

DIGITAL REALITY - TECHNOLOGY FOR SUSTAINABLE SKILLS DEVELOPMENT IN VOCATIONAL EDUCATION AND TRAINING

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Abstract

Increasingly the market demands innovative pedagogical approaches to the ever-changing industry. At the same time, teaching and learning must follow the growing needs, with innovative pedagogical approaches that will increase the quality and attractiveness of Vocational, Education and Training (VET). This is transversal to existing and/or newly created professions.

The choice of virtual tools can provide a solution to keep up with the pace of market demands. The use of Digital Reality (DR) technologies such as Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MX) and Extended Reality (XR), will allow students and trainees to complete a real task with simulated tools or in a simulated environment that mirrors reality. For this to be possible, it is necessary to develop a pedagogical approach and methodology for DR and VET tools with the possibility of international transferability in all areas of professional education. All this will strengthen the skills of teachers and trainers.

This paper will present the pedagogical and methodological approach that is being developed within the Erasmus + project, 2020-1-HR01-KA226-VET-094650, entitled: "Digital reality - the basis of skills training" (DRinVET). The development of the DRinVET project is based on many years of experience in the industry field working with DR technologies partner organisations, from the development of the environmental devices to pedagogical and methodological guidelines related to educational processes in welding.

Keywords: *Digital Reality, Skills Training, Vocational Education and Training*

1. INTRODUCTION

The impact that covid has had on several sectors has forced them to restructure in the face of this new reality. Education is no exception, many teachers and trainers had to adapt the way they were providing training and assessment to be delivered through online platforms, which, according to the Organisation for Economic Co-operation and Development report (December 2020), more than 60% have not learned to work in a digital environment. However, in vocational education, the problem is even more noticeable, especially when it comes to practical training and assessment. While online theoretical classes and assessment have been implemented, several students and trainees have been left without the opportunity to do the practical part in industry, training centres and schools due to the pandemic and anti-pandemic measures. Both challenges implied that wise solutions needed to be found to lessen these difficulties, primarily through accessible solutions for distance learning. In this sense, the Erasmus+ partnership project Digital reality – the basis of skills training or DRinVET for short, was created.

The DRinVET project partnership sees the solution, for practical training delivery and assessment in DR. In that sense, they are currently developing guidelines and tools to support teachers and trainers, who have found it challenging to adapt to the new digital environment, in overcoming their difficulties, allowing students and trainees to achieve a task using simulated instruments that reflect reality.

The guidelines and tools being developed aim to raise teachers' and trainers' competences and enable teaching processes that will safely lead towards the learning outcomes needed for the labour market, recurring to the pedagogy and methodology use of DR.

The DRinVET project involves 7 partners from 6 European countries – Croatia, Belgium, Hungary, Romania, Denmark and Spain – with different profiles and set of competences in the field of DR, such as an Association for the Promotion of Vocational Education, a Secondary Vocational School and a University, as experienced users of the DR tools, Companies that produce simulators based on DR technologies and a Virtual reality development agency.

The main purpose of the DRinVET project is to promote DR tools as a solution for distance learning, with the possibility of being applied to theoretical and practical teaching/training and assessment, which will be applicable to a variety of social crisis circumstances. Therefore, the goal is to develop tools and procedures that will allow teachers and trainers to acquire competencies to work in the DR environment, promoting learning through technology. Thus, the DRinVET partners are developing the following 6 Intellectual Outputs (IOs) throughout the project implementation:

- 1) Basics of digital reality: A handbook for teachers and trainers on how to use different virtual reality simulators for professional occupation in VET.
- 2) VET library of DR: A database of digital content creators/developers.
- 3) HOW TO...Best practice examples from VET digital classrooms across Europe (platform for knowledge exchange).
- 4) Pedagogical guidelines for learning and teaching using DR technologies.
- 5) Technical manual: Minimum conditions for education, training and testing in educational processes in virtual environment.
- 6) Guideline for online assessment: Tools and procedures to perform harmonized online assessment of learning gained through virtual environment.

