

Press release**Technische Universität Berlin****Stefanie Terp**

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<http://idw-online.de/en/news798157>Studies and teaching, Transfer of Science or Research
Energy, Environment / ecology, Oceanology / climate, Teaching / education
transregional, national**TU Berlin: VR game MARLA enables vocational students to improve their fault diagnosis skills****Virtual reality (VR) enables vocational students to improve their fault diagnosis skills**

Researchers at Technische Universität Berlin have developed a virtual reality game enabling metal technology and electrical engineering trainees to practice conducting repairs on an offshore wind turbine plant under realistic conditions. “MARLA – Masters of Malfunction” is an example of a serious game where vocational college trainees can work on their fault diagnosis skills in the safety of their classroom. The VR game was developed for the Oculus Quest headset and builds on the basic knowledge acquired in the first year of a vocational training. No expert knowledge of wind energy is required. Vocational colleges can now download the game for free.

Studies reveal that young technicians have insufficient mastery of a structured approach to fault diagnosis. They simply do not have enough experience. This is a problem also picked up on by instructors at vocational colleges who have expressed a desire for teaching material which includes authentic application scenarios for complete plants and facilities to provide better training for their students [1].

Locating and fixing faults

The goal of MARLA is to detect the causes of complex faults in the hydraulic breaking systems of offshore wind energy plants. This requires a systematic and logical approach. Using VR goggles, the trainees immerse themselves in a virtual experience without risk to either themselves or materials. They have to identify a sensor on a hydraulic diagram that has reported a fault, measure a control module to check that it is working properly, or fix a leaking connection point on the accumulator.

Greater scope for instructors

“Virtual tasks enable players to gain experience in strategic approaches to fault diagnosis, which they can then later apply in their work. At the same time, they get to experience the consequences of their attempted solutions,” says project leader Dr. Pia Spangenberg of the Chair of Economic Education and Sustainable Consumption at TU Berlin. “VR technology also allows instructors greater scope when planning and teaching their classes.”

Traveling by ship to the wind farm

In the VR game, the trainees take on the role of a wind energy specialist tasked with rectifying a fault in an offshore plant. Before heading to the wind farm by ship, the mission and basic operation of the plant are explained. They then conduct the individual steps of fault diagnosis on the off-shore plant. In the machine room at the top of the gondola, they check for possible causes of the fault and rectify/resolve it. And if they encounter any difficulties, their virtual colleague Alex is on hand to help them.

Alex the virtual workmate

“Alex serves as a pedagogical agent offering advice and support to the players and helping them to systematically diagnose faults. She initially takes on the role of a model and explains relevant steps and activities. However, as the game proceeds, the trainees increasingly take over the initiative themselves,” says learning psychologist Dr. Felix Kapp of the Chair of Human-Machine Systems at TU Berlin, which is responsible for evaluating the project. “MARLA does more than just motivate the trainees during the game. The experience gained in the VR environment is also great for building on in continuing education.”

The role of professional game developers

The application was developed and designed by project partner “the Good Evil,” a game studio based in Cologne. “As developer, it was important for us that the game is easy to use when conducting very complex fault diagnostic tasks,” says Linda Kruse, game developer and managing director of the Good Evil GmbH. “The operating concept is closely oriented to real activities in training, so that even beginners can quickly find their way into the game.” The initial evaluation shows that trainees learn about wind turbines and systematic fault diagnosis while playing MARLA, and that a virtual visit to a wind turbine increases their interest in the topic of wind energy [2]. Just under 200 trainees and students took part in workshops, including at the Oberstufenzentrum TIEM vocational college in Spandau, to actively develop and test out the game. “Trainees at vocational colleges generally don’t have the opportunity to enter a complete virtual plant to conduct a fault diagnosis. This is what makes MARLA a learning application of the future and one we are keen to integrate into our teaching,” says Arne Wahnfried, vocational college instructor and head of department at TIEM.

Didactic master plan

The VR game is integrated into a didactic master plan. This enables instructors to consolidate learning content on fault diagnosis using classroom tasks. The game's website includes didactic recommendations and teaching suggestions, a learning booklet, as well as assistance for dealing with technical issues related to the use of VR goggles in the classroom. To provide points of reference for classroom use, the game content was coordinated with the learning objectives of the vocational training curricula for metal technology and electrical engineering.

Triple recognition for MARLA

The prototype of the game already won the “AVRiL 2021” gold award from the Donors' Association for the Promotion of Sciences and Humanities in Germany, which honors effective learning scenarios in virtual and augmented reality. It was further nominated last year for the Science Award of the Deutsches Institut für Virtuelle Realitäten (DIVR) in the category “Best Concept.” On 23 June 2022, MARLA then received a Comenius EduMedia Award Medal from the Gesellschaft für Pädagogik, Information und Medien e.V. (GPI).

The final software is now available for download at <https://marla.tech>.

Project participants

The game and companion material were developed by a research cooperation group funded by the Federal Ministry of Education and Research. Cooperation partners include Technische Universität Berlin (project management and scientific support), the Good Evil (game development), the Koblenz Chamber of Trade (game distribution) and the Osnabrück-Emsland-Grafschaft Bentheim Chamber of Trade (game distribution). Vocational students from the Hein-Moeller Schule in Berlin as well as experts from the RWE Windpark Arkona were also involved in the conception. The didactic companion material was developed by Wissenschaftsladen Bonn e.V.

Further details:


Link to the game and further material: <https://marla.tech>

Sources:

[1] <https://www.journal-of-technical-education.de/index.php/joted/article/view/222>

[2] <https://link.springer.com/article/10.1007/s41449-022-00316-8#citeas>

Further information is available from:



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