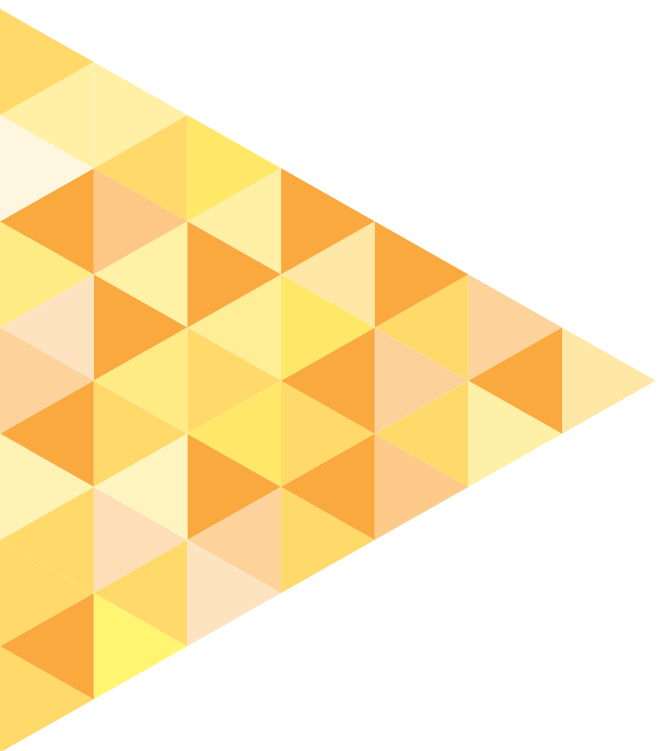


Diana Cáceres-Reebs | Luca Jelic

Digital media in vocational education and training

Good practice examples from Latin America and Germany



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Digital media in vocational education and training – good practice examples from Latin America and Germany

Diana Cáceres-Reebs, Luca Jelic

Abstract:

This BIBB publication on "Digital Media in TVET" aims to disseminate international good practice examples for the use of digital tools in TVET across contexts and continents.

All of the examples presented participated in the call for applications for the third edition of the "BIBB International Roadshow Digital Media in TVET". In addition to an introduction to the concept and objectives of the roadshow, in the main section you can find 14 examples of excellent digital TVET from various Latin American countries and Germany. Of the 14 initiatives presented in the publication, five were able to present themselves at the last BIBB Roadshow in Brasilia (November 2023). The initiatives include platform solutions, VR developments, learning applications for smartphones and much more. The editors ensured to cover a wide range of occupational fields and competences.

The publication ends with a positive overall conclusion and an outlook for the next edition of the roadshow in 2025.

Digital media in TVET – good practice examples from Latin America and Germany

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Foreword

Dear readers,

In teaching and learning, the use of digital media offers great potential for increasing enthusiasm for learning and for making vocational education and training more attractive, more inclusive and more flexible for young people.

For us as stakeholders in vocational education and training, digitalisation is posing huge challenges globally. We therefore need to share views and ideas beyond national borders on the opportunities offered by digital media in VET in order to better exploit these opportunities.



This includes learning about innovative examples from around the world which show how digitalisation can enrich initial and continuing VET. Equally important is promoting dialogue between training personnel in companies and vocational schools, strengthening IT and media education competencies and providing information about relevant training offers.

This publication is the result of a successful collaboration between the Federal Institute for Vocational Education and Training (BIBB) and the National Service for Industrial Training (SENAI) in Brazil. Its purpose is to present innovative best practices from everyday VET in various Latin American countries and in Germany and is therefore intended for an audience engaged in international VET practice.

The project examples cover a broad range from using simulation-based approaches for promoting specific competencies to platform solutions enabling engagement with different learning content and processes regardless of time and location.

I would like to extend my gratitude to all those who have worked in the projects for their contributions to this publication and hope you find this an inspiring read.

A handwritten signature in blue ink, appearing to read 'F. H. Esser'.

Prof. Dr. Friedrich Hubert Esser

President of the Federal Institute for Vocational Education and Training (BIBB)

Dear readers,

As the world moves into the digital age, educational institutions face the challenge to keep pace with technological innovations and play a new role in the course of the changes affecting all fields of human activity today. Brazil's National Service for Industrial Training (Serviço Nacional de Aprendizagem Industrial, SENAI), internationally recognised for its excellence in education for work, aims to be at the forefront of these changes, striving to promote a true digital transformation in TVET.

The use of new digital media in professional and technical training and teaching arrangements has expanded the boundaries of learning and opened up new and exciting possibilities for developing skills via previously unimaginable paths. We are just beginning to explore new digital tools such as online platforms, artificial intelligence, augmented reality, simulators and other immersive technologies that make our students' education richer and more exciting.



SENAI is proud to be part of the International Roadshow project “Digital Media in TVET”, in partnership with the Federal Institute for Vocational Education and Training (BIBB), the results of which are compiled in this publication. They reflect our commitment to innovation in the constant pursuit of excellence in education for the world of work.

Our engagement in this partnership with BIBB is further testimony to SENAI's commitment to leading the way in the digital transformation of technical vocational education and training in Brazil, not only to offer new ways of learning in traditional industrial activities, which are also undergoing profound technological changes, but also to prepare young workers for the professions of the future.

A handwritten signature in black ink, appearing to read 'Gustavo' followed by a stylized surname.

Gustavo Leal Sales Filho

Director General of the Brazilian National Service for Industrial Training (SENAI)

1. BIBB International Roadshow on digital media in TVET: from Asia to Latin America – a one-off event becomes a tradition



1.1 The Roadshow concept

In an increasingly digitalised world, it is essential that vocational schools and companies use digital media and technologies in initial and continuing vocational education and training and integrate this into their learning and work processes. Learning from each other internationally has a critical role to play in this.

The Federal Ministry of Education and Research (BMBF) launched the national roadshow in 2016. This was a national series of events, run by BIBB, which visited over two dozen cities up until 2023. One-day user workshops offered participants the opportunity to share thoughts and ideas, to network and to trial digital tools and concepts. The user workshops have been continued on the BIBB portal for training and examination staff (www.leando.de) since 2024.

BIBB converted the national concept into an international format in order to meet the international demand for exchange and cooperation. In 2019, BIBB showcased innovative examples of good practice from Asia and Europe at the first International Roadshow in Bangkok. A purely digital roadshow followed in 2021 with examples from Asia, Africa and Europe. In 2023, BIBB and its Brazilian partner institute, the National Service for Industrial Training (SENAI), held the third International Roadshow in Brasilia, showcasing examples from Latin America for the first time.

“Once is an event. Twice is a repeat. Three times is a tradition!”

For the third roadshow, we would like to thank SENAI for their support in creating this tradition!”

1.2 “The international roadshow: practical and innovative”

Benefits of the International Roadshow:

- ✓ Innovative **examples from practice are brought to life**
- ✓ Stakeholders from TVET practice are supported in **adapting digital solutions** to their own requirements
- ✓ Stakeholders from TVET policymaking and practice can **get in touch** with developers of digital teaching and learning concepts
- ✓ International **exchange** and opportunities for **networking**
- ✓ Greater understanding of the potential provided by technology-assisted learning in VET

1.3 Comments from the 2023 International Roadshow

Sharing thoughts and ideas with others and trying out the digital solutions was really inspiring!

Discussion among participants from training institutions and companies showed that, in many instances, the experience of using digital media and technologies in training was already positive, but that a greater awareness of these solutions was needed. The international roadshow offers an appropriate format for this.

The use of digital media makes initial and continuing VET more attractive!

In the view of participants from VET practice, the use of e-learning platforms, virtual classrooms, simulations and virtual reality learning applications has the potential to improve the efficiency and effectiveness of training programmes. This is because many of the examples presented promise much more individualised learning. Simulation-based approaches also allow activities and work processes to be practised in a safe environment while also reducing the consumption of resources.

Gamification elements in training have become well established!

Complex training content and learning processes can be delivered in a fun way and this increases the motivation and commitment of trainees. Gamification elements mean that the interactive involvement of learners is increased and this makes it easier to visualize and regularly review progress.

You can also benefit from the opportunity to try out innovative digital solutions for vocational education and training practice, to get in touch with developers and to share your thoughts and ideas with other international stakeholders in VET practice.

Join us at the next international roadshow in 2025!

2. Practical examples from the International Roadshow 2023



- 2.1 CONNECT platform (Corporación Formados - Ecuador)
- 2.2 MARLA – Masters of Malfunction (TU Berlin - Germany)
- 2.3 SENAI Experience (SENAI - Brazil)
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- 2.5 SuperLab Terra do Sol (SENAC Natal - Brazil)



“For vocational education and training to be successful, it is necessary to draw on the best experiences and share good management practices with other institutions.”

*Corporación Formados,
Ecuador*

2.1 CONNECT platform

CONNECT is the online platform that facilitates the tasks and processes of planning, monitoring and evaluating Dual VET in Ecuador as well as the interaction of the actors involved such as: business associations, training companies, business tutors, students, and higher education institutions.

The initiative promoted by Corporación Formados was financed with competitive funds from GIZ (German development and international agency) Ecuador, specifically the Innovation Fund. Corporación Formados is the administrator of the platform and provides access to the different study programmes through the chamber coordinator, who has the role of coordinating the training process in the company.

What has been developed?

