



USING AUGMENTED AND VIRTUAL REALITY IN TVET

# Planning and Execution of Electrical Installations in an Authentic Virtual Environment

Submitted by FOSH, South Africa

BIBB International Roadshow DIGITAL MEDIA IN TVET

**bibb** Federal Institute for  
Vocational Education  
and Training

  
**BILT**  
Bridging Innovation and  
Learning in TVET

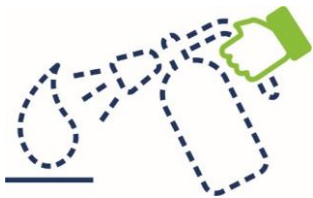
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## Abstract

The increasing complexity of products and underlying processes in the digital era requires TVET systems to impart advanced practical and cognitive competencies and put a focus on the development of problem-solving skills, rather than focusing on the execution of routine tasks and theoretical knowledge. South Africa has adopted several national policies with the aim to embrace the changes caused by the digital era.

In line with those national policies, FOSH developed various digital training applications to foster the acquisition of professional competencies for various trades, including plumbing, electrical installation and bricklaying and support the development of modern TVET system for the digital era.

The presented example illustrates the VR training application for electricians.



## Basic Information

- **Purpose of immersive technology use in TVET:**
  - Dealing with unfamiliar situations
  - Acquisition of professional competencies
- **Sector / subject area:** Electrical installation
- **Type of training:** Formal TVET and non-formal post-secondary level education
- **Start date:** 2020 (to date)
- **Partners:** Business Science Corporation (Development)

## Educational Concept

### Learning contents & outcomes

The interactive virtual learning environment in the field of electrical installation focuses on the **contextualization of technical knowledge** and **practical skills**.

Learners have to **independently carry out customer requests** within the virtual environment e.g. install switches, plugs, intermediate switching devices.

Their **tasks and work steps** include prior site inspection and planning of required materials and working time; preparation of an installation plan and cost estimate; carrying out installations with the planned materials and tools and checking the functionality of installations. The application evaluates learners' performance on the basis of the functionality of the installation and the profits and/or losses made.

The application helps to achieve the following **learning goals**:

- Strengthening learners' analytical skills to analyze a given situation / problem and reflect on their own actions
- Fostering learners' problem-solving skills and professional know-how that are required on-the-job

### Educational setting

The learning application is integrated as an **optional educational offer** in the framework of formal TVET and non-formal training at post-secondary level in South Africa.

The VR application can be implemented as **class-based learning** as well as **work-based learning** at the workplace.

- The **target group** are learners in the TVET system and new job entrants in the area of electrical installation.
- Learning takes place in **small groups** of no more than 10 people per learning session, as physical space is often limited.
- The application realizes a **project-based learning approach** and involves **game-based elements**.
- As learners are completely autonomous in using the VR application and carrying out work tasks virtually, the main responsibility of **teachers and trainers** is to create a conducive environment for learning.

All learning modules have been aligned with the South African occupational qualification standard and TVET curriculum for electricians.

