VRinSight GREEN PAPER

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BOOSTING VIRTUAL REALITY IN LEARNING

E.N.T.E.R.

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2020

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ABBREVIATIONS

2D	two-dimension
3D	three-dimension
AC	associated country
AI	artificial intelligence
API	application programming interface
AR	augmented reality
AT	Austria
ATM	automated teller machine
B2C	business to consumer
BE	Belgium
BETT Show	British Educational Training and Technology Show
BIM	building information modelling
CPI	Cyprus Pedagogical Institute
CY	Cyprus
DE	Germany
DG CNECT	Directorate General for Communications Networks, Content and Technology
DigCompEdu	Digital Competence Framework for Educators
DK	Denmark
DMA-SR	decision making and acting under stress and in high risk situations
DOF	degrees of freedom (3/three or 6/six DOF)
EC	European Commission
EDIHs	European Digital Innovation Hubs
EdTech	technology-supported education
EFL	English as a foreign language
EPUB	electronic publication
EQAVET	European Quality Assurance Reference Framework
EQF	European Qualification Framework
ERCIS	European Centre for Information Systems
ES	Spain
ESR	early stage researcher
EU	European Union
FHM	Fachhochschule des Mittelstands
FI	Finland
GR	Greece
H2020	Horizon 2020 (EU Framework Programme)
H&S	health and safety
HE	higher education
HEI	higher education institution
HMD	head-mounted display
HPC	high performance computing
HR	Croatia
HR(D)	human resources (development)
HVET	higher vocational education and training

ABBREVIATIONS

ICL	intercultural learning
ICT	information and communication technologies
IFC	industry foundation classes
IO	intellectual output (defined deliverable within the course of Erasmus+/KA 2 projects)
IT	Italy / information technology
K-12	from kindergarten to 12th grade, is an American expression that indicates the range of years of supported primary and secondary education
LEA	law enforcement agency
LT	Lithuania
MOOC	massive open online course
MR	mixed reality (VR and AR – same as XR)
MS	members states (of the EU)
NO	Norway
NWE	North-West Europe
OCT	overseas countries and territories
PBL	problem-based learning
PC	personal computer
PL	Poland
previs phase	pre-visualisation phase
PT	Portugal
QOE	quality of experience
RDF	resource description framework
RO	Romania
ROI	return on investment
SE	Sweden
SI	Slovenia
SLD	specific learning disorders
SME	small and medium-sized enterprise
SRIA	Strategic Research and Innovation Agenda
STEM	science, technology, engineering, mathematics
SVR	social virtual reality
SWOT	strengths, weaknesses, opportunities, threats
TR	Turkey
UK	United Kingdom
UX	user experience
VC	venture capital
VET	vocational education and training
VLE	virtual learning environments
VR	virtual reality
XR	extended reality (VR and AR – same as MR)

Europe's Long Road to Turning VR into Reality

Michael Schwaiger

In recent years, technologies that enhance or recreate real world environments are increasingly influencing the world of manufacturing. With virtual reality (VR; 2D/3D computer-generated immersive environments), augmented reality (AR; real world environments overlaid with computer-generated inputs) and the combination of both as well as their extension with other features (mixed reality/MR or extended reality/XR) it is possible to simulate almost any process carried out in the physical world – which includes within industry and commerce, ranging from customer service to marketing, finance, human resources (HR) and production. It can be observed that not only have VR/AR/XR technologies, services and offers improved rapidly, but at the same time application costs have also dropped dramatically. In the past, these technologies were only used primarily for the development of premier products due to their high costs, meaning that their use with lesser value products would have resulted in a lower return of investment (ROI). However, today, these technologies have become much more common in industry as their cost-effectiveness has increased significantly. Thus, the value of investing in VR/AR/XR has become much more broadly recognised within the manufacturing sector (Choi et. al., 2015).

Therefore, the global VR/AR/XR market is growing exponentially and is expected to reach €150 billion in 2020. This will have an enormous impact on many areas of the economy, HE and VET and this revolution is being reflected at many of major fairs and conferences, e.g. at the Hannover Messe/DE in the field of smart industry, at the BETT Show/UK for education, the University Industry Interaction Conference/FI for HE business cooperation and the EuroVR Conference to be held in Valencia/ES in November 2020 (at least as at early August 2020 no official cancellation had been published). Whether and how Covid-19 will determine the market development of VR/AR/XR technologies in general cannot be seriously predicted yet. Most experts expect a very positive effect on all IT technologies that enable communication, knowledge acquisition and transfer as well as entertainment in digital forms – as they do not require physical contact. A significant increase in the general awareness and acceptance of VR/AR/XR as serious tools in private, social and professional life can already be observed. This should lead to even greater investment in these technologies and the acquisition of extensive knowledge and skills concerning their application.

However, regardless of what influence Covid-19 will actually have on these developments, the central question within this context was already red-hot before these little invisible guests turned our lives upside down: how well are Europe's society and economy generally prepared for the Industry 4.0 challenge? Unfortunately, compared with its major global business competitors in the USA, China, Japan but also in South Korea and India, Europe has started slowly in utilising VR/AR/XR business and learning environments and is in danger of lagging further behind. The problem exists less amongst Europe's larger enterprises with

their high investment levels in technical equipment and HDR, but these only represent 0.7% of all European enterprises. The remaining 99.3% consists of SMEs, the backbone of Europe's economy, who generally experience greater difficulties in investing staff, time and financial resources in order to keep pace with ICT developments. (Eurostat, 2017)

A look at the situation in the partner countries confirms this finding. A good example is the situation in Germany, one of the largest economies in the world, where two of its main areas - manufacturing and engineering - are heavily affected by smart industry. 99% of German industry is represented by SMEs and they are not well prepared for this challenge. Paradoxically, the strong economic position of SMEs currently being experienced in Germany is in fact an enormous barrier to their smart development: Many German SMEs are – at least they were in pre-Corona times – too busy to pay appropriate attention to this issue! It is a combination of a lack of time and of awareness which many see as the most serious threat to SMEs. Therefore, the German Federal Government has initiated the so-called High-tech Strategy 2025 (www.bmbf.de/en/the-new-high-tech-strategy-2322.html), which targets the consolidation of resources and promotes transfer and strengthening the dynamism of innovation in industry, to create favourable conditions for innovation, thus boosting dialogue and participation. A main aim within this context is to step up investment in research and development from the current level of approximately 3% of Germany's gross domestic product per annum to 3.5% by 2025.

With varying degrees of difference, and with the exception of Finland - certainly a role model amongst Europe's digitalisation class - the situation is similar in all other partner countries and regions (Austria, Flanders and the Basque Country). Everywhere, SMEs feel that they could be left behind in terms of digitisation and fear for their future prospects. And everywhere politicians are frantically launching investment and digitisation initiatives to prevent this from happening. Whether and how successful these measures will be, remains to be proven - in any case, it would have been desirable if national and regional politicians had paid greater attention and urgency to this issue earlier.

And what has happened at the European level? In comparison to within many individual Member States, the digitalisation of the public and commercial economic sectors has long been postulated and promoted by various strategies and programmes at the European level. In particular, the European Commission has recognised that the successful digitalisation of the European Union is not only a technical and infrastructural challenge, but that awareness raising as well as digital education and training are at least equally important.

As early as 2011, the Commission launched the Agenda for Modernisation of Europe's Higher Education Systems (COM (2011) 567 final) which sought to improve "the quality and relevance of higher education by exploiting the potential of ICTs" (p7), aiming to make the "knowledge triangle work by linking higher education, research and business for excellence and regional development", by creating close and effective links between education, research and business. Lastly it sought to "build on the pilot project to strengthen the interaction between universities and business through knowledge alliances" (p11).