The platform has modules for the registration of students, the uploading of curricula and rotation plans, the registration of companies and tutors, the uploading of training agreements, the registration of follow-up visits, the creation and registration of satisfaction surveys, the retrieval and registration of mid-term and final exam grades, the registration of evaluation commissions, job offers, and more.

The digital platform is available in a web environment and has a robust cloud server that can scale its features according to the number of users and information and manages high security standards to prevent computer attacks common in systems that use the Internet to transmit data and information. The platform also has an intuitive and easy-to-use UX (user experience) design. Additionally, it has an interactive manual that facilitates the induction and training processes for new users.

The platform provides reliable, relevant and secure information on:

- ✓ Agreements
- ✓ Learning reports
- ✓ Rotation plans
- ✓ Training framework plans
- ✓ Business projects
- ✓ Certification exams

Main objectives

- To consolidate information on the training process
- To encourage the exchange of information between the actors within the dual VET system
- To facilitate the recording of activities
- To facilitate interaction between the training company and the trainee

Importance of the user induction and training process!

Since its launch at the end of 2020, the platform has reached a wide audience. There are 12 study programmes in the fields of wood and forestry, food, industry and manufacturing, administration and commerce, as well as 93 active companies, 5 chambers/associations and almost 500 business tutors.

The main challenge in setting up the platform was to secure the contributions of all the stakeholders: students, companies, chambers and educational institutions. To this end, in-person workshops were held at the beginning of 2020. However, lockdown arrived and the analysis of processes, tests, etc. was done remotely at a time when carrying out such work in this way was a new thing for the country. Since the platform went live in 2021, details have continued to be tweaked, including the employment exchange module, which was not initially defined. This module provides a space for companies to post job offers and contact the pool of VET graduates, and students can access the job offers and contact the company. Apart from the technical aspect, for the tool to achieve the best results it is very important that there is a good induction and training process for each user, since, for example, in the more manual industrial sectors more complications arise in the use of platforms due to staff not always being familiar with the use of computers.

On an international level, in 2021 Connect attracted the interest of the VET system regulators in Colombia (Medellín) and Morocco and work began to adapt the platform, taking into account certain specific requirements resulting from the regulations and structures of each country. In the medium term, an app is planned to improve interaction with the platform.



Contact

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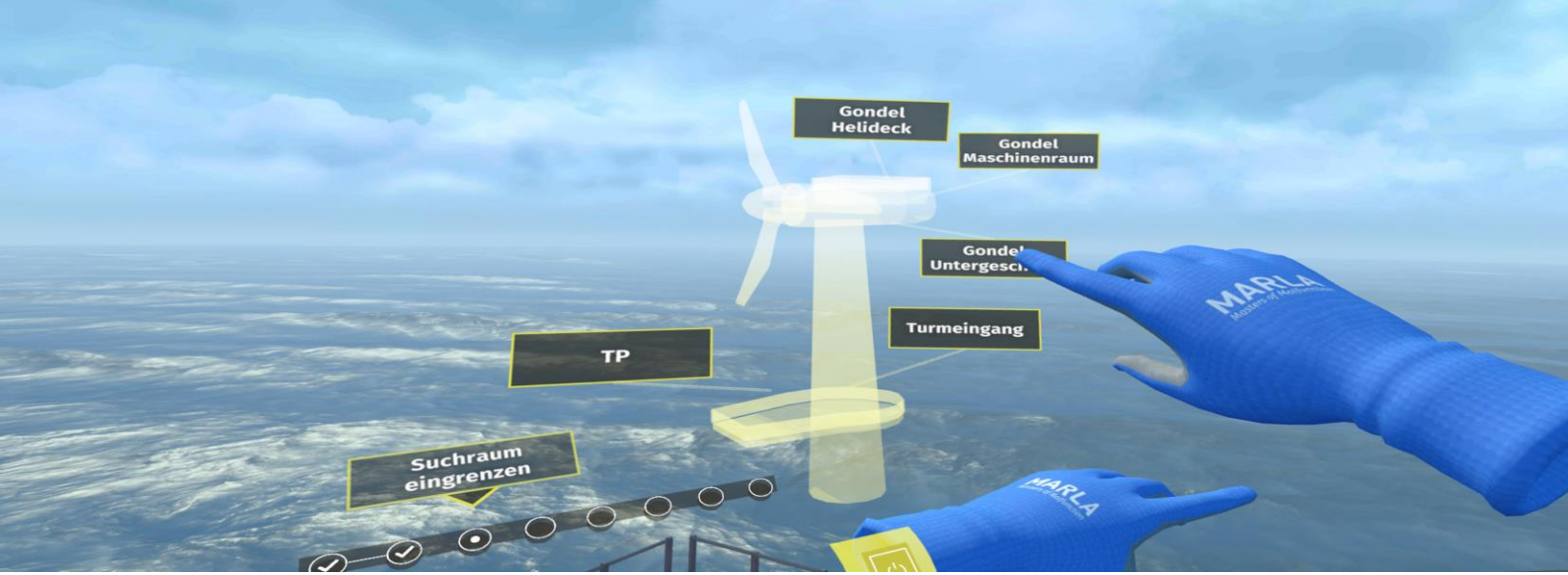
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2.2 MARLA – Masters of Malfunction

Using the Marla VR learning game, aspiring offshore wind turbine maintenance personnel can practise onshore how to diagnose faults on the system.

As part of the MARLA-Masters of Malfunction research project, a game-based virtual reality (VR) learning environment, which includes accompanying materials for teaching, was developed and evaluated. The game “MARLA – Masters of Malfunction” is a so-called serious game. This allows metal technology and electrical engineering trainees to develop their fault diagnosis skills simply and safely while in the classroom at their vocational school. The game and accompanying materials were developed by a research network funded by the Federal Ministry of Education and Research (BMBF). The network partners are the Technical University of Berlin (project management and academic support), the Good Evil game studio (game development), the Koblenz Chamber of Crafts and Trades (game distribution) and the Osnabrück-Emsland-Grafschaft Bentheim Chamber of Crafts and Trades (game distribution). Vocational school students from the Hein-Moeller School in Berlin and skilled workers at the RWE Windpark Arkona were also involved in developing the concept. The Wissenschaftsladen Bonn e.V. Education centre developed the accompanying didactic material.

What has been developed?

In the VR game, trainees take on the role of a skilled worker specialising in wind energy whose job it is to fix a fault on an offshore turbine at sea. To start with, the mission and the basic functioning of the wind turbine are explained to them before crossing over to the wind farm by boat. On the offshore turbine, they then work through the individual steps of fault diagnosis. They check for the potential causes of the fault in the machine room up in the nacelle and fix the fault. If they encounter difficulties, their virtual colleague, Alex can help them. The aim of MARLA is to detect the causes of different complex faults in an offshore wind energy plant. This demands a systematic and logical approach. The VR game was designed for the “Meta Quest” headset and builds on the basic knowledge from the first year of training; no specialist knowledge of wind energy is required. The game's website provides information on how the game is installed and learning materials for use in the classroom.

As part of the project, a series of investigations were carried out into the cognitive and motivational effects of the MARLA learning application and into how to integrate the application in teaching. The initial evaluation results show that, using MARLA, trainees learn about wind turbines and systematic fault diagnosis and also that the virtual visit to a wind turbine increases interest in the topic of wind energy. Almost 200 trainees and students were involved in the development and piloting as part of workshops.

MARLA
Masters of Malfunction

GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung

„When carrying out the virtual tasks, players gain experience of the strategic approach when diagnosing faults and can then transfer this into their day-to-day work. The trainees also experience the consequences of the solutions they try out.“

MARLA project team,
Germany

Main objectives

- Improve fault analysis skills
- Making vocational education and training more effective using VR
- Create enthusiasm for wind energy
- Improve vocational education and training for sustainable development
- Integrate game-based learning into training

Serious games – a factor to take seriously in VET!

The VR game is integrated in an overall didactic concept. This allows teachers in the classroom to address and consolidate learning content on fault diagnosis using specific tasks after the game. The game's website provides a handout with didactic recommendations and teaching suggestions, a course booklet, and help on technical issues relating to the use of VR glasses in the classroom. The developed game content has been aligned with the learning objectives in the framework curricula for training occupations in metal technology and electrical engineering to provide starting points for using the game in the teaching.



MARLA can be integrated very effectively into everyday teaching at vocational schools. It is designed for a broad audience and can therefore be used extensively. MARLA is fully ready to use and free – making it unique in Germany. It can also be used

internationally for training to teach trainees how to approach fault diagnosis systematically.

The response to the project and the awards and nominations received indicate the high level of interest within the community in general. It has been shown that complex content can be delivered in an innovative way using a VR game. This means learning content can be addressed in a way which is appropriate to the target audience.

The potential provided by immersive and virtual learning applications for VET is also reflected in the new training occupation of “Immersive Media designer” which has recently been announced. This offers further starting points in terms of content for designing immersive learning applications in the context of vocational education and training.