As there are currently no solutions such as the ones offered by the DRinVET project, but an emergent need for their implementation, the partnership agreed to apply a "step by step" methodology through each phase of the project development, as in a step by step to the solution. Hence, all IOs are being developed according to this methodology, both internally and externally. Even though the project results are primarily intended for secondary vocational teachers, their students, high(er) VET education, adult education institutions with vocational characteristics, their trainers and trainees, and public authorities both at national and international levels, it is significant to emphasize that the pedagogical guidelines and tools being developed are general for DR, in order to ensure transferability. Therefore, their use will not be limited to vocational education.

2. EXPECTED RESULTS

2.1 Basics of digital reality

Basics of digital reality is a manual being developed for teachers and trainers, that will provide guidelines on how to use different DR simulators for occupation in VET. It will also provide training materials for the Instructor 2.0 and establish the different types of DR environments, such as XR, VR, AR, MR, among others, and its impact in the VET education. It will also contain recommendations and best practice examples for educators on how to select virtual technologies that can be most effectively integrated into their own education system; summarize and compare the advantages, disadvantages and possible limitations of different DR environments; provide recommendations to support the choice when it comes to selecting training tools according to the training needs; summarize and standardize the use of different simulators in VET; present what kind of VET areas can be addressed efficiently thanks to the use of DR technologies and how can they benefit in everyday vocational training and adult education; and formulate methods for what kind of pedagogical tools the educator can most effectively use to develop the skills of his/her students and trainees, thus exploiting the benefits of DR technologies.

2.2 VET library of DR

Mastering using digital skills is only one side of the coin. The other, which is much more time consuming, is choosing from the vast offering presenting itself on the internet. Hundreds and hundreds of hours have gone into the research and many more are to come. The teaching has moved online and will remain there for an unknown while and DR in all its forms has become the teacher's and trainer's best friend. Resorting to technology in teaching/learning, has become a standard. This is precisely why the educational world needs a database of digital content creators/developers (teachers/trainers/specialists) across Europe who can contribute to the development of digital training in the VET field through the elaboration of theoretical lessons materials, practical exercises, real life situations that can be simulated using AR/VR/MR/XR technologies, among others. The possibilities are endless. Such a database of people/institutions from all European countries, who have either theoretical knowledge about the topic, or who can develop content, would be highly beneficial to everyone involved in VET, be it on a secondary or higher level or even in the adult education. In other words, the target groups of this output are all the VET educators and providers across Europe. This database will not only prove itself very practical but will also save time since all the information one requires will be in one place. The only thing left to do will be to start the search across the categories. This is an innovative, practical and fast at the same time idea. Furthermore, there is a potential for cooperation between the industry and the education fields using the results from the database. As we

know, in the VET field the synergy between these two stakeholders is very important, since one cannot exist without the other. They complement each other, and in working together, they yield the best possible results.