It was followed by the Digital Single Market Strategy which underlined a new dynamic across the European economy as a whole, fostering jobs, growth, innovation and social progress, since all areas of the economy and society are becoming digital; consequently it postulated that a "change is needed in the way education and training systems adapt to the digital revolution" and to the empirical findings that showed "teachers' lack of digital competences, and their lack of confidence in using digital technologies meaningfully in teaching." Additionally, a recent public consultation on the Agenda for the Modernisation of Europe's HE Systems showed that "over two thirds of students and recent graduates perceive a mismatch between the supply of graduates and the knowledge and skills that the economy needs. [...] Other important challenges identified by stakeholders include the impact of technology and globalisation on higher education [...]" (EC 2015/196: New Skills).

From this, initiatives were derived to increase the digital competences of educators as quickly as possible (EU 2017/29000: Education Policies in Europe and Beyond, 41), and as a consequence, the European Framework for the Digital Competence of Educators endorses initiatives that set up learning activities in digital environments for both teachers and learners, and which allow teachers to experiment with and develop new formats and pedagogical methods (EU: DigCompEdu 2017, 52). This includes the continuous evaluation of IT curricula at all training levels as well as the creation of applied blending learning environments in authentic settings, such as in workplace-based learning.

All these policies and programmes may appear to be very comprehensive and numerous, but in reality, they are insufficient and fall far too short for Europe to swiftly catch up with other industrialised nations. The EC is aware of this and has just proposed the creation of the first ever Digital Europe Programme, which will invest €9.2 billion to align the next long-term EU budget 2021-2027 with the increasing digital challenges. With this programme, European Digital Innovation Hubs (EDIHs) will play a central role in stimulating the broad uptake of artificial intelligence, high performance computing (HPC) and cybersecurity as well as other digital technologies by industry (in particular SMEs and midcaps) and public sector organisations across Europe. EDIHs will function as one-stop shops to help companies dynamically respond to the challenges and become more competitive (EC/DG CNECT, draft working document 05/05/2020).

In summary, there are now finally identifiable activities and promising initiatives, both at the regional and national levels as well as at the European level, to better equip Europe for the IT challenges of the 21st Century. From the previously mentioned points, the following can be stated:

- Digitalisaition of life at all levels is a global challenge which should not - especially not in the EU - primarily be tackled at national level.
- A global competition is ongoing within industry and commerce, which will determine who will take the lead with smart industry and who will be left behind; with the USA, China but also Japan, South Korea and India, Europe has extremely strong opponents to compete against – and currently it is not well positioned.
- An important advantage held by the opponents is the – more or less – homogeneity of their political and economic structures. Whilst here, Europe still has much catching up to do and is very busy dealing with (increasing) national interests and the strong diversity of economic developments within its Member States.

EDITOR'S NOTE

- In particular, Europe's traditionally strong manufacturing industry is under pressure from new forms of digital industries which tend to focus more on services and communication rather than on production. The fact, that most of the enterprises are SMEs is also to Europe's disadvantage, as it is expected to become more and more difficult to compete with the big global players outside of Europe.
- Therefore, it is even more important that Europe's manufacturing SMEs develop into smart enterprises as quickly as possible! Due to raising importance on the one hand and decreasing prices on the other hand, VR/AR/XR has developed into an important IT area for SMEs. However, SMEs will need support from experts, such as HEIs and VR/AR/XR service providers.
- Consequently, if Europe really wants to tackle the challenge of fostering VR/AR/XR technologies within SMEs in manufacturing industries, it must act transnationally to provide solutions of EU-wide relevance. Therefore, within recent years, the EU, many Member States and their regions have launched initiatives and policies which all postulate the same bottom line: apart from technical equipment and infrastructure, an open-minded society well trained and connected is an elementary precondition for developing into a smart future.

The VRinSight project group has derived from these assumptions that awareness-raising and education are among the most important key points for Europe's - as quick and as successful as possible - transformation to a digital knowledge society. In the long term, we want to encourage SMEs to go digital and provide them with the necessary expertise. However, we do not focus primarily on training technicians, but rather on managers and human resources managers in companies. With our project we want to ensure that they are already intensively informed about the strategic, operational and financial possibilities and advantages of using VR/AR/XR as an important element of the smart industry during their business studies.

EDITOR'S NOTE

In order to guarantee this, however, business administration lecturers themselves must be familiarised with the technologies, their use and their advantages. The solutions that the project group has developed for this purpose are presented in the first part of this magazine, together with field reports and lessons learnt from the project work and key notes dealing with immersive learning in general from European experts outside the partnership.

The second part gives an insight into the variety of EU project work currently being carried out concerning the use of VR/AR/XR in various fields and for various target groups accross Europe. Between October 2019 and April 2020, we have researched and contacted 41 ongoing or recently completed EU projects related to VR/AR/XR. They all approach the topic via awareness raising and learning - in either a narrower or a broader sense. And 24 of these projects have agreed to present their project in this magazine. I can assure you that the contact persons listed are all very nice people, and you are warmly welcome to contact any of them for further information or exchange.

Generally, this magazine should lead to building up new networks, to learning from each other and transferring knowledge between different actors in connection with VR/AR/XR, and it should publicise existing work and projects which will lead to new initiatives and activities. Above all, it should serve to raise awareness amongst political decision-makers and stakeholders so that they can recognise the signs of the times and promote these new technologies as quickly and intensively as possible in order to further advance smart industry in Europe and to promote the digitisation of society as a whole. This expressly includes extensive prioritisation of the topics digitisation, smart society and Industry 4.0 in all their various forms in relation to future funding programmes and calls!

May the VR/AR/XR forces be with us ...

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KEYNOTES

VRinSight has identified its topic very holistically, considered various approaches and developed interdisciplinary solutions ... read about some of them.

Photo credit: Fachhochschule des Mittelstands

VRinSight: Boosting Virtual Reality Learning in Higher Business Management Education

Carsten Domann, Ian O'Donovan

Upon witnessing the rapid developments in virtual reality (VR) and the significant rise in the usage of this technology in other regions of the globe, the partners of the VRinSight project set about establishing a project to pro-actively address the evolving skills gaps that small and medium-sized enterprises (SMEs) in Europe are increasingly facing and will continue to face as VR technology begins to revolutionise how business is conducted in the modern global economy. The VRinSight partnership concluded early in its establishment that the higher education institutes (HEIs) of Europe are not only key to addressing this challenge but also bear a responsibility to the wider economy and to the students they are educating, in ensuring that these graduates in Europe are adequately prepared with the relevant technical skills to fulfil their role in managing SMEs, and ensuring that Europe's industry remains competitive. It is therefore incumbent on the HEIs across Europe to make sure that their professors, lecturers and academic staff possess key knowledge on VR technology, so that the necessary skills can be acquired by business and management graduates. Bringing these academics up to speed with the latest VR developments was thus the key challenge that the VRinSight partnership set itself and to deliver a training programme that could accommodate academics, so that this knowledge can become a staple part of university curricula and trickle through higher education business graduates into businesses and industry across Europe.

The VRinSight partnership also recognised the need for flexibility in such a VR training programme so it could be beneficial to academics outside the discipline of business management, as well as being transferrable to industry and be made available to current SME management who maybe seeking support in becoming familiar with VR and understanding how they can benefit from this technology. In order to encompass the requirements and

needs of these key target groups, the VRinSight project partnership was consolidated to include representation from HEIs (Tampere University/FI, Katholieke Universiteit Leuven/BE and Fachhochschule des Mittelstands/DE), industry (Federación Vizcaína de Empresas del Metal/ES), services in VR technology (WAKEONE/FI) and EU quality management and dissemination (E.N.T.E.R./AT). This cooperation model between universities, industry and services would secure the necessary input from each target group and ensure innovative and relevant deliverables from the VRinSight project that would make a lasting impact upon education and business.