Contact

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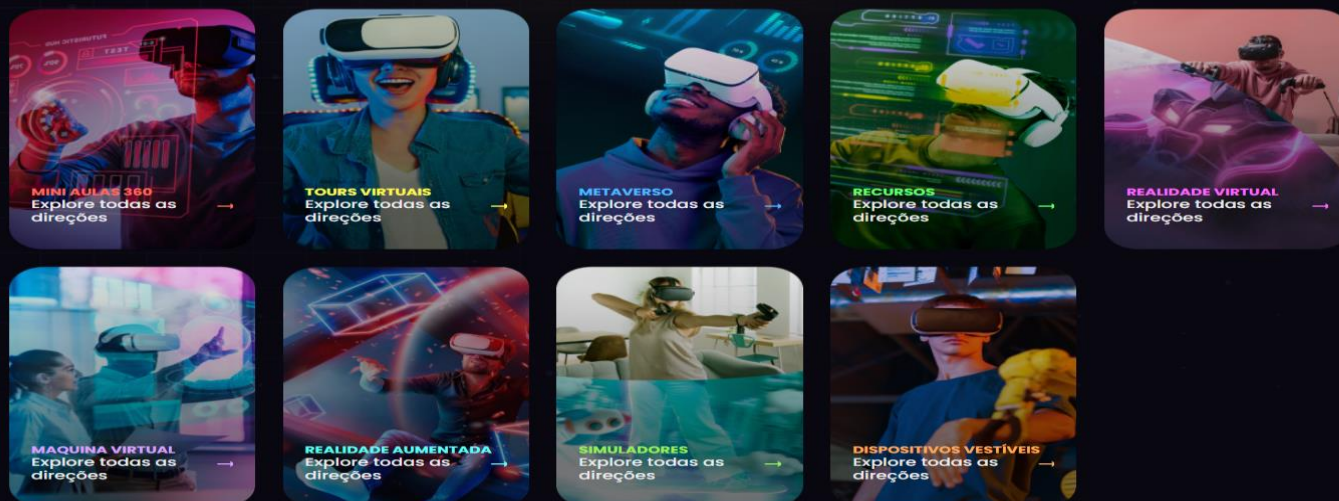
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Game website:
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Source: Press release,
TU Berlin, 06.12.2022:
<https://www.tu.berlin/ueber-die-tu-berlin/profil/pressemitteilungen-nachrichten/vr-game-teleportiert-auszubildende-auf-ein-offshore-windrad>





“SENAI Experience seeks to revolutionise education, generating lasting impact and changing the way we learn and teach.”

SENAI,
Brazil

2.3 SENAI Experience

The platform's solution offers virtual tours, 360° panoramas, and VR/AR simulations. This guarantees the most realistic and flexible preparation through immersive educational resources.

SENAI Experience aims to enhance vocational education and training with extraordinary benefits. By means of simulations and virtual, augmented and mixed reality, a practical environment is provided that allows students to improve their skills safely. The platform's online accessibility eliminates geographical barriers, democratising access to quality resources. By joining SENAI Experience, students gain practical experience, in-depth understanding and, above all, the confidence to face the real challenges of the working world.

What has been developed?

Through the platform, teachers can develop skills in realistic virtual environments along with the students. Students can learn at their own pace and keep up to date with the latest technologies. SENAI Experience is not just a platform, it is a hub of immersive resources developed by SENAI, Edtechs and other educational institutions, preparing students for the future of work. SENAI provides teachers with access to a library of dozens of immersive learning resources and user guidelines to support the development of technical skills required by the labour market. The resources can be used for both regular and distance learning courses.

The integrated technologies (AR/VR) are very realistic. This increases teaching effectiveness and student engagement. These benefits place the student at the centre of the process, transforming learning into an engaging and interactive journey.

In addition, a significant effectiveness was observed when it came to skills development. The practical application of these immersive tools facilitates the assimilation of complex concepts and the improvement of practical skills. The use of virtual reality and simulators allows students to experience authentic professional situations, preparing them comprehensively for the challenges of the labour market. The metaverse and 360 videos, in turn, broaden horizons by offering global experiences and realistic contextualisation.

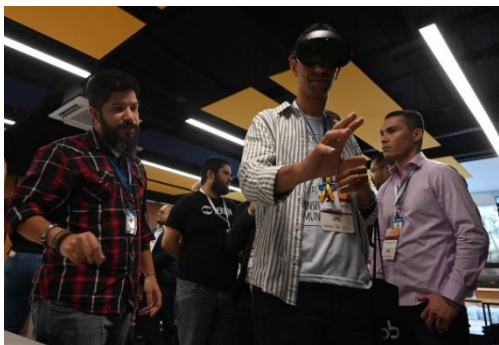
Ultimately, SENAI Experience not only adopts the potential of immersive technologies in vocational education and training, it also maximises them by generating tangible results, from exceptional engagement to effective and applicable skills development. To date, more than 150 SENAI teachers have incorporated SENAI Experience resources into their lessons.

Main objectives

- Stimulate learning with immersive resources
- Increase accessibility
- Prepare professionals for the real world
- Transform vocational education and training

Accessibility as a challenge

The process of developing the SENAI Experience platform shows that network collaboration is the foundation of educational success. The creation of a platform that enables the efficient delivery and sharing of resources between teachers and developers has resulted in unprecedented democratisation and a significant gain in terms of the dissemination scale of these resources. Network collaboration has provided variety and enrichment in the educational offer.



There were two major challenges: the infrastructure and the distribution of the devices. Thus, there are solutions ranging from low-cost options to high value-added investments. This multi-faceted approach not only made it possible to resolve accessibility challenges, but also to ensure that different levels of experience could be provided, avoiding zones of digital

exclusion. It was extremely important to instruct teachers in the use and application in the educational context in order to facilitate the use of these technologies in the classroom.

Further research will be carried out to develop more accessible and effective devices, thus promoting digital inclusion. In addition, there is a need for flexible strategies that can adapt to the different socio-economic realities of the target audience, ensuring that everyone can actively participate in the educational transformation provided by platforms such as SENAI Experience.

It's also important to always be alert to new technologies that can be incorporated as educational resources and integrated to optimise the user experience. A clear example of this is generative AI that can accelerate and personalise resources and the way they are delivered to students according to their preferences and affinities.

Contact

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SENAI Experience website:

<https://experience.senai.br/>





“The assembly of the case is quick and simple, following intuitive and well-structured instructions. All the necessary components are contained in the case, and you just have to click on the application shortcut to start the simulator software.”

*SENAI São Paulo,
Brazil*

2.4 Forklift Simulator

Immersive experience that allows operators in training to practise driving, stacking and load handling skills in a safe, virtual environment before and during practical lessons.

The forklift simulator project is an additional tool used during the practical lessons of the forklift operation course. Users can learn to operate the forklift, improve safety techniques, and familiarise themselves with the controls without the risk of real-world accidents.

What has been developed?

SENAI has developed a simulator to improve forklift operation training in the educational environment of “NR11 Forklift Operation” courses. The simulator not only increases students’ confidence and competence, but also promotes more effective learning. It provides an interactive and immersive experience by offering a realistic 3D environment and high-quality graphics that accurately reproduce forklift operating scenarios. This experience allows physical interaction through controls that simulate a real forklift, providing instant feedback on user actions, such as guidance messages and alerts about errors. The simulator reduces the need for field training, increases student safety, and saves significant resources. By using simulation technology, the project adapts to the guidelines of labour and safety legislation, ensuring that students are prepared to meet the established standards.

The project was carried out in two phases. In the first phase, the development of the software was finalised, and a partnership was established with Toyota Empilhadeiras (a forklift manufacturer) to build a realistic simulator. A real forklift cockpit was used to assemble the simulator, which provided an immersive and authentic experience. However, the high cost of the cockpit limited the possibility of scaling the solution to multiple training points. To address this limitation, the second phase of the project was started with the aim of reducing costs and expanding the solution. To this end a portable case was developed, at a mere 1/10th of the cost of the original cockpit, which allowed operators to carry out the complete training in a similar way to the cockpit. This case has been designed for ease of transport and assembly, with casters and an ergonomic design, allowing it to be used in different locations such as classrooms, training spaces or workplace environments.

Main objectives

- **Promote training in a safe and virtual environment**
- **Train operational skills with a variety of forklifts**
- **Optimise and save training time and resources**
- **Motivate students via the concept of gamification**
- **Promote continuous progress in training**

Valuable teaching and learning tool

The software interface is user-friendly and guides the user through clear configuration options and the selection of simulation scenarios. Users can start their training sessions quickly and dive into in an immersive virtual environment that accurately replicates forklift operations in a variety of practical situations. During the use of the simulator, the instructor plays a key role in guiding the students on operating the simulator and monitoring their progress. SENAI currently has six cases and a cockpit version. However, in the state of São Paulo alone, SENAI has 90 fixed schools and 78 mobile training units. To meet the training demands of these units (SENAI-SP), 14 more cases are expected to be built by June 2024. In 2023, in the state of São Paulo alone, 19,591 people were trained in forklift operation. This figure represents the equipment's usage potential.



One challenge was the fact that the forklift course had traditionally been taught for years without the use of technology, and some instructors were afraid to introduce changes to the didactics. This obstacle was slowly overcome through orientation and training for the instructors, who eventually agreed that the simulator would be a valuable teaching tool.



In terms of future plans, the project intends to consider extending the use of the simulator to other SENAI units, including in other states, and the construction of 14 new cases as part of this expansion plan. The integration of emerging technologies, such as virtual or augmented reality, will also be explored. The plan includes the creation of a third version of the simulator, possibly using devices such as the mixed reality from Oculus.

Contact

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*Servicio Nacional de Aprendizaje
Comercial*

"Social inclusion is highlighted by the fact that the students conceived the project based on supporting people with disabilities, promoting social equity for the deaf, blind and for wheelchair users with structures adapted for them (ramps, Braille readers and panels for use in the Brazilian sign language Libras) inside and outside the supermarket."