## Technical Setup

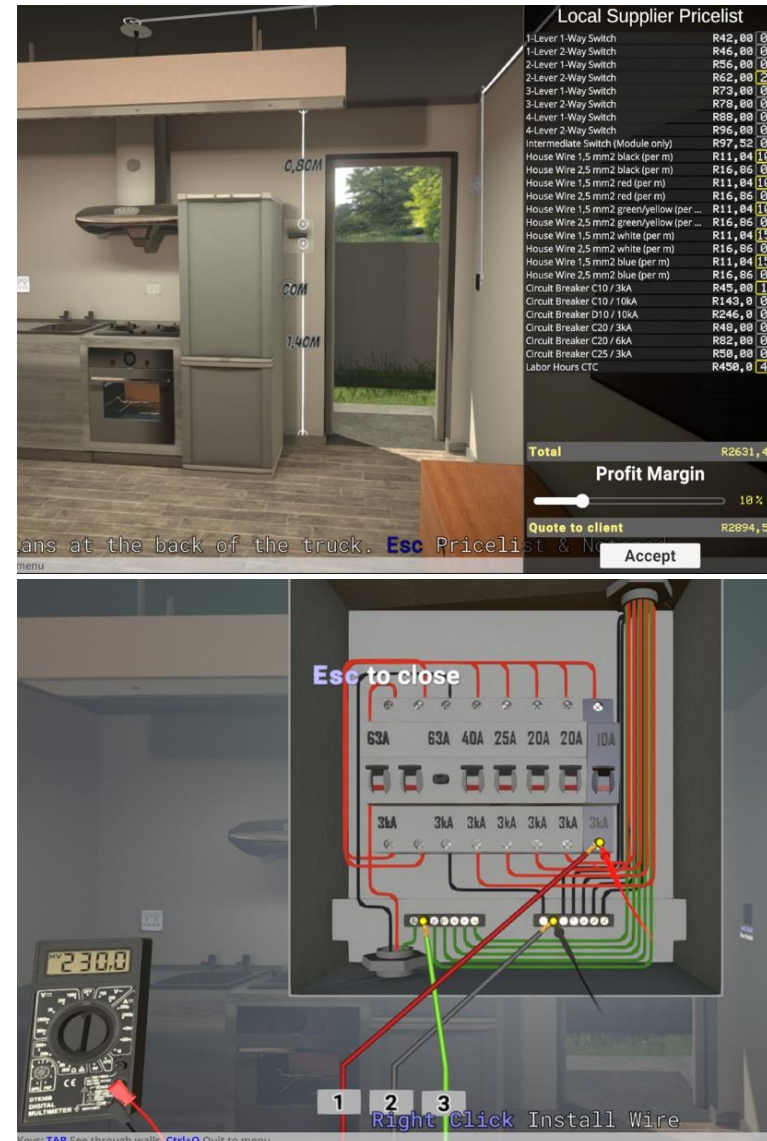
### Hardware

The learning scenarios have been developed in a **BIM (Building Information Modelling) environment**. This allows the application to be used with a laptop, mouse and keyboard.

Optionally, the use of **Virtual Reality** (e.g. headset, controllers) allows learners to perform all work tasks in a 3D environment.

### Motion Tracking & Interaction

- The mouse/keyboard or controllers are used to **interact with digital objects** (touch & trigger)
- **Tools** are available e.g. for estimation of costs, measuring of voltage etc.
- Existing electrical installations can be **made visible** for ease of reference



## Benefits of Use in TVET

### **Training of authentic work situations becomes possible in school-based TVET systems**

As learners often have only limited exposure to the challenges that might be experienced in a real life scenario, virtual project-based learning through gamification greatly contributes to improving their professional competencies.

### **Training in authentic virtual environments fosters the development of 21<sup>st</sup> century skills**

The increasing complexity of products and underlying processes in the digital era requires TVET systems to impart advanced practical and cognitive competencies and put a focus on the development of problem-solving skills, rather than focusing on the execution of routine tasks and theoretical knowledge.

### **XR training applications are cost-effective**

Participants adjusted quickly to the new learning environments and pilot trials with learners in South Africa and Namibia indicated a positive impact on the development of competencies, thus outweighing the costs for development.

## Lessons Learned

### **Project parameters should be clearly defined**

As immersive learning technologies have unlimited possibilities, it is crucial to have a clear vision of the learning objectives and scope of the XR project.

### **Adequate time should be provided for beta testing**

Piloting with different audiences usually opens up the development for additional perspectives, scenarios and possibilities.

### **Experts of the respective trades need to be included**

A sound technical knowledge – especially on the execution of tasks and problem solving approaches - of the trade is required in order to provide for project-based learning that is aligned with the defined objectives in the TVET curriculum.

### **Teachers should receive sufficient guidance**

Teachers often present a greater resistance to change. Sufficient time should be spent providing orientation to teachers about the pedagogical requirements for the use of XR applications in TVET.



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The Bridging Innovation and Learning in TVET (BILT) project provides TVET stakeholders with a platform for exchange and supports them to address current challenges in TVET systems, which arise due to technological, social, environmental, and workplace changes. Within BILT, the overarching theme is New Qualifications and Competencies in TVET, which is supported by four focus themes in the context of TVET:

- Digitalization
- Greening
- Entrepreneurship
- Migration

Through regular knowledge exchange, thematic project activities, and expert working groups BILT leverages the existing mechanism of the UNEVOC Network to offer opportunities for collaboration and peer learning in

Europe, Africa, and Asia and the Pacific. The project complements national developments to explore and support innovative, market-oriented and attractive modes of learning and cooperation in TVET.

The results of ongoing activities are accessible on BILT's web page.

The BILT project is carried out in collaboration with UNEVOC Network members, coordinated by UNESCO-UNEVOC with support of the German Federal Institute for Vocational Education and Training (BIBB), and sponsored by the German Federal Ministry of Education and Research (BMBF).