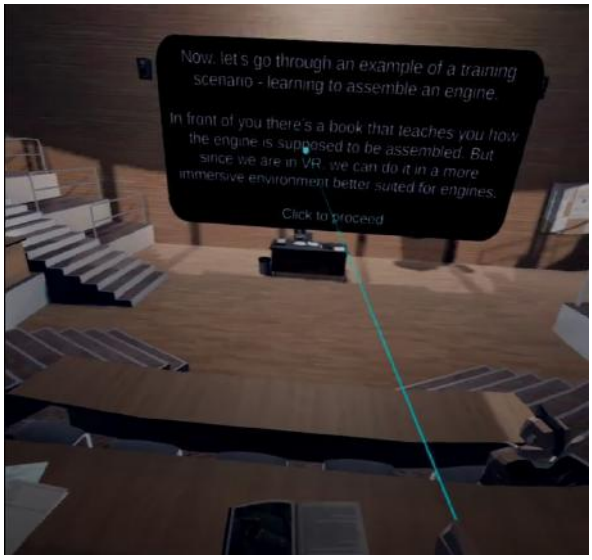
Before embarking on the development of a VR training programme, the partnership sought in-depth input from its target group by undertaking a European Survey of HEIs, a survey of SMEs, and in-depth research into available VR technology and its suitability for the educational setting. These studies surveyed perceptions, attitudes as well as experiences of VR within the two target groups and sought tangible case studies and best practice examples of VR use in education and business. The resulting Survey Report publication gave the project partnership essential insight for developing content for the subsequent VR Training Programme and for developing structured training that would be accessible and appealing to both academics in higher education as well as to management staff in SMEs.

Interestingly the survey uncovered how sporadic VR developments tend to be across European universities, with only isolated instances of VR adoption appearing within these organisations and it also revealed a limited awareness of the practical use of this technology within education and its potential for learning. The survey also highlighted that when this technology does appear in European universities, rather than being adopted and experienced by lecturers and students alike in the halls of learning, VR is largely confined to the research laboratories of these institutions.

With the objective clear, the partnership set about writing a structured content and curriculum for the VRinSight Training Programme. As well as giving an introduction to

VR technology, the training programme was designed with a hands-on approach covering the basic functionalities of VR equipment, basic handling of VR hardware, working with suitable software, and how to integrate VR technology into a classroom setting, as well as providing a roadmap across the landscape of countless VR applications that are currently available. A showcase of the best 25 VR applications available was carefully selected by the project team for their suitability for use in a classroom setting and ability to bring learning material to life and allowing students to experience a new form of learning. The training programme was developed with a range of modules addressing the diverse requirements of the target groups, such as the pedagogic aspects to be considered when integrating VR into the classroom and how VR can enhance the learning experience for students. Furthermore, the training programme outlines the concrete benefits to businesses that have adopted VR, and gives clear examples of how VR can be integrated into the business operations of a modern SME. Instances including VR:

- enabling immersive collaboration in product design;
- enabling remote maintenance support of industrial machinery;
- enabling staff training in high-risk/hazard scenarios;
- visualisation of business processes and organisational structure, as well as product lifecycle analysis and project workflows.



The VRinSight training Program (see screenshots on this page) was structured with flexibility and accessibility in mind with a logical mix of practical and theoretical learning coupled with learning activities and assignments to ensure a thorough and effective participant training. As part of the practical learning experience necessary in the training programme the project partnership designed and created a purpose-built virtual reality platform, that guides participants though the experience of virtual reality and the essential learning benefits of VR in education. The so called VRinSight Classroom embodies and illustrates in a VR experience much of the key learning content covered in the training programme and compliments by means of a VR experience the learning undergone in the training programme's modules. The VRinSight Classroom gives users a new and novel perspective of how learning and education can be experienced.

In order for the VRinSight project mission and its key message to make a lasting impact, the project partnership published a Green Paper which you are now holding in your hands. It serves the dissemination to target groups such as to academics and SME management and also significantly to key stakeholders who are in a position to assist and support the adoption of VR in business education and education generally, at a political level and at the level of educational strategy and in industry. The VRinSight Green Paper includes key addresses

from experts across Europe, each outlining their experience with VR and its potential for the purposes of education. Lessons learned and recommendations from not only the VRinSight project, but also from similar project across Europe are included and should serve key stakeholders greatly in guiding their choices and decisions regarding educational policy and strategy, and outline to SMEs and business across Europe, how the adoption of VR technology solutions can help overcome the current and future challenges faced by the European economy.

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KEYNOTES

Europe Should Lead on Immersive Education Technology

Kari Peltola

The future of computing will be immersive. New technologies are replacing the current, somewhat crude VR and AR headsets and are overtaking smartphone and 2D screen-based computing experiences.

Radical developments are giving us a glimpse of the future. Last year Oculus Quest created a new category for VR HMD (head-mounted displays) - the powerful 6DOF (degrees of freedom) standalone. Data suggests that this category is very different from the wired PC VR. People are spending considerably more time in VR and return to consume content more often.

In terms of AR/MR we will see the big wave hit during the next five years as behemoths like Facebook and Apple are positioning themselves to fight over the new immersive market. These companies employ thousands of people who are constantly looking to find exciting new ways of defying the constraints of the physical world and, I am sure, they will deliver us something amazing in a couple of years.

As one of the major Nordic MR solution providers, Wakeone has been tackling the technological and use-case challenges at the frontline for many years now, and we are seeing a major shift of enterprise segment attitudes because of 1) technological development and 2) the urgent need to find productivity gains in a sustainable way. In many ways, sustaining this momentum is critical for the future of Europe.

In order to realise their goals, enterprises require capable and educated people. Major long-term trends and the current situation are driving the need for more effective ways of preparing people to enter the workforce. Thus, improving our education system is critical, as it needs to be able to evolve and help enterprises take advantage of these emerging technologies.

Currently the majority of investment activity as well as major leading companies investing in this sector are in the USA and China. The

next five years will be very formative in the sense that the big race for the next computing platform will be fully on. We hope to see European companies taking the initiative and displaying leadership in both developing hardware and platform solutions to enable the immersive future. As the platform game is still on, we should be active in creating alternatives to the largest players Microsoft, Huawei, Apple and Facebook who are playing a long game and who are inching towards the same type of dominance that they have today with cloud platforms.

European Union activities are critical in creating such an environment that can facilitate the emergence of world-class technology companies that can actually compete in the global platform game. Cross-country collaboration on major technology development efforts creates the basis for a more unified sector that can take on the challenges posed by both the East and the West. We believe that the new EU research and development programmes for the budget period 2021-2027 should focus major resources at projects that help to take the European MR sector forward.

It is clear that during the next five years European higher education institutions have the opportunity to accelerate the diffusion of this technology. The VRinSight project has created a curriculum that can be used as a first step for participating in the development of the immersive future in Europe. Being amongst the first to adopt these technologies will give us the key to not only more effective and engaging education, but also to unlocking the expected productivity gains that will be the basis for ensuring Europe's prosperity in the 2020s and beyond.

The future is unfolding in front of our eyes as technologies converge in unexpected ways. Immersive technologies will help us address the largest challenges of our generation by transforming the ways we experience the world and giving us the tools to make our world smaller, in a positive way.

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Five Key Insights for Successful VR Adoption in HEIs

Osku Torro

VR has the potential to transform how we learn and collaborate. However, embedding the use of VR into organisational practices requires much effort. Here is a short summary of five key insights that HEIs could consider when adopting the use of VR in education.