*SENAC Natal,
Brazil*

2.5 SuperLab Terra do Sol

Integrative project set in Minecraft Education Edition that contextualises technical knowledge, digital games and artificial intelligence in the Supermarket Services apprenticeship course.

The project is a learning experience in which the course students exercise technical-scientific skills, a collaborative and sustainable attitude, innovative problem-solving, knowledge building, and the use of educational technologies by creating a virtual practice environment in the supermarket area as a tool related to topics such as visual merchandising, shop layout, aisle organisation, logistics, sustainability, and the inclusion of people with disabilities.

What has been developed?

SuperLab Terra do Sol is a project in which students on the Supermarket Services apprenticeship course developed the structure of a supermarket while taking into account the premises of sustainability (use of photovoltaic solar energy as renewable energy and a large green area around the supermarket), social inclusion, and contemporary supermarket marketing practices. Those involved in the project were divided into teams responsible for creating the supermarket's interior and exterior spaces and warehouse. All the activities took place on the premises of Senac, Natal. The students taking part in the project had already completed the Supermarket Services apprenticeship course, which ended after 1,120 hours of course time, divided into 640 practical hours and 480 hours of theoretical lessons. At the end of the project the students were free to choose whether to continue with their professional training.

SuperLab Terra do Sol was created with the aim of democratising access to an understanding of the supermarket universe in the form of virtual and augmented reality, allowing for a differentiated and playful vision of how supermarket structures are interconnected in their final design. SuperLab Terra do Sol may resemble the blocky graphics usually found in Minecraft, but it allows everyone to fully understand the existing structures. It can be used via desktops, laptops, tablets and/or other electronic devices. To join the Terra do Sol SuperLab, simply visit the following link: <https://education.minecraft.net/joinworld/OSwxMSw4LDQ=yes>.

Main objectives

- **Publicise the use of digital technologies and gamification in vocational education and training**
- **Develop skills aimed at simulating real situations**
- **Encourage active and frequent student participation in vocational training**
- **Promote a creative and collaborative attitude among students when carrying out projects, developing technical skills through teamwork**

An initiative that encourages young people's enthusiasm and active participation!

By promoting maker culture and giving the students the digital autonomy they needed to develop the assigned activity, it was possible to provide the students and other various users the possibility of learning new things in a different way. This resulted in the creation of a supermarket with all the most contemporary standards of structures on the world market, valuing aspects such as accessibility, sustainability, social inclusion, and the use of related advanced technologies, primarily artificial intelligence. Practising using the Terra do Sol SuperLab gives users the opportunity to understand the world of supermarkets in a more playful and interactive way, stimulating collaboration, the knowledge building and the creative process as basic elements that enhance a more differentiated practice.

The Terra do Sol SuperLab, set in Minecraft Education Edition, allows anyone to access and explore the game through an access link, and gives teachers the option of a didactic use of the tool in their classes, whereby the project is a great ally for developing more motivating and differentiated classes in terms of teaching and learning. Given that many of the students were previously unaware of the game and its potential uses, which go beyond the simple fact that it is a game, but rather an excellent and stimulating learning tool, the great challenge in developing SuperLab was to give digital autonomy to those involved in the implementation of the project. To complete the project, the aim is to improve with a greater interface using artificial intelligence and to incorporate new functionalities into the Terra do Sol SuperLab to make it even more attractive and widely disseminated.



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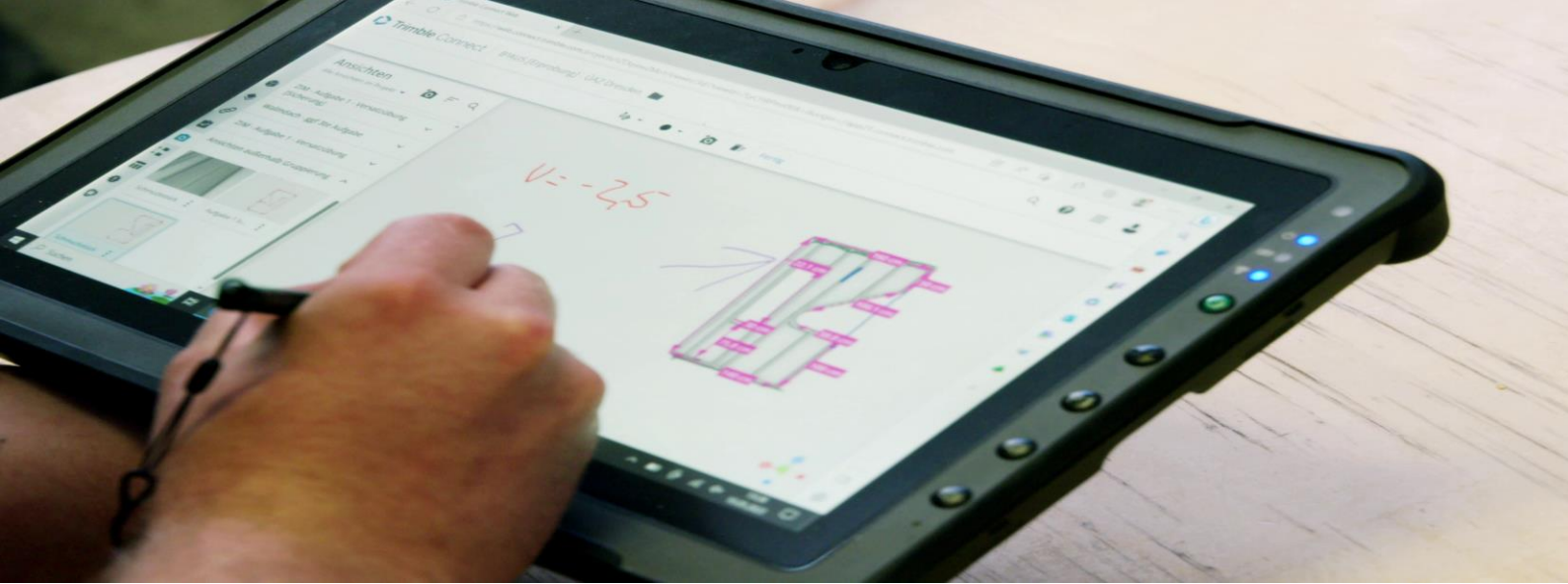
Access to the Superlab link:



3. Other examples from Latin America and Germany



- 3.1 B³AUS – BIM-based construction training (Bau Bildung Sachsen e.V. - Germany)
- 3.2 Online Learning Platform – B-Learning Mode (INATEC - Nicaragua)
- 3.3 DEVstart (SENAI - Brazil)
- 3.4 IT4ME: IT competencies for industrial professions (Technische Akademie Nord e.V. - Germany)
- 3.5 LUMIS Campus (LUCE Foundation - Germany)
- 3.6 Platform for knowledge management (CONALEP - Mexico)
- 3.7 Programme for process control and computer-assisted systems (SENA - Colombia)
- 3.8 SENAI Play (SENAI - Brazil)
- 3.9 SIMP Virtual Workbench (IFRS - Brazil)



3.1 B³AUS – BIM-based construction training

How can future skilled workers be better prepared for the changes in construction site procedures due to the arrival of BIM-based tools? The project addressed this question.

Since September 2020, the six project partners had been looking in detail at the low-threshold introduction of Building Information Modelling's (BIM) holistic and collaborative working method into inter-company training. To support this, BIM-based learning, working and design tasks are being developed and used for the 19 main construction occupations. Selected BIM-based tools such as the common data environment (CDE), building information model (BIM model), 3D viewer, and robotic total station were made accessible and easy to understand as learning media via digital end devices (tablets and interactive boards). Experience and expertise were incorporated into a guide and example application tasks. These are likely to have huge appeal to construction training centres which are interested.

What has been developed?

The project was successfully completed in June 2023 and the results are already indicating a sustained impact at the locations of the project partners. One reason for this is because a network has been created that is pursuing the idea and the potential uses of BIM-based learning, working and design tasks at the participating inter-company learning locations in Rostock, Brandenburg an der Havel, Hamm, Mannheim, Holleben, and Dresden. On the other hand, the project results, which are freely accessible and which comprise:

- guide and work materials
- 79 BIM models and
- example learning, working and design tasks for different main construction occupations

are helping the training staff at other inter-company construction training centres to make their own way in the developing and establishing of BIM-based learning, working and design tasks.



"If we use these technologies in inter-company training, the trainees will transfer this knowledge into the companies."

*B³ AUS project team,
Germany*

Main objectives

- Introduce BIM at a low threshold level into construction training
- Develop learning, working and design tasks.
- Provide training personnel with the necessary skills
- Facilitate transfer of findings across Germany

The added value for TVET practice must be identifiable!

The guide supports training staff methodologically and didactically in introducing BIM into inter-company training. The BIM models are divided thematically into the three areas of civil engineering, structural engineering and interior construction and the main construction occupations associated with these areas. Trade-specific work orders form the basis of the BIM models for all end devices used.

In civil engineering, for example, the BIM models of a road layout with pavement are analysed using the 3D viewer. The information included regarding materials and quantities is incorporated into the work planning for putting the kerb into place and creating the paved area. When checking the work results, information from the BIM model regarding dimensional accuracy and material usage is included. Documents and photos support the process of understanding. They can be opened from the CDE and used to implement the work order. The results and four explanatory videos are available for download on the Bau Bildung Sachsen e. V. project website.

