪ (I_2) experience are Self-made, focusing more on higher order ▪ Game Learning ▪ 5 Star Rating	Achieving a 5 SRT within a timespan of three (3) years in a row

CHAPTER 8.0
TeCC HOPED AND DREAMS

TeCC 4.0 marks a significant leap forward in educational innovation, harnessing Virtual Reality (VR) technology to redefine learning experiences. At its core, TeCC 4.0 aspires to create an immersive environment where virtual reality facilitates deep exploration and collaboration. The cornerstone of TeCC 4.0's vision lies in its Immersive Investigation ($\mathbf{I_2}$) activities, where learners engage with VR simulations to deepen their understanding of complex concepts and hone their problem-solving skills

Through VR-enabled experiences, TeCC 4.0 empowers learners to embark on a journey of discovery, transcending traditional educational boundaries. By breaking down barriers to collaboration, TeCC 4.0 creates opportunities for interdisciplinary engagement and innovation. Additionally, TeCC 4.0 aims to cultivate a global mindset among learners, preparing them to thrive in an interconnected world. By leveraging VR technology, TeCC 4.0 enables students to engage in cross-cultural exchanges, broadening their perspectives and fostering empathy and understanding.

"… TeCC 4.0 stands at the forefront of educational innovation, shaping the future of learning through immersive experiences that transcend borders and inspire discovery. Achieving and sustaining these aspiration takes commitment, focus and risk-taking from stakeholders."

Furthermore, TeCC 4.0 envisions a future where VR-enabled learning becomes a catalyst for real-world impact. By immersing students in virtual environments, TeCC 4.0 equips them with the skills and knowledge needed to tackle global challenges. Through initiatives like Immersive Investigation ($\mathbf{I_2}$), TeCC 4.0 fosters a spirit of exploration and curiosity, empowering learners to push the boundaries of knowledge and creativity. Ultimately, TeCC 4.0 stands at the forefront of educational innovation, shaping the future of learning through immersive experiences that transcend borders and inspire discovery. Achieving and sustaining these aspiration takes commitment, focus and risk-taking from stakeholders.

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GLOSSARY

Term	Definition
AR	*Augmented Reality*
AMBER	*Achieving 1 Star Rating - 50-100% projects are Programme Type*
BEACON	*Achieving 5 Star Rating - 80-100% projects are Inter- Agency*
BLENDED LEARNING	*Combines face-to-face and online learning*
DigitalEyez	*Refer to TeCC 4.0 room equipped Virtual Reality (VR) and Interactive Investigation activities*
eLOs	*eLearning Officers*
FLAME	*Achieving 4 Star Rating - 80-100% projects are Inter-Department types*
4IR	*Fourth Industrial Revolution*
FYPs	*Final Year Projects*
Immersive Investigation	*leverages virtual reality (VR) and other immersive technologies*
I_2	*Immersive Investigation*
KINDLE	*Achieving 3 Star Rating - 80-100% projects are viable Intra-Department types*
MAROs	*Multimedia & Resource Officers*
ROI	*Return of Investment*
SOPs	*Standard Operating Procedure*
SPARK	*Achieving 2 Star Rating - 80-100% projects are Programme*
SRT	*Star Ratings*
STEAM	*Science, Technology, Engineering, Arts, And Mathematics*
OSH	*Occupational Safety and Health*
TeCCs	*Technology-enabled Collaborative Classroom*
TeCC 2.0	*Collaborative learning spaces*
TeCC 3.0	*Maker Space Innovative Hub*
TeCC 4.0	*Augmented Reality and Virtual Reality Hub*
TVET	*Technical Vocational Education & Training*
VR	*Virtual Reality*

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