1. Standalone head-mounted display (HMD)

Standalone HMDs (i.e. all-in-one VR system that does not require a PC) is the game changer. These headsets offer superior usability and prices (about the same as a mid-range mobile phone), and they outperform older generation HMDs in many ways (for example, Oculus Quest supports many advanced features, such as hand tracking). In educational use, multiple standalone HMDs can be managed via hardware racks that enable centralised charging, sanitation, and software installation and updates. Doing without PCs and cables also saves physical space that is needed for the safe and comfortable use of VR.

2. Quality over quantity

Our brains treat VR as real, even though we know that it is not. For some people, VR may feel too overwhelming or uncomfortable. Poor user experience drives people away from VR. VR adoption depends on the quality of VR and the possibility of individuals trying out VR at their own speed. Fortunately, VR technology is much better than it used to be. VR developers are just starting to master building user experiences that do not only feel real in terms of sensory stimuli but which are psychologically engaging.

3. Social virtual reality (SVR)

The most important content in VR is other people. Avatar-based interaction in SVR enables rich remote communication in a shared 3D space. SVR software that includes tools for presentations and brainstorming, such as file sharing, whiteboards, and laser pointers, substitute a physical classroom with a virtual one, but without any geographical boundaries.

In SVR, natural 3D space and spatial sound enables multiple small group brainstorming sessions simultaneously. Avatars are our digital representations; with the gaze, gestures, and posture they foster effective turn-taking and dialogue.

4. Recognising the complexity

If you can simulate everything, what should you simulate? What information should be presented to a user? What are the specific interactions? Who are the individuals communicating with each other? Recognizing the complexity behind these questions is critical in successful VR adoption. For example, in a virtual building, an architect works with a different layer of information than a construction engineer or a marketing person. Every user group also requires a different set of tools and interactions. Similarly, both information and interactions should be customised depending upon who is communicating with whom. However, more details within the simulation lead to increased costs and decreased scalability.

5. Educating the educators

In general, HEIs currently do not possess much knowledge of VR. Therefore, educating the educators about VR and its potential is critical. Most European countries have an active base of VR enthusiasts, developers and research groups who are willing to work with educational VR. Unfortunately, collaboration between these initiatives tends to be low. Building cross-disciplinary projects focusing on both technological and human factors is essential in building VR related know-how in HEIs. Fields that study sociotechnical systems, such as information systems science, hold a particularly interesting position in bridging this gap.

In summary, our insights suggest that successful VR adoption in HEIs emphasise standalone HMDs, high-quality VR, and focus on social interaction. There is also a need to map out the complexities of VR development in the cross-disciplinary context.

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Five Key Principles for the Successful Use of EdTech

Jonas De Raeve

Technology for educational purposes is on the rise. This is definitely the case for lifelong learning, with more and more companies using technology, simulations, games, virtual reality etc. in order to better train their workforce. In recent years technology is also finding its way into formal education. EdTech is a booming business. Today, global EdTech is already estimated at more than € 150 billion and is likely to double within the next five years. This is mainly because the education sector as such is a rapidly growing market. 500 million more learners are expected by 2025 and the share of technology investment will probably increase substantially.

As an effect of the Covid-19 pandemic, 1.5 billion students were abruptly affected by school closures and relied on online classes to continue their education. Although technology limited the negative impact on their learning outcomes, this sudden transition was not an ideal situation for the successful implementation of technology. When using technology for education, especially for children and youngsters, the added value should be obvious. Technology is only an instrument to achieve a certain goal, in this case better education. With the right preconditions and solid government policy, technology can create added value. Five key principles should be taken into account.

1. Make sure the technology itself is effective

The main reason for using EdTech is to make education more effective and strengthen the learning process. It is quite clear from science what good teaching is. The same principles - repetition, structure, activation, variation, feedback etc. - can also be applied to educational technology. The development and use of educational technology must therefore be based as much as possible upon evidence from educational and cognitive science.

2. Do not forget the teachers

Teachers and trainers must choose which technology they will use for a specific purpose and within a specific context. This requires and skills. The digital revolution only increases the

need for good teachers. Again, we know from science what good teaching means. That does not change. In a digital world, the teacher remains the expert who transfers knowledge through instruction. Technology should be used to support this. It is important to implement educational technology in initial teacher training and lifelong learning throughout the career pathway.

3. Invest in IT infrastructure

A solid IT infrastructure in schools and any kind of education and training institution is essential for accelerating further developments in educational technology. Today, the use of IT in school is still relatively limited at all educational levels and this has not changed substantially over the last few years.

4. Develop a general strategy

This is the responsibility of governments on the one hand and school management on the other hand. The government should support schools in using and implementing technology. At the school level, a change in mentality is needed in policy. This has gradually been the case within higher education, but more work needs to be done within compulsory education.

5. Promote alternative qualifications

On the growing lifelong learning market, educational technology is creating new training opportunities. This results in alternative ways of achieving qualifications in addition to formal degrees given by recognised educational institutions. Examples are digital badges, micro-degrees, professional qualifications, etc. However, there are still many limitations to the broader use of these alternative qualifications. They are not always known to employers, are often not formally recognised by the government, and there is sometimes a lack of trust concerning the quality and content of these qualifications.

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Higher Education Needs to Lead on Immersive Learning

Harri Lammi

We need immersive technologies now more than ever, but we must work together to create a thriving, leading immersive learning ecosystem in Europe. Technology is ready to be implemented but now HEIs should be the driving force for change that pushed forward and accelerates the immersive learning revolution.

During the last couple of months, the Covid-19 virus has shown us how much we actually need technologies that enable learning and doing in a remote fashion. Schools in Finland have adapted extremely quickly to this new situation and most of the teaching is already done using virtual technologies. However, the big shift is still to come. Our learning methods and technology are still founded on listening and writing, instead of true experiencing and experimenting.

Even if we are going to have major short to medium term economic impacts due to the virus, we will need to look forward. Digitalisation is only going to accelerate. We need better technology to enable better productivity. Continuous learning and the technologies to make this possible are going to be deciding factors in the future competitiveness of our region.

Finland has the best education system in the world. This is a fact that has been demonstrated numerous times in worldwide studies. From the frontline we see that the age of immersive digital education is coming but it should also be accelerated, similar to what Tesla is doing for the electric car ecosystem.

The best way to learn is by doing. Virtual reality enables doing things in ways that would otherwise be impossible, expensive or dangerous. We can actually experience history. We can actually visit a high security nuclear powerplant and learn to maintain it without any

danger. We can create, test and modify machines before they ever become physical. It is clear why virtual reality offers superior possibilities in comparison to other learning technologies.

So why is it not ubiquitous already? It comes down to usability, content and price. I must admit that on more than one occasion I have struggled technically with a PC VR setup. Wires have been inconvenient, content stores have been empty and finally, it has been quite expensive to purchase a powerful PC plus a VR headset. Luckily, the situation has changed quite dramatically through Oculus launching its Quest headset.

Standalone VR headsets with 6DOF have qualities that make them the perfect entry-level devices for the education sector. Reasonable prices, greatly improved usability, no wires and improving channels to consume content give us the first platform that can really move immersive education forward.

Even though language, writing, books and the printing press have been tremendous inventions, immersive learning will be about experiences and 3D content. It is true that major investments will be required to develop technology and capabilities at many levels. It is still day one for the content creators and we are only seeing glimpses of what is actually possible when we start to create truly immersive learning experiences. However, now is the time to leap forward and start to build the required capabilities and ecosystems at the European level.

HEIs should lead from the front. They should be driven to find the best ways of utilising and exploring this potential so that the whole of society can benefit. They should not wait for some private sector company to create immersive teaching material but rather start to experiment and create it and the required capabilities themselves. Integrating the technology into teaching should be done in an iterative fashion, listening, learning and improving. It is now time.