It is important to precisely clarify the intended use of the BIM model in order to create the necessary graphical information (geometry and details) and non-graphical information (component and material designations) when preparing the model. When providing



training to training personnel, training courses on the use and application of the BIM-based tool have been shown to clarify and highlight a clear practical relevance as well as the use in inter-company training. While the trainees are engaging with and using the tools informally, they need guidance and moderation to ensure they do not “lose themselves in trying things out” and instead focus on the purpose of the tool which is to fulfil the work order. In order to facilitate the use of the BIM-based learning, working and design tasks and to make access to the BIM models and training documents easier for training staff and for trainees, these are to be included in future in the learning offer of the e-Construction Academy des Bau Bildung Sachsen e. V.

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e-Construction Academy:

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Project results:

<https://bau-bildung.de/projekte/nationale-projekte/b3aus/projektergebnisse>





INATEC
Tecnológico Nacional



National Technical and
Technological Institute – INATEC,
Nicaragua

“The implementation of the B-Learning mode in technical education allows us to take a significant step towards digital transformation.”

INATEC,
Nicaragua

3.2 Online Learning Platform: B-Learning Mode

Transversal modules provided in the virtual mode enable teaching and learning for all technical professions and provide all students with the opportunity to interact with an online learning platform.

The B-Learning mode is being implemented by the National Technical and Technological Institute (Instituto Nacional Técnico y Tecnológico, INATEC), founded in 1991 as the governing body of technical education and vocational training (ETFP) in Nicaragua. It currently has a national network of 61 technological centres throughout the country, which offer 70 technical study Programmes and train 45,000 professional technicians and 450,000 people in training courses each year. Technical education is free in Nicaragua, as is basic and higher education.

What has been developed?

The online learning platform is a combination of the development of transversal skills for work and life and the use of technology in training processes. This is ensured by each technology centre through ICT (Innovation, Creativity & Technology) teachers who provide technical and methodological support to students and use the virtual platform to encourage creativity, innovation and the use of technologies.

The main tools used for the development of the B-Learning Mode are the virtual campus and the language learning platform. The virtual campus is implemented in the Learning Management System, Moodle, and integrated with INATEC's academic system. In this campus, virtual classrooms are created for the development of transversal modules. These classrooms contain learning material, discussion forums, self-assessment activities, grading systems, reporting systems, etc. that allow the progress of students to be managed through the mediation of ICT teachers from each technology centre.

INATEC has adopted the ADDIE (Analysis, Design, Development, Implementation and Evaluation) instructional design methodology for the training offer in virtual format, as well as the skill-based learning model. For the evaluation of virtual courses and careers, homework submissions, collaborative work, forums, questionnaires and feedback from virtual tutors are used.

Main objectives

- To implement integral training
- To move towards digital transformation
- To promote the development of digital skills
- To support the teaching staff

Key factors for the success of the format!

The virtual campus is not only a repository of information, but a well-organized system for the management of online training processes, consistent with the skill-based model of technical education and for human development.



As the primary outcome, 100% of technical education students have been able to interact with technologies in their training process, in the first instance, a platform for virtual learning that influences the development of digital skills corresponding to the ICT skills framework according to UNESCO: Understanding the role of ICT in education, curriculum and evaluation, pedagogy, the application of digital skills, organization and administration, and the professional learning of teachers. The implementation of these tools has led INATEC to strengthen the teaching staff and work teams that manage the platforms. Initially, the challenge was to achieve the integration of all the students.

Key factors contributing to the success of the implementation of the B-Learning mode using the virtual campus include:

- ✓ technological tools,
- ✓ trained teachers, and
- ✓ e-learning methodology consistent with the training model.

The next steps and challenges for INATEC are to integrate new technologies such as simulators and virtual and augmented reality in the learning processes of technical VET, and to continue to reap the benefits of promoting the use of technology, innovation and creativity, where, for example students of technical education, have excelled in national events such as Hackathon Nicaragua and the National Rally of Innovation Nicaragua.

Contact

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Platform website:

<https://campus.tecnacional.edu.ni>



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QUERO TESTAR GRÁTIS



DEVstart

"After all, programming requires patience and repetition. Practice is the key. Practise as much as you can and celebrate every victory on this exciting journey that starts now."

SENAI Santa Catarina,
Brazil

3.3 DEVstart

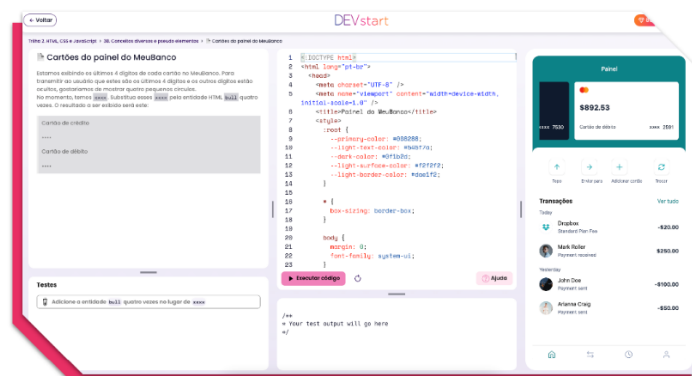
DEVstart is a complete educational ecosystem that trains, connects and sets students on a path to success in the field of front-end development.

The platform adds technical value to training and careers by combining a gamified platform, instant feedback with Artificial Intelligence (AI), cinematic videos, and connections from active networking among the community. The programme offers an immersive, practical and challenging experience in the world of technology for students to achieve the desired proficiency, whether they are young people starting out on their professional journey or people looking to change their careers, both of which take place in a constantly evolving technological environment.

What has been developed?

DEVstart is a platform offering rich educational experiences that provide learning and training in front-end software development. With an average learning commitment of 240 hours, the student turns theory into action, ensuring that each concept taught is immediately put into practice to improve their programming skills. As a platform that allows continuous learning through videos, polls or "hands-on" activities, one of its notable features is the use of a sophisticated Artificial Intelligence (AI) that acts as a virtual tutor. It provides students with real-time corrections and feedback on exercises, which encourages them to take the lead in their own learning. El recorrido del alumno se divide en tres vías:

- 1) Programming logic
- 2) HTML and CSS and Javascript
- 3) React: one of the main front-end development frameworks



At the end of each part, the student must develop a "Certification Project", publish it on GitHub, and receive a score higher than 7. This ensures that the student has developed the skills required for certification and that they are also able to create projects that can be used as a portfolio during the next stages of their career.

Main objectices

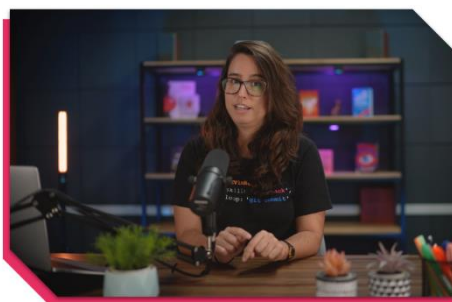
- Offer an immersive, practical and challenging experience
- Turn theory into action
- Create job opportunities in front-end development
- Align learning with the demands of the technology market

DEVstart courses are recognised by companies

DEVstart has become known in the educational world not only for its innovative pedagogical proposal, but also for its tangible results. With more than 3,000 students already having passed through the platform, it's meaningful impact on their professional trajectories is visible. One example of this success is the growing number of students who have found jobs in front-end development after completing the course, or who have obtained salary increases or promotions by changing careers. This proves the effectiveness of DEVstart's methodology and technological tools, which are a dynamic and constantly improving solution for training the new generation of front-end professionals.

Its efficient use of asynchronous content with moments for synchronous interaction is a notable feature. DEVstart is an intuitive platform that respects the student's pace and connects them to a community where they can network (Discord), take part in live streams, ask questions, and expand their tech knowledge. The constant evolution of technologies increases the necessity of frequent updates, from the platform's backend to the search for a good user experience, and this means we must remain up-to-date at all times and aware of all the digital traceability that students leave on the platform.

The project will be further developed according to the needs of the users, and tested and implemented on a daily basis, thus reflecting DEVstart's commitment to staying at the forefront of the best digital educational practices and its alignment with the professional demands of the technology market. Examples of future improvements include creating an interactive notebook and advanced interaction options in the video player. These improvements will facilitate a richer and more engaging learning experience, with personalised guidance to deepen each student's individual learning experience in DEVstart.



This culture of continuous innovation enriches the students' learning experience and reaffirms DEVstart's position as a technologically advanced course that leaves a lasting impression on the CV of every participating student.

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IT4ME

GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung

"Skilled workers are increasingly working with digital processes such as 3D scanning, 3D printing and automated systems. They are required to master programming languages, set up and maintain IT systems, and remedy irregularities. IT4ME delivers the foundations for these digital competencies in a two-week additional module."

IT4ME project team,
Germany

3.4 IT4ME: IT competencies for metal working and electrical occupations

Technische Akademie Nord e.V., a not-for-profit training organisation in the north of Germany, is developing IT-related additional modules to ensure trainees in the metal working and electrical sector are ideally prepared to meet the requirements of Industry 4.0.

The aim of the IT4ME project was to transfer future competencies in the IT sector to metalworking and electrical occupations and to integrate these in the form of an additional module in existing training curricula. As part of the planning, piloting and integration of the new IT training occupation in the TAN training portfolio, it was anticipated that its broad-based nature would offer a range of different opportunities for developing content for the design of the additional module. A combination involving the additional qualifications of additive manufacturing and robotics (programming) was also intended to meet the requirement of incorporating future technologies and their potential networking in company-based processes.