For more information, please visit

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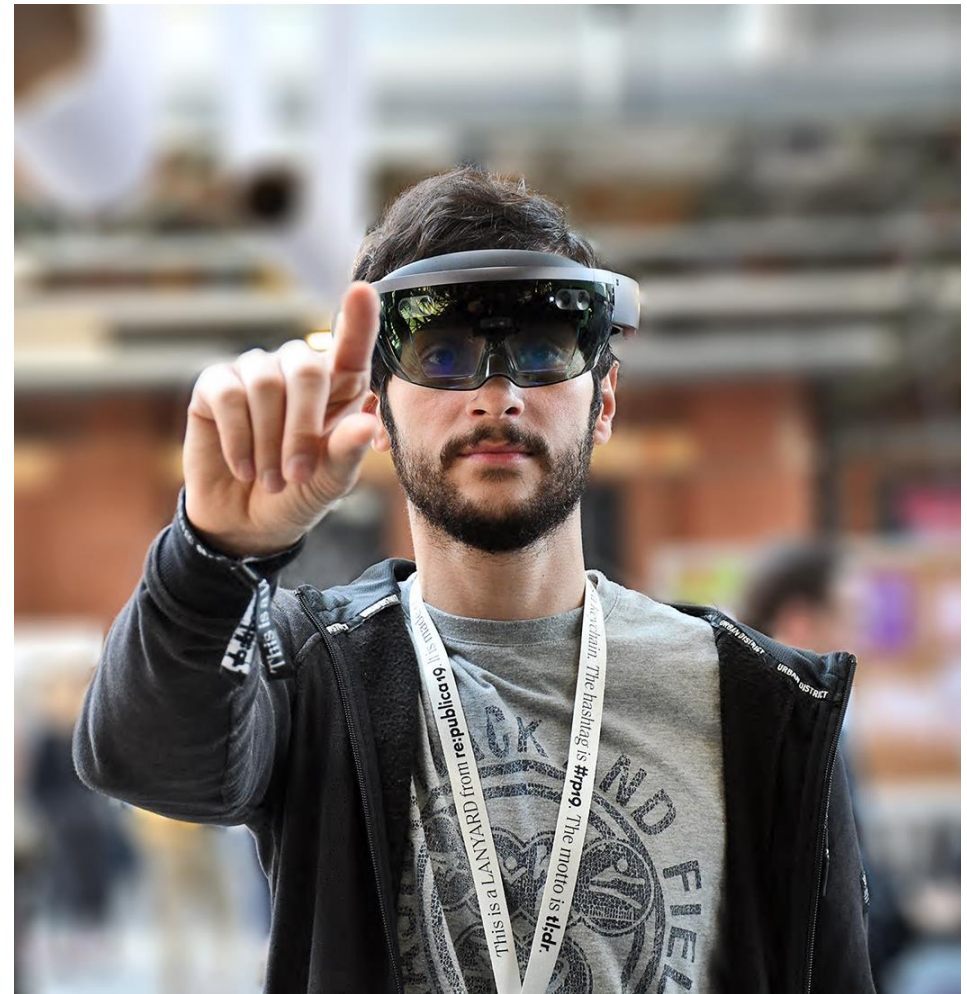
## BIBB International Roadshow Digital Media in TVET

Initiated by the Federal Institute for Vocational Education and Training in Germany (BIBB), the Roadshow aims to show the potential of digital applications and technologies for teaching and learning in Technical Vocational Education and Training to make learning more flexible and enhance the quality and attractiveness of TVET.

The format builds on the German Roadshow 'Digital Media in TVET', which has been successfully implemented and conducted by the Federal Ministry of Education and Research in Germany (BMBF) in cooperation with BIBB since 2016.

More information:

<https://www.bibb.de/de/105326.php>



## About FOSH

FOSH specializes in the development of content, training material and learning experiences for various trades, including plumbing, electrical installation, bricklaying and more through a collaborative and community-based approach that engages relevant stakeholders from the private and public sector and society in South Africa.

By optimizing digital, virtual and online technology and combining this with modern methodologies, FOSH creates multi-dimensional and reality-based learning experiences that enable participants to succeed in the South African and African labor market.

## Contact & Further References

### Contact

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### Further references

- Website FOSH: <https://fosh-learning.co.za/>
- Website BSC: <https://bscglobal.com>

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