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Immersive Technologies and Their Application in Education

Pablo Aguirrezabal, Judit Gomez

In recent years, VR has gained a lot of ground as an alternative approach to traditional learning experiences, mainly due to the ability of this technology to provide a highly interactive visual environment very similar to that offered by the real world, allowing students to experience the feeling of being present in an environment with greater possibilities of interaction with its surroundings.

A VR system is different from other computer applications, due to the fact that it gives the user the feeling of being present in the virtual world and being able to act accordingly. This notion of presence is increased within a virtual environment where VR is used, which has two key components that other technologies do not have, immersion and interaction.

In order to overcome the obstacles presented by the concepts related to these topics, the use of virtual environments offers a very powerful immersion feature, which when carried out within the right context, allows for an interactive experience that is complemented by a representation of the concept beyond the production of the formulations that are typically present in traditional face-to-face training.

In the academic areas mentioned above, success for a student depends largely upon his or her ability to anticipate and manipulate abstract information. Finding ways to help people recognise patterns, to understand qualitatively physical processes, to move between the different frames of reference and to understand more easily the dynamic models that can contain intangible information, can be very important and useful in many educational situations.

Despite all of this, VR is becoming increasingly popular in today's educational media due to its wide variety of applications in modern society. It is becoming a very practical and powerful medium that can be used in teaching, especially in situations in which what is

abstract and intangible is required to become concrete and manipulable, such as science education. However, its application cannot only be limited to the above situations, as this technology has also been shown to be useful within the humanities and arts too.

Due to the potential of this technology, there are currently an increasing number of applications, that focus exclusively on learning as opposed to training. Learning should be viewed differently than training, although these may be difficult to separate and depend upon one another. Learning consists of acquiring the information that is provided by the virtual environment. Training, on the other hand, mainly involves the responses given by the user within the environment itself.

Many researchers and education professionals believe that VR technology offers great benefits that can support education. For some other people, the ability of VR to facilitate constructivist learning activities is the key factor, while others focus on its potential for providing alternative forms of learning, which can support the different learning styles of students, such as visual, audio or kinesthetic learning.

VR offers many advantages to education, including the delivery of information through multiple channels, the targeting of different learning styles, and also experience-based learning. Immersive technologies should be included in the academic field in a more structured and in not such an experimental way, as is currently the case. Progress will be made on this aspect due to the mere fact that technological devices are becoming cheaper, but there is still a challenge linked to the training of teaching staff that needs to be resolved.

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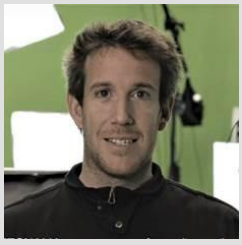

tecnalia Inspiring Business

Photo credit: TimeRide | Link: www.youtube.com/watch?v=XjswgkRavb4

The Educational Power of VR

Ignace Martens

The US market researcher Zion Market Research expects the global eLearning VR market to grow by 42.9% every year for the next 8 years. This means the market will grow from $60 million in 2018 to around $1478 million by the end of 2027. The International Data Corporation is expecting even 98.8% growth of VR in higher education in the coming years. Why is VR booming at this moment? Of course, there is the rapid evolution of VR that has led to performant but affordable hardware and software today. But at the same time, education is rapidly discovering the specific opportunities this technology offers for enhanced learning. This text gives an overview of some unique features of VR, useful in education.

The first time you use VR, you will be overwhelmed by its ability to immerse you in another world and by the fact that your brain treats it as real. The immersive experience is further enhanced by the head mounted display that enables a learner to stay focussed on the topic. This is a learning solution for those students who are prone to distraction. Moreover, sets like ClassVR, with a number of headsets and monitoring software, allow teachers to follow up where students are looking at using head tracking technology. Teachers can also upload their own resources (such as 360° photos or videos) or they can make them using e.g. Google Expeditions.

To help fully understand a subject, with one click, you can switch between an egocentric view, where you are controlling the events like a pilot or machine operator and the exocentric view where you are watching the events. Students can choose where to look at and where to go. They do not have to "stick with the group" like with school excursions. Therefore, they can direct their own flow of information according to their own way of learning. Physical school trips are organised only a few times a year. With VR, students can visit the whole world or even the universe, every day. In an app like Google Earth VR you can teleport yourself to another place and look around with just a few clicks. Some locations are out of reach for

school trips, like an active volcano, the aurora borealis in the very north or the top of high mountains. With VR such locations are within reach. Teachers can visit museums virtually with their students without restrictions of opening hours and minimal safety distance and without losing time in long queues. In some museums, VR is used to go back in time and let visitors experience how life was in the past. In Cologne, Germany, people can visit the Time Ride Museum. There, they can sit in an old tram and have a virtual ride through Cologne in around 1910. In this and many other virtual expeditions, VR offers a high level of situated learning. That means that students not only learn about the topic but at the same time they gain impressions of other aspects of life in the surrounding environment. VR not only allows you to look at the virtual environment but also offers possibilities to interact with that environment. Nowadays, machine designers develop digital twins of their designs in order to allow training of operators in executing maintenance tasks or in making operating decisions under different circumstances (like e.g. flight simulator training). VR training with these virtual twins can be organised in a virtual space. Participants just need to log-in to this virtual space. They do not need to move physically to the training location. They can practice as many times as they like and thus costs can be saved.

In social VR, the immersive feature of VR is used to foster empathy in many different situations. In the Stanford University app Becoming Homeless, people can experience how it feels to lose your job, to be forced to sell your possessions to pay the bills, to become homeless and to have to beg for money. VR has great potential in social sciences because it can generate the impression of remote presence. This is the immersive experience of a real place, including real-time remote interaction with the people there. E.g. in Belgium, children with a long-term illness can use the BedNet app to have a virtual presence in their classroom from their hospital bed and to communicate in real time with the teacher and the group.

VR is not the solution for every pedagogical problem, but it can add value in many learning situations, enhancing motivation, enthusiasm and last but not least creating a higher retention rate.

So, try VR. Think about its potential to bring your lessons to a higher level and to overcome the barriers you feel.

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VR as a Competitiveness Factor for SMEs

Joseba Sainz de Baranda

The sustainability of a business over time and how to enhance a company's profitability are usually the most critical issues addressed by SMEs managers. For this reason, an organisation is always in search of new technologies that can achieve the desired results with minimum input over a short time period. Thus, companies must face within the context of the 4th Industrial Revolution, characterised by new industrial and communication technologies, dramatically increased levels of interaction between all parts in the organisation.

The 4th Industrial Revolution has the potential to improve the productivity of businesses and companies, but it also brings risks for competitiveness, job markets and society. Since senior management support is essential for fostering Industry 4.0 and because management is the core part of a company, changes in management affect both all main processes within a company and all of the business model components: value proposal main activities, relationship with clients, technology and innovation absorption capacity, organisational structure and corporate culture management. Industry 4.0 and, in particular, key enabling technologies such as VR, are becoming critical in addressing company challenges and changing client needs.

VR, despite being a technology usually related to gaming, is becoming an interesting resource with great potential in industrial environments with impact in many areas of a company, such as research, design, planning, marketing, risk management, maintenance etc.

Considering the implementation of VR technology in a company is an important decision, that requires not only a deep understanding of the current internal expertise and digitalisation status of the company, but also a VR business strategy is necessary to ensure the sustainability of the implementation over time.

Apart from the benefits and advantages that are clear and which most companies can recognise, there are some barriers to overcome for effective VR implementation, which are related mainly to the return on investment, level of digitalisation and the lack of internal VR related competences.

In this sense, there are many players within the VR ecosystem who can interact with SMEs for both sides' benefit, such as public organisations, clusters, professional associations, consultancy firms and especially higher education institutions. There are also many ways of collaboration, but the first approach to the issue should be taken by SMEs. Implementing small scale pilots to provide evidence, hiring technology for a short time period to test the concept or the partner with a university that has VR technology, as well as undertaking a student project, could be an appropriate approach when starting to implement VR strategies.