What has been developed?

The most significant outcome from the project was development of the IT4ME module. The module's schedule comprises two days of networking basics, three days of robotics and four days of additive manufacturing. Lecturers with different specialisms were involved in the development. The robotics sub-module is a specific technological innovation. Thanks to the robot arms, Calliopes and Calli:bots which have been purchased, and the developed and existing competencies in this area, interested students and trainees can now also be introduced to the robotics topic outside of the module. This is also of particular interest in the context of the many existing STEM projects run by the Technische Akademie Nord.

The purchase of the MetaQuest VR goggles and the developed VR application are a real benefit to the training centre. Employees at the training centre had previously also not been very familiar with virtual reality technology. Looking ahead, the developed application has provided an important foundation for placing a greater focus on such future technology and for integrating the use of this into inter-company training.



Main objectives

- Adaptación de las profesiones del metal y la electricidad a la Industria 4.0.
- Ampliación de la propia cartera de cursos
- Ensayo de la RV como método de enseñanza/aprendizaje
- Integración de las tecnologías del futuro en los procesos empresariales

All good things come in threes!

A clear structure in three modules meant that the basic principles and practical skills could be delivered in a targeted way. The varied materials helped to ensure that trainees were able to understand the content both independently and in a group context. Flexible provision of the modules at different locations made it widely accessible for trainees in different regions.

The project's main challenges involved reducing the content and coordinating requirements in the three specialist areas. This required intensive coordination to ensure that the knowledge delivered met the digitalisation requirements in the various faculties. Achieving a balance between broad basic knowledge and specific specialist content was a constant challenge.



Although the modules can be booked individually, it is recommended that participants complete all of them. The combination of the basic principles, applications in practice and professional integration leads to a full understanding of the digital world, which develops via a holistic approach.

When using the booking tool, it should be noted that this needs a

thorough introduction and training in order to ensure it can be used without any problems. Clear communication regarding flexibility of the booking options is essential so that customers are able to select modules according to their requirements.

The developed modules can now be offered as a standalone training programme for trainees and are also accessible to external customers as part of continuing education measures. The insights gained from the project can be used as the basis for developing further training offers focusing on more specific digitalisation topics. The tools and methods could also be applied in other training sectors in order to provide broader support for digital competencies.

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3.5 The LUMIS Campus

The LUMIS Campus offers a digital all-in-one learning ecosystem. Users are able to switch seamlessly between different resources and applications via a single sign-on .

The LUMIS Campus combines a range of different digital solutions and offers all user groups a broad-based learning experience ranging from e-learning in the LMS (such as Web Based Training, Explainity or Quiz) to virtual learning scenarios (customisable for teachers via a 3D library or even pre-packaged) and immersive events/exhibitions using an individual avatar. This is accessed via a single sign-on procedure, the choice of either PC or VR goggles, and in multiplayer mode.

What has been developed?

The LUMIS Campus has been developed in order to adapt vocational education and training to the changing requirements of the world of work. It aims to meet learners' current and future needs digitally by creating a flexible, varied and future-oriented learning environment.

The tools include a learning management system based on Moodle, a VR space including the campus, learning spaces, an exhibition area and event location as well as VR learning scenarios. Teaching staff are able to create these learning spaces themselves and can access the 3D library. The VR scenarios enable trainees and skilled workers to train in real 3D work situations.

The LUMIS Campus was created as part of the InnoVET project "Alliance for Vocational Education and Training in Eastern Bavaria" (ABBO). The system aims to revolutionise vocational education and training by combining different technologies and standalone solutions including a learning management system (LMS), VR learning scenarios, a virtual exhibition, virtual events and a virtual campus environment.

The tools developed create significant added value for practice by offering a broad selection of learning opportunities from e-learning in the LMS to virtual learning scenarios and immersive events and exhibitions. The VR scenarios in particular enable trainees to practise in realistic work situations without risks, which would be difficult and also expensive to implement in the real world. Companies are able to use the exhibition area to showcase themselves at career orientation events and attract potential trainees. The digital learning ecosystem also facilitates flexible and individualised training as well as cooperation between different training stakeholders.



"We've been to lots of exhibitions over the last two years and have seen that so far only standalone solutions are available. There are learning management systems, VR environments and AR scenarios. However, there is no system that brings everything together in the way that our LUMIS Campus does. We are pioneering this!"

*ABBO project team,
Germany*

Main objectives

- **Integrate different standalone solutions**
- **Adapt vocational education and training to current requirements**
- **Create a flexible, varied and future-oriented learning environment**
- **Generate specific added value to support practice**
- **Encourage regional networking and digital cooperation between learning venues**

It's about getting everyone involved onboard!

The integration of different technologies and the creation of the LUMIS Campus worked well in the project. The virtual reality scenarios, the potential for teaching staff to create learning spaces for their individual requirements and the integration of different learning methods all achieved positive outcomes. The tools were received very positively by participants. Worth noting in particular are the user-friendliness, the motivating interactive elements and the flexibility when learning.



Communicating the extensive added value provided by the LUMIS Campus to the different user groups presented challenges. Companies were interested, however it was important to demonstrate the specific added value created for them, for instance with the example of the

virtual exhibition for attracting trainees. Concerns over the perceived effort involved in using e-learning, VR scenarios and virtual exhibitions also had to be addressed.

When using the tools, it is important to make sure that the range of functions and opportunities are communicated so that users are fully informed. It is important to support companies and schools and to ease their concerns by showing that the application of digital and virtual tools is not as difficult as it may seem and that specific support is offered.

Following the end of the project, there are a range of options available for the future use of the LUMIS Campus: The plan is for the LUMIS Campus to be used widely for schools and companies in the Upper Palatinate region and beyond. The learning ecosystem is to be developed and adapted to new requirements. The findings from the project might also serve as the basis for further innovations in vocational education and training. Another aim is to further improve products and tools and to transfer these to other educational institutions. The project team is seeking to sustainably integrate digital learning environments in VET.

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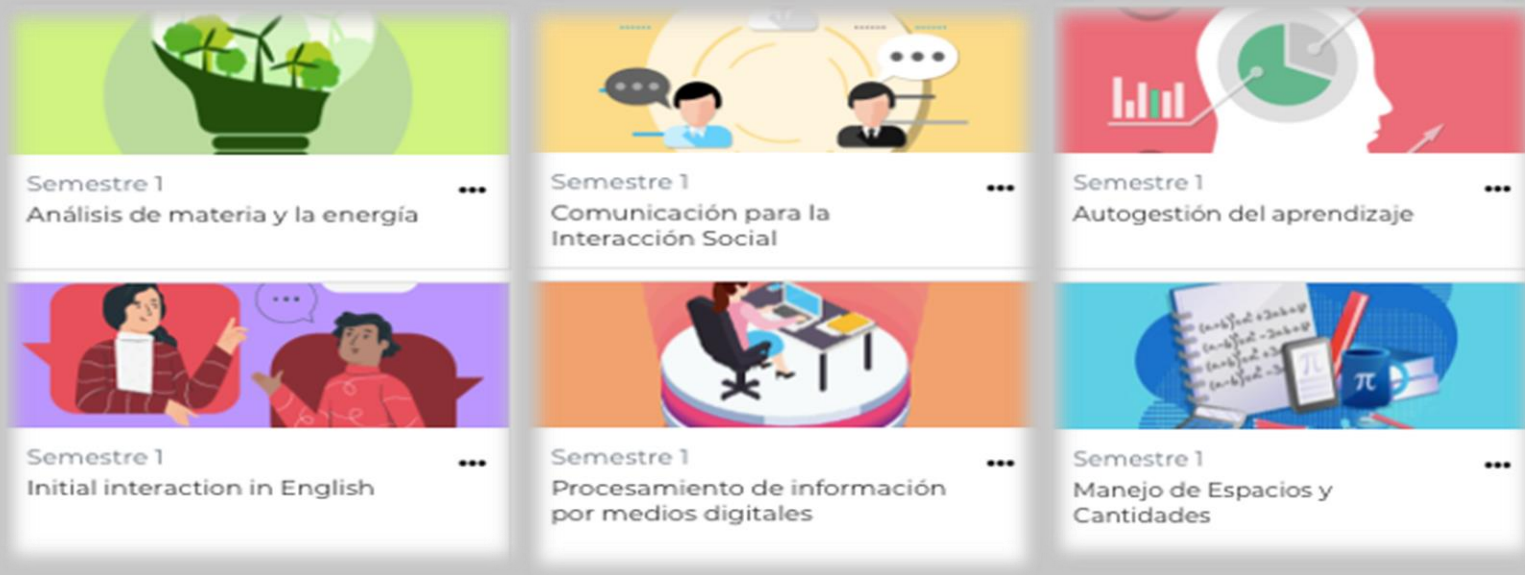
Project homepage:

<https://abbo.de/>

Quote source:

https://www.innovet.de/innovet/de/aktuelles/ABBO_LUMIS_Campus.html





3.6 Knowledge Management Platform

The platform allows the use of digital media and information and communication technologies for the interaction between students and teachers at the National College of Technical Professional Education, CONALEP.

Created at CONALEP during the first semester of 2020, the platform enables a non-face-to-face teaching-learning process and is available in Mexico to a student population of around 300,000, mostly aged between 15 and 18 with medium to low socio-economic status.

What has been developed?