2.3 HOW TO ...

HOW TO... is a handbook focused on the presentation of best practices in digital teaching and learning resorting to virtual classrooms, that will directly contribute to the implementation of digital platforms, that will target a wide range of digital tools dedicated to teaching, learning and assessing students in vocational schools. A strong emphasis will be placed on dedicated platforms such as examples of good practices using Google Classroom or Microsoft Teams, but also on dedicated open source, be spoke, or on-the self-learning management systems. The most used e-learning platforms will be summarized by country and among Europe in order to link them and to provide digital tools for teachers and students. With the covid pandemic, raised an important issue to the educational systems. According to OECD (2020) report related to the impact on education systems, the COVID-19 crisis has exposed the many inadequacies and inequities in our education systems – from access to the broadband and computers needed for online education, and the supportive environments needed to focus on learning, up to the misalignment between resources and needs. Previous reports of OECD also outlined that less than 40% of educators felt ready to use digital technologies in teaching with wide differences across the EU. Furthermore, although there are simulators that use technologies based on augmented reality or virtual reality, they can only be accessed by students inside the laboratories of the vocational school. No European country has been prepared for the transition from traditional face-to-face learning to online or blended learning, much less in the case of practical activities necessary for qualification in special trades such as welding. Therefore, the need to present the best practices in the activity of teaching/theoretical and practical learning is necessary for the improvement of the educational process in vocational schools that have not used digital tools so far. On the other hand, the digital skills of teachers and students are very important for the success of up taking the virtual learning environment in education process. According to JRC Technical Report of EU (2020) related to the impact of covid on education, the need for professional development in the area of ICT skills for teaching is also higher in schools with high concentration of disadvantaged students. The target groups are teachers, trainers, students and trainees. Teachers and trainers will benefit from concise information on how to employ the widely used digital tools, good practices applied in 2020 as a result of the translation of the educational system from the teaching, learning and face-to-face assessment environment to the digital and virtual environment. Students will be able to access online courses using their own phone, laptop or tablet. Teaching notes will be developed for teachers and trainees to provide them with harmonized digital competences focused on online learning management system, and virtual classrooms as well as simulators using augmented or virtual reality. These will support and comply with the Digital Education Plan outlined by the European Commission to make education and training systems to fit for the digital age. Also, the best practices developed will meet the needs for digitally competent and confident teachers and education and training staff as well as provide examples with high-quality learning content, user-friendly tools and secure platforms with respect privacy and ethical standards. These results are expected to have a major impact on the teaching and learning processes. The expected impact is to increase the digital skills development to VET learners and apprentices as well as to offer professional opportunities for teachers, trainers and other educational staff. The transferability potential is high, taking into consideration that the outputs will be focused on digital content, the best practices elaborated in these intellectual outputs can be easily transferred to other teaching and learning processes in various technical domains. The teacher from VET schools will be encouraged and assisted in their efforts to adopt project results.

2.4 Pedagogical guidelines

The purpose of this component is to describe and define the pedagogical guidelines for employing DR within teaching and learning. The special focus is on VET, but the guidelines are generic to ensure transferability. There are 4 main reasons for implementing DR in education, especially in VET, based on necessity and benefits:

2.4.1. The COVID-19 effect:

COVID-19 shut down most learning institutions, but most, despite initial challenges, managed to maintain a good portion of their educational offerings and deliver teaching and testing via online media platforms. However, VET is still suffering tremendously, since theoretical classes were maintained, but apprenticeships and internships were cancelled; practical exercises were made impossible; and VET students were prevented from taking their practical exams, thereby not being able to graduate. Various unions have advocated strongly for future-proofing VET, for instance via DR tools.

DR tools such as physical models that simulate the actual tool's behaviour, computer-based training models and Virtual and Augmented Reality versions of training environments, have shown enormous potential addressing the above problem, as it relates to the educational context. These tools enable the learners to perform the actual task either with a simulated tool or in a simulated environment mirroring reality. In this way students can still train their practical skills and even take exams. Some studies find no discrepancy between the skills practiced in a virtual versus a real environment.

In a January 2020 report by PwC* which compared traditional training with training in VR, found that , 1) learners in VR courses could be trained up to 4 times faster, 2) learners are more confident in applying what they've learned in VR, 3) learners are more emotionally connected with the materials, 4) VR learners are more focused and, 5) VR learning can be more cost-effective (less transport, less material usage, etc) and more accessible (no construction site is needed for instance).

In short, DR technologies show a valid tendency to increase learner outcome. This has been documented by, among others, Copenhagen University lecturer and researcher in VR and educational psychology, Guido Makransky, in several studies. However, it has been found to be equally important to establish a structure and process around DR inclusion. In some studies, VR when used alone, had no further effect than simply watching a video or movie. However, if combined with pre-teaching, VR were shown to have a better effect than all other technologies. This stresses the importance of establishing proper pedagogical guidelines, especially with the significant increase in online learning platforms (Udemy, Coursera, etc). Also, several reports outline a considerable growth in the desire for distance learning and the number of independent platforms (Coursera, Udemy, Smart Learning, etc) and established educational institutions that formally offer the possibility.