Virtual reality is capable of transforming traditional sectors such as manufacturing industries, but policies for the future enabling good access to finance for innovation and the development of the digital economy will play an important role in developing the VR industry, and it can become even more important if it is linked effectively with the business of traditional SMEs.

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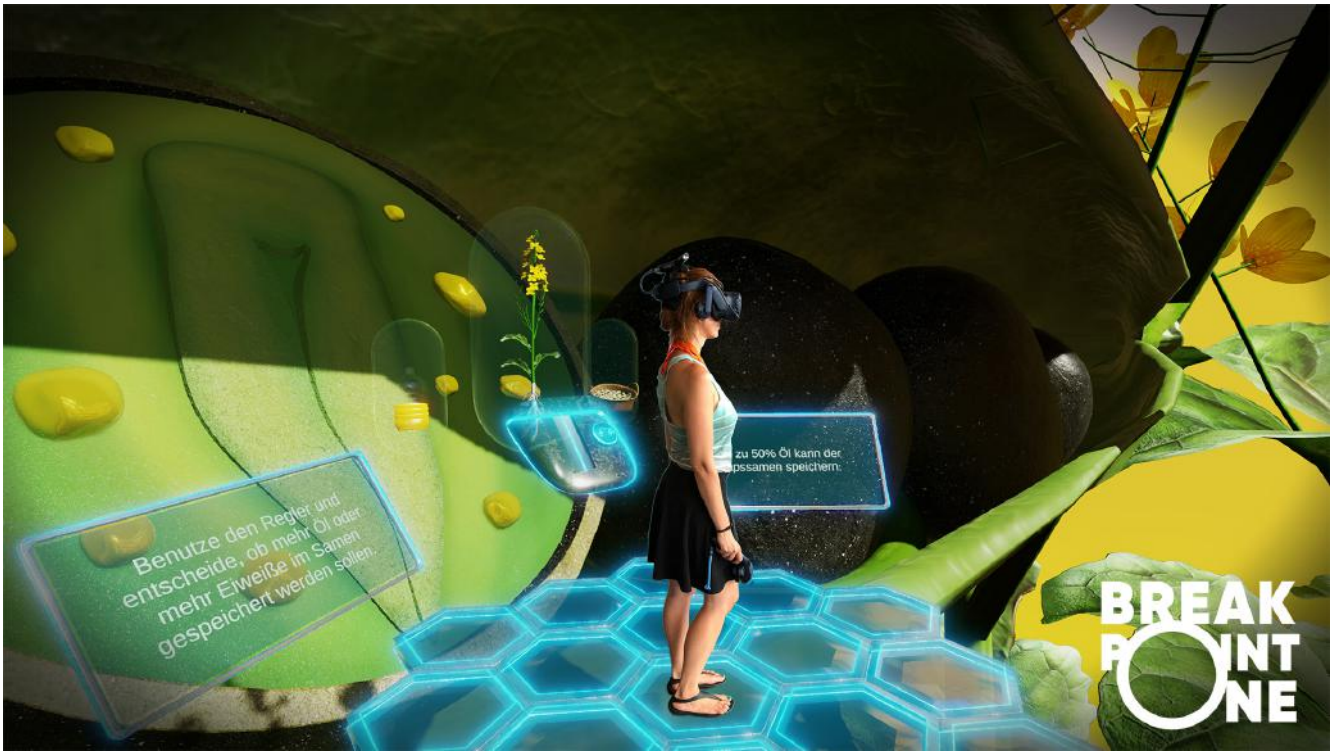

VR in Higher Education

Christine Ripken, Olaf Sacher

At Breakpoint One we are researching the possible uses of virtual reality in education and research. We develop VR experiences for education, data visualisation and training. Based on our own experience in the use of our applications by school children and in research through various publications, we clearly stand for the use of VR in education.

Strong visual memory

People retrieve and remember information better when it is gained in a visual way compared to just having to learn words. As Prof. Brad J. Bushman from the Ohio State University points out, much more of our brain is devoted to vision than to the processing of words. Although these findings originated in the 1980s, our educational system still focusses on the verbal communication of its content. We, as a Berlin-based Start-Up, want to change this focus in future education. Therefore, we utilise Virtual Reality to convey educational content.

Additionally, VR also conveys the third dimension. Due to the additional depth cues we expect the brain to immerse more strongly with educational content. Learners will memorise, for instance, historical knowledge better when fully experienced by themselves in VR. Seeing the pyramids being built or the interaction of molecules will support understanding and memory. Besides better visual memory, research yields better memories of emotional moments than non-emotional moments.

Better memory of emotional moments

Everyone can remember the first time he/she met his/her future wife/husband or a sky dive even years later. However, the content you must learn for your next big exam seems to vanish from your mind as soon as you have completed the exam even though you have spent weeks revising this content. How come? Why can we not make use of the amazing benefits that our semantic memory yields?

As the research group at the department of Electrical and Electronic Engineering of the Centre for Intelligent Signal and Imaging Research in Malaysia states, emotional events are remembered more clearly, accurately and for longer periods of time than neutral events. With continuously developing hardware and software the immersion of users in VR becomes more and more convincing. Thus, we can expect future experiences in VR to become even more emotional than they have been up to now. We believe that the clever incorporation of emotional moments will make a user remember the learning content better than if he or she were just reading a book. We are fully convinced that emotional guidance through an entertaining and educational virtual reality experience will burst the limits that we are facing nowadays in educational settings.

Keeping attention to the point

The next exam is approaching, but the content of our fridge is more tempting than our book's content. Procrastination is the phrase that describes the phenomenon of students preferring to clean up their flats during exam periods, playing games on their phones or just mind wandering. Potentially a well thought through concept for a virtual edutainment system can prevent students from procrastination and thus make education more effective. The events in virtual reality can be organised in a way that continuous feedback is necessary. In this way the user stays in the interaction loop. Furthermore, regular games alternating with educational exercises can be included so that there are times to relax and exercise mentally.

Better understanding of complex problems

Imagination is one boundary of learning. VR can help our limited imagination significantly and make the unimaginable or unperceivable tangible. The complex structures of a cell can be represented in space and be inspected from inside and, as already mentioned, you can experience the building of the pyramids or explore the architecture of buildings long past.

All of this makes VR possible and will provide an enormous step forward for knowledge transfer in education and science.

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VR in the Classroom

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As an educational technologist at the Cyprus Pedagogical Institute (CPI), I always strive to promote innovative educational approaches, especially through the implementation of VR and AR technologies in K-12 classrooms. The mission of our Educational Technology Department (https://tet.pi.ac.cy) is the implementation of teachers' continuing professional development programmes in the areas of ICT, in the K-12 teaching and learning process. For the past three years, we have been trying to integrate VR and AR technologies and tools, mainly through our "Innovative ICT Schools" programme (https://innovativeschools.pi.ac.cy).

When I first became familiar with VR technology, I was seeking to find practical solutions in order to use both VR and AR technologies within the context of innovative teaching and learning. My goal has always been to facilitate better learning outcomes while promoting the traversal skills of students of the 21st century, including autonomous learning, digital literacy, collaboration and critical thinking. Back in 2016, I personally realised that the Google Expeditions platform was one effective and relatively easy way of integrating VR into our classrooms, compared to other VR tools. The Google Expeditions platform allows teachers

to act as "guides" and to lead their students (as "explorers") through immersive VR tours-expeditions, to almost anywhere in the world, through a vast collection of organised 360° photospheres and 3D images, exploring both the macro- and microscopic worlds (museums, landmarks, parks, the outer space, human body systems etc.).