Digital resources have been created within the platform according to an instructional design suited to the format, cognitive level and communication infrastructure available to the target group of both students and teachers, while taking into account the existing telecommunications gaps in some regions where students are located. Priority has been given to the use of the school's existing IT infrastructure to avoid additional costs. The strategy chosen for the implementation of the digital platform and the distribution of learning content, with a minimum of essential content that corresponds to a specific curriculum, consists of tools based on a Learning Management System (LMS) that serves the 63 technical professions of the CONALEP system, both in the basic disciplinary training and in the professional component.

For the creation of the digital materials, based on the curricula and suited to the format, teachers from the college with outstanding digital skills were invited to form teams or instructional production teams composed of two or three expert teachers, one educator and one advisor for the design of the experience. The team from the Applied Technologies department converted the instructional design documents produced by the teams into digital resources, which were placed in the LMS, where the structure of groups by subject already existed and included teachers, students and campus monitors.



Colegio Nacional de Educación
Profesional Técnica – CONALEP

"It is clear that students prefer the use of these digital platforms, such as the Knowledge Management platform, rather than classes via video conferences."

CONALEP,
México

Main objectives

- To promote learning through digital platforms
- To increase interaction between students and teachers
- To increase the effectiveness of technical education
- To facilitate access to an easy-to-use tool

Web environment encourages autonomous learning!

For the distribution and means of interaction between the roles in the teaching-learning environment, an LMS (Learning Management System) in a web environment based on Moodle was made available. It can be accessed from various devices, ensuring moderate data transfer to accommodate the reduced connectivity conditions among some of the student population, and it fulfils the purpose of creating, reviewing, managing, distributing, and administering all content and activities related to e-learning training, a hybrid learning scheme, or as a complement to in-person sessions. The platform was installed on the school's existing infrastructure, so there were no additional costs. This technology applied to education makes the classroom experience much more effective, either through self-study prior to the classroom session or with the subsequent reinforcement of knowledge and/or skills. In addition to being an easy-to-implement tool, the LMS significantly improves the learning experience for the target students.

All the modules (subjects) of the basic disciplinary training – a common core for all the study programmes – were implemented, in addition to 36% of the vocational education and training modules. The use of the platform was initially spread over three consecutive semesters, with teachers and students studying almost entirely from home, and was extended over several semesters with staggered or partial attendance at college's 313 campuses. At least 33% of the student population adopted the platform, including the population of the south-eastern state of Oaxaca with a high digital divide and poor internet connectivity due to its rugged terrain, as well as the border state of Baja California, with five of the six campuses at locations bordering the United States of America. It was found that the socio-economic conditions of the target population are not a determinant limiting factor for the adoption of content distribution through the LMS platform; however, the possession of devices and an Internet connection does favour an increase in the time available for studying through the medium.



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3.7 Programme for process control and computer-assisted systems

Technical-pedagogical platform made up of different educational facilities that emulate industrial processes, computer equipment connected in a network, a local network and a WAN network that allows access to the training platform from anywhere in the world.

The Centre for Electricity and Industrial Automation (Centro de Electricidad y Automatización Industrial, CEAI) of the National Education Service (Servicio Nacional de Aprendizaje, SENA) has been promoting a common training programme in process control and computerised systems for fifteen years. The programme uses a technical platform that includes a remote access teaching system to carry out the training activities, in combination with a management platform to manage user access. The platform has been used continuously for both the certified and supplementary training programmes. The agreement between SENA and the Japanese government through its cooperation agency JICA, signed in 2005, allowed for five annual courses on “Supervision and Fully Integrated Automation”, with the participation of 44 partner institutions from 13 Latin American countries. This agreement helped CEAI improve its vocational education and training, and, after the international course, the joint training programme was created, ensuring the continuity and development of training activities at CEAI, both nationally and internationally.

What has been developed?

The joint training programme facilitates the creation and implementation of collaborative learning activities between CEAI-SENA teachers and external partners. These activities, proposed by the associated teacher and the CEAI trainer, aim to enhance the training activities by integrating web technology resources with industry-related learning processes. Video conferencing is used to present activities, exchange concepts and communicate with the educational facilities remotely accessing the computer equipment available in the CEAI training workshops.



Servicio Nacional de Aprendizaje,
Colombia

“This online interaction goes beyond remote access to simulation equipment, allowing for a dynamic exchange of ideas and learning objectives.”

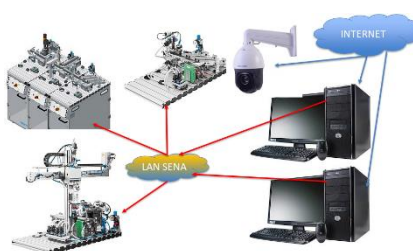
*SENA Valle del Cauca,
Colombia*

Main objectives

- To promote collaborative learning
- To integrate technological resources into the learning process
- To facilitate remote access to simulation equipment
- To strengthen and standardise training activities

A programme with an international dimension!

For the development of training activities, access is provided to one of the computers available in the training environment. These computers contain the learning guides that allow the proposed activities to be implemented, as well as the necessary computer applications to realise automation and control strategies in the teaching facilities.



An innovative training strategy implemented by SENA has strengthened and standardised training activities at national level. In the Valle del Cauca region, 10 groups of 25 students have been trained as industrial automation technologists in two of the 10 training centres in the region. In addition, 100 instructors in the electronics and automation network of 12 training centres have been trained; this network is made up of 31 training centres. SENA's training offer has expanded internationally, providing training in industrial automation to counterpart institutions in Chile, Paraguay, Uruguay and Nicaragua. At the international level, around 300 engineering students from the institutions involved in the joint training programme have been trained, with a significant resulting impact.

After fifteen years of consolidation of the joint training programme, the creation of an interdisciplinary team was essential to implement the technical-pedagogical platform and develop the necessary curriculum. One of the initial challenges was to obtain a public IP to allow external access to the platform; the necessary communication platform is now in place. Although the programme is consolidated, it is expected that more Latin American training institutions will be involved in the near future. It is recommended that the communication and training units of the participating institutions work together to multiply this type of programme, thereby recognising the importance of communication structures in vocational education and training.



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"This project was a pioneer in the use of video, podcast and WhatsApp resources at SENAI, setting a precedent in the institution's history and guaranteeing the security of user data in compliance with the General Data Protection Act."

*SENAI Play Team,
Brazil*

3.8 SENAI Play – Hit play on your learning journey

SENAI has developed a free platform with vocational education and training micro-courses and mini-courses with the aim of making learning accessible to everyone and allowing students to study from anywhere.

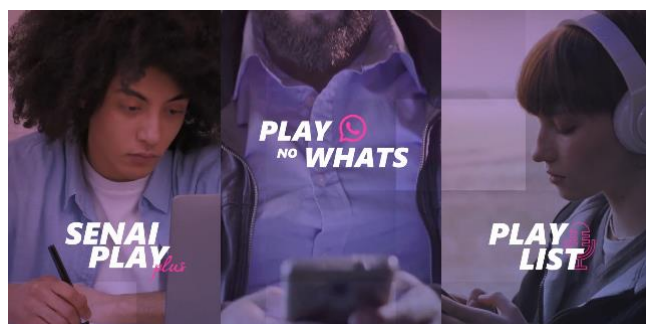
SENAI Play uses technology to provide student-centred learning, with courses featuring gamification that are accessible from any device and place. This student environment allows users to learn at their own pace and according to their needs.

What has been developed?

The SENAI Play platform offers a modern and dynamic approach to learning. Micro-courses of up to 10 hours and mini-courses, which are learning programmes of up to 60 hours in length, are provided in the form of "knowledge pills". These are assessed by questions in which the student needs to achieve a 70% mark in order to obtain a certificate and a digital medal, both endorsed by SENAI and recognised by the industry.

The platform offers three different course formats. Play Plus offers microlearning with short, practical videos for those who prefer to learn quickly and efficiently. "Play no Whats" is a course accessible via WhatsApp, allowing students to study from anywhere and interact with Cadu, SENAI's chatbot. For podcast lovers, "Play List" offers courses in audio format, available on the main podcast platforms such as Spotify and Amazon Music.

In addition, SENAI Play features elements of gamification, allowing students to accumulate points with each achievement, by means of Experience Points (XP) and digital medals protected by blockchain technology. These points can be exchanged for digital rewards in the form of SENAI Coins, SENAI's digital currency.



The digital environment provides an experience personalised by artificial intelligence (AI), which recommends courses based on the user's habits on the platform and their interests. This technology is also used to generate the questions.

Main objectives

- Provide a user-centred learning experience
- Promote democratisation of access
- Facilitate the dissemination of knowledge in various industry segments
- Offer a variety of professional education courses
- Encourage student engagement through gamification elements

SENAI Play – Learning becomes a game!

Since its launch, the platform has been well received by students, who have taken advantage of the opportunity to access content for free and flexibly. More than 130,000 students currently have access to content in line with the market. The quality of the courses on offer has been one of SENAI Play's main attractions. The “knowledge pills” have allowed students to deepen their knowledge, while the micro and mini-course formats have provided more dynamic learning. The gamification elements incorporated into the platform have also contributed to student engagement, which reached 95 per cent in 2023. The possibility of accumulating points and exchanging them for rewards has encouraged active and continuous user participation on the platform.



The variety of course formats offered by the platform is one of the project's main strengths. The flexibility of choosing between courses via WhatsApp, videos and podcasts has made it possible to cater for a wide range of learning preferences.