2.4.2 The social inclusion component:

As noted by Milan Zver on the report "Academic further and distance education as part of the European lifelong learning strategy", "poor access to educational opportunities can reduce people's competitiveness in the labour market and cause difficulties in their private life or even lead to permanent inertia, exclusion from society and, as we have seen in recent years, violent radicalisation, especially among the young, who are the most vulnerable in circumstances of risk." Accessibility of distance learning, especially in VET can help alleviate this problem, but in order to do this properly, a good pedagogy and methodology for the use of the DR tools, which does not currently exist, must be developed, which also has international transferability. In summary, results are not merely achieved by introducing digital tools in education, as shown in many different studies. The various tools must be integrated correctly in the pedagogical and educational models in order to reap the benefits. In turn, it is expected that distance education can and will become more inclusive and that VET education in general will be more solidly future proofed, for disturbances such as covid. These guidelines will be ensured via continued research and synthesis of state-of-the-art methodologies in combination with project findings.

2.5 Technical manual

The technical manual will describe the minimum necessary conditions for education, training and testing in educational processes in virtual environment. For its performance, all technical issues related to technologies applied to education will be considered: learning management system, virtual and augmented reality tools, multimedia and other educational applications with a view to improving teaching-learning processes. The real need to improve the quality of online VET, establishing the minimum requirements at a technical level to carry out the training experience successfully. The target group is represented by teachers and students. Teachers will have a greater knowledge of the educational resources, tools and applications that they can use in their courses to improve the teaching-learning processes. Students will be able to know, access and use a variety of motivating educational resources using a digital environment closer to their needs, considering that they live in a digital world. The inclusion of innovative tools to learn, teach, evaluate, test, and monitor student learning in virtual environments. With the creation of this technical manual, it is expected to take a step forward in improving the quality of these processes. By creating this handbook, the quality of the teaching and learning process in virtual environments will increase. Virtual training should not be a pdf repository where students practice e-reading but rather an opportunity to connect a variety of resources and tools to generate meaningful, motivating and successful teaching-learning experiences.

2.6 Guideline for online assessment

The development of this guideline and online tools aim to set rules to ensure the quality when performing assessment of digital/virtual learning outcomes. The guideline will describe the procedures and conditions

in which the online assessment shall be conducted and consider best-practices in the development of assessment tools, which will be in the form of case study projects, multiple choice questions, short essays, among others. The external review of the assessments will be organized to ensure that the standards of the assessments are consistent with the guideline and aligned with a harmonized implementation (meaning following the same quality criteria). This Guideline will support teachers and trainers in the development of online assessment, by providing the assessment template that can be used as reference for several qualifications and courses in order to facilitate their uptake by National VET and HE Systems. It will also be transferable since it will be used as a reference for a range of online trainings. Thus, contributing to a wider implementation across Europe.

3. CONCLUSIONS

The covid pandemic had a global impact on many sectors, being the one addressed in this paper education, especially VET. The main reason for this focus has to do with the fact that all classes were moved to the internet, in a period of uncertainty, where both teachers, trainers, and students, trainees had to adapt to a new teaching/learning reality. In the meantime, the DRinVET project was created by a partnership that commonly sees the solution for online training and assessment in DR. For this reason, in this project the partners involved are developing tools to help teachers and trainers, who have found it difficult to adapt to this new digital environment, overcome their difficulties, especially in terms of conducting and assessing practical training. In this way, students and trainees will experience the completion of a task using simulated tools that reflect reality. Hence, the DRinVET project is expected to have an immediate and long-term impact on vocational education, from the local, to the national and international levels. The project can also be considered a basis, because it will deliver tools that will provide all target groups with easier access to DR technologies; the foundations for further personal development of teachers, trainers, students and trainees; and the development of the educational organisations and institutions in which they work and learn. Teachers, trainers, students and trainees will learn how to learn with technology. This will allow them to dive into DR as experienced users and take part in the education and technology race.

4. REFERENCES

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