VR technologies provide opportunities for more realistic and immersive experiences. Students can be immersed into the 360° 3D digital environments and their explorations contribute to enhancing and transforming their experiences from "third-order" into "first-order" experiences (personal). Even with the use of smartphone-based VR glasses and the and the 3DOF apps, students can actually "live" the experience, they have the feeling of "presence", of "being there" in the centre of what they are viewing. Moreover, we usually combine those VR experiences with other stand-alone AR apps (on tablets) and we also guide the students in viewing relevant 360° VR videos through their VR glasses. For the past three years, in many of our VR integration lessons, we have been implementing the "parents and teachers at the same desk" approach, where parents are invited into the class, collaborating with their children, and, through their smartphones and VR glasses, they both "live" the VR experience. The feedback we receive is overwhelmingly positive. Students are really motivated and excited with these VR R experiences, and this is also reflected on how they perform during the lesson's tasks (i.e. producing oral and written discourse) and how their creative thinking and imagination is triggered.

Moreover, as a department, we have recently established the Digitally Supported Learning Environment (https://digilearn.pi.ac.cy), and one part of its mission is to help teachers and students experience more immersive VR and AR in education. Beyond the VR glasses-based experiences, both teachers and students have the opportunity to use high-end VR systems such as the Vive Pro as well as autonomous systems (Oculus Quest). We are now looking into establishing collaboration with HEIs and research centres to develop content and activities that can be implemented within educational contexts.

Last, I strongly believe that VR could be effectively used in HE, in many different subjects. The design and implementation of VR content and activities in HE could also be beneficial for and tightly related to similar efforts for VR integration in upper secondary school curricula and settings.

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VR Teaching and Learning within HE in Europe: Outcomes of a European Survey within HEIs

Panagiotis Kosmas, Eria Makridou

VR is expected to have a major impact upon education, training, business and industry. HEIs have already made some steps towards introducing VR within teaching and learning, although in-depth education and training is required to boost knowledge of the field. In this article, a brief state of the art on the global development of VR teaching and learning within HE will be presented, highlighting the case of six EU countries: Austria, Belgium, Cyprus, Finland, Germany and Spain.

In Austria, only a few applications can be found. For example, a medical university has planned to implement virtual surgery within teaching during 2020. Also, VR seminars and research projects are taking place in various fields of higher education. Presently, VR is mostly used for research purposes, and in e-commerce, supporting companies in advertising their products in VR shops.

Finland, one of the world's leading countries in the field of education, has published a stream of academic research highlighting the benefits of VR in education. Finland is also implementing VR technology in education for high quality social VR applications and high-quality educational content. One of the most promising ways of combining VR and HE could be the field of construction and engineering, as there already exists 3D content that could be used in VR.

In Cyprus, VR technology is mostly used in university research labs, which carry out research related to the development, implementation, and promotion of VR b solutions in education and in other fields. VR in HEIs in Cyprus is also used for teaching science, foreign languages and history, such as via virtual visits to archaeological sites and interaction with monuments. VR devices are also being combined

with motion-based technologies within the context of embodied learning environments.

Belgium has been using VR in HE for quite a long time for education and training. Some examples include the use of VR in biology, sociology, medicine, and teacher training. For example, VR applications are used for 3D microscopy and in healthcare. Furthermore, VR is used in teacher training, with Google Expeditions being widely used, as it provides rich material, including the 360° video recording of demo lessons.

The use of VR in Spain is being driven by central and regional policies related to the implementation of the EU's Regional Innovation Strategy for Smart Specialisation and Industry 4.0. The given focus lies mainly in the incorporation of intelligent systems into production plants, the improved use of emerging capabilities and technologies for new products, the integration of advanced materials into higher added-value solutions, as well as in the areas of raising efficiency and sustainability.

In Germany, research into the HE usage of VR/AR has uncovered that only a few institutions incorporate the technology in a significant way. This usually takes the form of dedicated departmental teams with a particular focus on VR technology development. One of the key findings that was common amongst HEIs was that VR is often introduced into learning and research to replace an alternative or more expensive technology (for example flight simulators, and engineering tasks), and the real potential benefit in the future for universities will be the financial aspect as VR technology becomes increasingly less expensive.

VR technology opens up new, exciting possibilities, as it allows learners to practice their skills with no real-world consequences. However, in order to successfully foster VR applications in particular at HE levels it is highly recommended that education and business management members receive high quality training in basic technical and digital skills in order to apply VR solutions within their working environments.

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VR/AR in Rehabilitation: Future Perspectives and Challenges

Marco Sacco

VR and AR technologies are currently emerging as extremely promising solutions for implementing rehabilitation interventions in the future. They allow for an ecological rehabilitation that facilitates the transfer of acquired skills to real-life contexts. Also, they permit customising treatments based on the subjects' needs and preferences, and to make the rehabilitation process less boring, thanks to the possible introduction of gaming or social elements. A relevant advantage is also the possibility of measuring the subject's performance using objective variables and/or integrating sensors within the VR/AR application. This is helpful in providing the patient with real-time feedback during the execution of an exercise. In addition, the performance outcomes could also be elaborated upon and stored for keeping track of the individual's progresses over time.

As national health and welfare systems need to change in order to respond to the needs of ger life-expectancy and to more and more chronic chronic pathologies, digital solutions may play a key role, especially considering the evolution of care towards a home-based paradigm.

Future perspectives should consider the evolution of national health and welfare systems towards the digitalisation of services, thus, investing in digital technologies for rehabilitation and continuation of care could represent a first step. Clearly, the whole process is complex and must be faced considering all the potential risks related to the online exchange of sensitive information between a patient and his/her therapist(s).

Moreover, a series of devices (e.g. smartphones, tablets, VR headsets) and services (e.g. a fast internet connection) must be provided to the end users: this requires new infrastructures and new business-models that regulate the access to these new services.

To achieve this transformation, a big effort is needed from both national bodies and private companies, and also private and public clinics must be considered when widening access to digital healthcare for all citizens.

Additionally, therapists must be properly informed of the potential of VR/AR technologies. They must be aware of the benefits and must learn how to deal efficiently with them on a daily basis. Up to now, many therapists do not consider digital technologies as helpful tools, but rather they are afraid that their work could be less valued or that their role could be replaced by autonomous systems. This is obviously not true: the human component in the relationship between the therapist and the patient must be preserved, and the therapist must be always present to supervise the entire process. What is going to change is how the patient-therapist relationship occurs: probably the main part of the rehabilitation exercises would be performed at home in an unsupervised or telerehabilitation setting, while meetings would be mainly for instruction, training, programme changes and evaluation.

A starting point may be represented by academic courses dedicated to medical personnel, which should start introducing new and digital technologies to make the future generations of therapists aware of their potentialities and capable of fully explotitng them, without feeling devalued.

Researchers and developers of VR/AR applications for rehabilitation must also be careful when designing, validating and releasing new products. Firstly, the design of any solution dedicated to people, especially to those who are frail, should follow a user-centred approach, thus considering their specific needs. This is crucial for the acceptance of technology, which, in turn, is a key element influencing whether a user, either patient or clinician, would use a certain product or not. Regarding validation, the assessment of the acceptance and of the feasibility of an innovative intervention must occur prior to the evaluation of its clinical effectiveness. Only in this way, in fact, the newly-designed intervention could be considered acceptable, and thus compliant with ethical priniciples.

We can conclude that there are many critical issues to be faced when it comes to introducing VR/AR technologies into existing procedures, such as social and health care. However, we believe that such an effort could be fruitful for all the stakeholders involved in the rehabilitation field and that it could improve the way in which our national health and welfare systems take care of their citizens.