Another highlight is the dynamic nature of digital learning. User preferences can change quickly, and the platform is able to adapt to these changes with AI.

As the project progresses, the platform is constantly being updated based on new technologies. However, ensuring that the content remains relevant in all course formats is a challenge as the market is constantly being updated.

One of the focuses is AI, which can help personalise the student experience. There are plans to develop AI functionalities to provide real-time feedback, help assess student progress, and identify areas where they may need more practical support.

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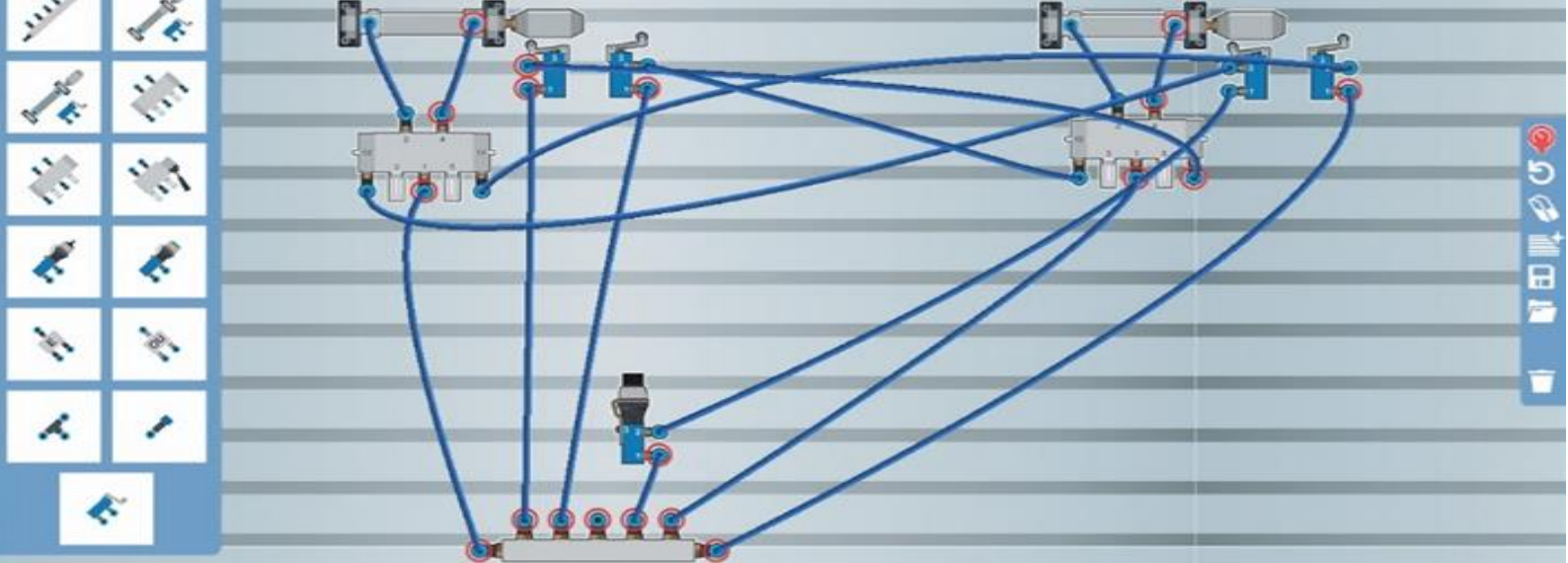
SENAI website:

<https://www.portaldaindustria.com.br/senai/>

SENAI Play page:

www.senaiplay.com.br





3.9 SIMP Virtual Bench

Simulator of pneumatic systems (SP), electro-pneumatic systems (SE) and electrical controls (CE) for driving motors and other automation controls based on Digital Twin technology.

The Virtual Pneumatics Simulator “SIMP” is used to teach students of all levels about industrial robotics. It is user-friendly and easily deployable for people with physical disabilities due to its use of assistive technologies. It is easy to implement on computers and features extensive bibliographic and video support material.

What has been developed?

SIMP is a digital platform that simulates on a PC the conventional teaching benches used for the teaching/learning process of SP, SE, CE and automation technologies, and can be extended to hydraulic systems and drives. It was developed in partnership between the Industrial Technical College of Santa Maria (CTISM) and the Federal University of Santa Maria (UFSM) with the aim of meeting the distance-learning demands of these educational institutions.

Its potential was later identified in face-to-face classes, where it complemented practical exercises on physical teaching benches, as well as during the COVID-19 pandemic, reaching students who could not attend classes in person. SIMP can assist in the technological development of regions or countries with few resources, allowing small investments to be made safely due to the knowledge acquired with these automation technologies. It has a customisable appearance, and its graphics can be adapted to the needs of each institution or country. This makes it easier to understand how the technologies it features are practically applied, as all the devices used are accessible in menus on the SIMP screen.



"SIMP can also be used by students with physical disabilities (except visual impairments) who are unable to operate physical benches, as in the case of students with no arms who were able to understand and master pneumatic controls using SIMP."

CTISM/UFSM,
Rio Grande do Sul,
Brazil

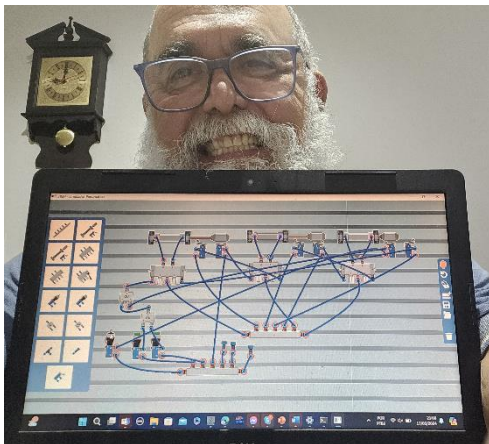
Main objectives

- To facilitate learning the fundamentals of automation and robotics on an individual basis.
- To motivate teachers and students in teaching and learning with simulations.
- To avoid installation defects or physical risks during the learning phase.
- To facilitate access to the tool for people with physical disabilities.

An inclusive simulator that is flexible in time and place

SIMP has been deployed in various classes at CTISM to more than 1,500 regular students from various technical courses in biannual curricular components since 2009 and has spread throughout Brazil and other Latin American countries in its simplified model, i.e. basic pneumatics only, as free software. The simulator offers students or professionals in the industrial technical field the option to study anywhere with access to a computer at a time that suits them, unlike the physical teaching benches that are only available at school and by appointment, making it impossible for students to find solutions to proposed problems in a low-noise environment, which is necessary for students with Autism Spectrum Disorder (ASD), for example. SIMP has successfully gone beyond the limits of CTISM and UFSM and is reaching more institutions every day.

In its original version, SIMP is a real success, being distributed free of charge to a hundred institutions in Brazil and Latin America. Although the initial objective was



to serve distance learning only, due to the impossibility of moving the physical teaching benches, SIMP was then used in pneumatic automation courses at CTISM and distributed to other institutions. It operated safely, just like a physical teaching bench, even indicating issues such as leaks and, pressure drops due to inadequate connection. SIMP can be seen as an ideal tool for teaching automation systems either alone or in combination with physical teaching benches. In subjects where the

assembly of a physical circuit was required, for example, students who were unable to attend face-to-face practical classes passed by studying exclusively with SIMP and successfully assembling the pneumatic circuit on the physical bench. SIMP is constantly evolving, with its simplest application available free of charge, as well as three modules covering SP, SE and CE. There are also plans to serve the process controller (PLC), three-phase motor frequency controllers, and hydraulic systems segments.

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4. Conclusion – practical application can deliver great added value!

In times of transformation, vocational education and training also always involves an exciting search for good ideas for your own practice. This publication is intended to offer exactly that. It provides a pool of excellent, innovative and attractive examples from practice which readers can adapt to their own work environment while also focussing on the opportunities and challenges that come with using digital applications.

Learning by example is a core human capability and an indispensable pedagogical tool. As an editorial team, we hope that we have put together a publication that will promote learning.

Three international roadshows focussing on digital media in vocational education and training are now behind us. Looking back, these were successful events which set out to enable participants to experience digital solutions to the challenges of VET practice on the basis of selected examples from around the world. Central to the events was the active engagement with the digital applications as well as participants having direct contact with product developers.

In addition to the five examples from practice from the third international roadshow in Brasilia, this publication includes six further examples from Latin America and three examples from Germany. These represent a broad range of ideas and approaches for innovative solutions for VET. The examples show how the use of digital technologies:

- ... enhances vocational competencies flexibly in terms of timing and location
- ... provides a more precise representation of the reality in the profession
- ... develops specific competencies in a protected context
- ... supports exchange between relevant stakeholders in the training process.

Looking ahead – what happens next with the international roadshow?

Vocational education and training depends on the close link between development and practical application.

This is precisely where the international roadshow “Digital media in vocational education and training” comes in. Over recent years, the format has developed into a worldwide flagship for excellent international VET and will continue to do so. The next international roadshow is due to take place in 2025. We would like to invite you, our readers, to participate. Please bring along your own examples from practice and share these with the other participants. Contact us if your institution is interested in being involved. The open exchange of ideas is a key strength in our societies and, as an institution, our declared aim is to promote this wherever we can. We hope we have been able to get you interested in trialling digital applications and integrating them within your professional practice. Please do not hesitate to contact the individual project managers or contact us directly. Please send any feedback to: internationalroadshow@bibb.de.

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