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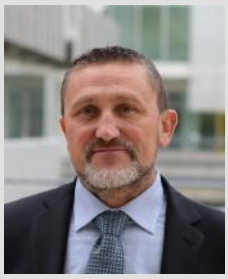

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VRinSight - A Serious Attempt to Bridge Gaps in University Business Cooperations

Nikolaus Schwaiger

In my view, the VRinSight project poses hugely important questions and, at several levels, it puts its finger on sore points that have existed for a long time within university education and research, cooperation with industry and in relation to the generally sluggish pace of digitisation in Europe. This applies both to the project topic in its narrower sense and to its embedding within larger frameworks and developments.

Firstly, it presents to a wider specialist audience important new VR/AR/XR technologies and their significance for higher education as well as for the manufacturing industry in general and in particular for SMEs. This is immensely important because, as I know from my own research trips and collaboration work, Europe is in danger of falling behind the international competition - as it is with digitisation in general. To prevent this, extensive education and IT support programmes need to be urgently rolled out. Against this backdrop, it is all the more astonishing and completely incomprehensible - unfortunately also at Austria's insistence - that at the most recent EU summit in July 2020, it was above all the future-oriented areas of education and research that had to accept budget cuts in order to generate funds to combat the Covid-19 crisis. It can only be hoped that the European Parliament recognises the short-term nature of this - thoroughly populist - decision and will only finalise the 2021-2027 budget once significant corrections are made in the sense of a future-oriented and sustainable European education, research, economic and digitisation policy.

Secondly, it is very important that this topic is brought to Austria in particular, but also to other countries of course, and that it remains permanently a focus of attention. Austria is currently still economically well developed, but it is not a model pupil in terms of digitisation; not to mention that VR/AR/XR is hardly used by Austrian companies - especially by SMEs. It is therefore all the more important for Austrian companies and business people to not only find out what the current state of the art is in Europe and also worldwide regarding VR/AR/XR, but they must also be given the opportunity to network with others, exchange information and learn from each other. Only

through such transnational approaches will national economies and their actors be able to participate quickly and comprehensively in and benefit from the "digital revolution". At the same time, interest must not be limited to the sacred cow preached by the conservative economic school - short-term ROI and high value creation through the reduction of preliminary work within research and development. As interdisciplinary and complex as these new technologies are, their potential for ecological, social and political change - both positive and negative - must always be considered holistically in addition to the economic aspect. VRinSight propagates this progressive view and would like to introduce it sustainably into companies. The fact that VRinSight trains today's business lecturers in VR/AR/XR in order for them to then reach and train the actual target group - future managers of tomorrow's SMEs - is a wonderful example of how elegantly and far-sightedly educational policy measures can be designed to achieve their goals. In this context, however, it is above all economic policy makers at the national and European levels, as well as business representatives, who are called upon to openly embrace digitisation in a more visionary and risk-taking manner. We must stop being suspicious and hesitant about it as an annoying additional task and cost factor, but rather see it as an opportunity for both the economy and society as a whole - e.g. with regard to the operational development and market placement of companies. This is all the more true since these developments are irreversible and there are no alternatives to shutting out this topic in the long term. It is therefore imperative that Austrian and European companies avoid at all cost experiencing the painful truism regarding willingness to innovate: If you do not keep up with the times, the times will pass you by!

Thirdly, the project demonstrates the relatively inexpensive and simple, but also very effective potential of largely informal forms of learning, such as the comprehensive exchange and transfer of know-how between different actors, experts and stakeholders across disciplinary, sectoral and national borders. This approach is not particularly new and hardly anyone would dispute its relevance. Nevertheless, it is surprising how few such learning clusters and cooperation initiatives are ultimately implemented or make the transition from being just lip service and strategic planning to being real sustainable and operational. VRinSight even goes a decisive step further here: it has recognised that the exchange of experience and knowledge between different organisations often works better than within the individual

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units of a larger organisation itself, which is undoubtedly also true for universities. Especially within more conservative education systems - which probably includes Austria - there is either very little or no exchange between disciplines, faculties and universities. Although graduates must often cooperate closely with each other in the world of work, they have hardly heard of or spoken to each other during their higher education. There are many examples of this, and VRinSight has chosen a classic for this, which I know only too well from my own experience, as I am active in both university education and research as well as in the business world: the eternal dilemma of technical-scientific (engineering level) and business (management level) experts in a company not understanding each other. The underlying narrative can be summarised as follows: The former always only see implementation-relevant and often fantastical technical solutions completely detached from their financial and feasibility aspects, while the latter stick too closely to their figures and tables and have neither knowledge, imagination nor the courage to open themselves up to innovative technical developments and visions.

There are certainly some more moderate examples of this constellation and some lucky companies will not even know of this problem, but overall, it offers a wonderful breeding ground for lengthy misunderstandings, mutual blockades and flagging development processes. Amongst other things, it leads to a situation in which some people no longer dare to think innovatively at all and retreat into a passive working position over time, whilst others almost reflexively adopt a priori negative view of every suggestion for innovation and change without seriously examining its potential or usefulness.

VRinSight seeks to find a way out of this situation by presenting the latest VR/AR/XR technologies in their current stage of development and future potential to prospective company managers and university instructors and then by training them to actively use a wide variety of apps. Exactly such measures are necessary to bridge the communication and understanding gap between technical and business personnel. Of course, engineers, physicists, mathematicians and chemists would also need to be involved with the relevant


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principles and areas of business administration and management. However, there is a general barrier to all attempts and efforts to overcome this: This interdisciplinary approach seems to be easier for students to implement, but how do you get experts who have been in professional life for years to critically question their positions again and again, to open up to new ideas and to continually modify their way of thinking and working? It is astonishing that the well-known "you can't teach an old dog new tricks" phenomenon can also be observed among educators, i.e. those people who demand continuous learning as well as personal and professional development from others. Anyway, it will to be of no avail! Just as the digital revolution is irreversible and has no alternative, the concept of lifelong learning will develop more and more from a non-binding theoretical postulate to being an absolute real necessity, which decides upon the success or failure of life cycles, of people, of organisations as well as of socio-political organisms. The sooner we understand, accept and act accordingly, the better. In this context, policy makers and other experts are certainly responsible for creating the necessary frameworks and providing the required resources. Above all, however, we must recognise that it is precisely here that each individual must be aware of his or her high level of personal responsibility to proactively modify his or her behaviour in the future and to openly look beyond the horizon.

With regard to all of the above-mentioned areas, it has been very interesting and informative to witness the VRinSight project, to exchange ideas with its actors, to learn from each other and to gain new perspectives and approaches that can fertilise both the academic and business worlds.

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Photo credit: Marija Kanizaj

PROJECTS

Let us have a look at what other European projects and initiatives are currently working on in connection with immersive learning ... and what we can learn from them.

ALIEN

Active Learning in Engeneering Education

Hariklia Tsalapatas

ALIEN designs, implements, and validates an active learning methodology based on PBL environments addressing real-life issues related to STEM concepts. This methodology aims to build amongst students skills that are in demand by industry and facilitate their easy transition into the workplace.

Traditional learning methodologies based on the passive transmission of information fail to develop competences that students need for both their professional lives and for being active members of their communities. HEIs need to modernise their pedagogical methodologies, moving into active learning processes whereby students engage in activities that promote higher order learning skills like analysis, synthesis, and evaluation.

Project and problem-based learning (PBL) are active and learner-centred methodologies in which students develop their knowledge and competences by following a problem-solving process, usually based on real-life situations. The identified benefits for engineering and technology students are considerable in

KEYFACTS

ACRONYM
ALIEN

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Active Learning in Engineering Education

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FUNDING PROGRAMME
ERASMUS+

DURATION
15/10/2017 – 14/10/2020

WEBSITE
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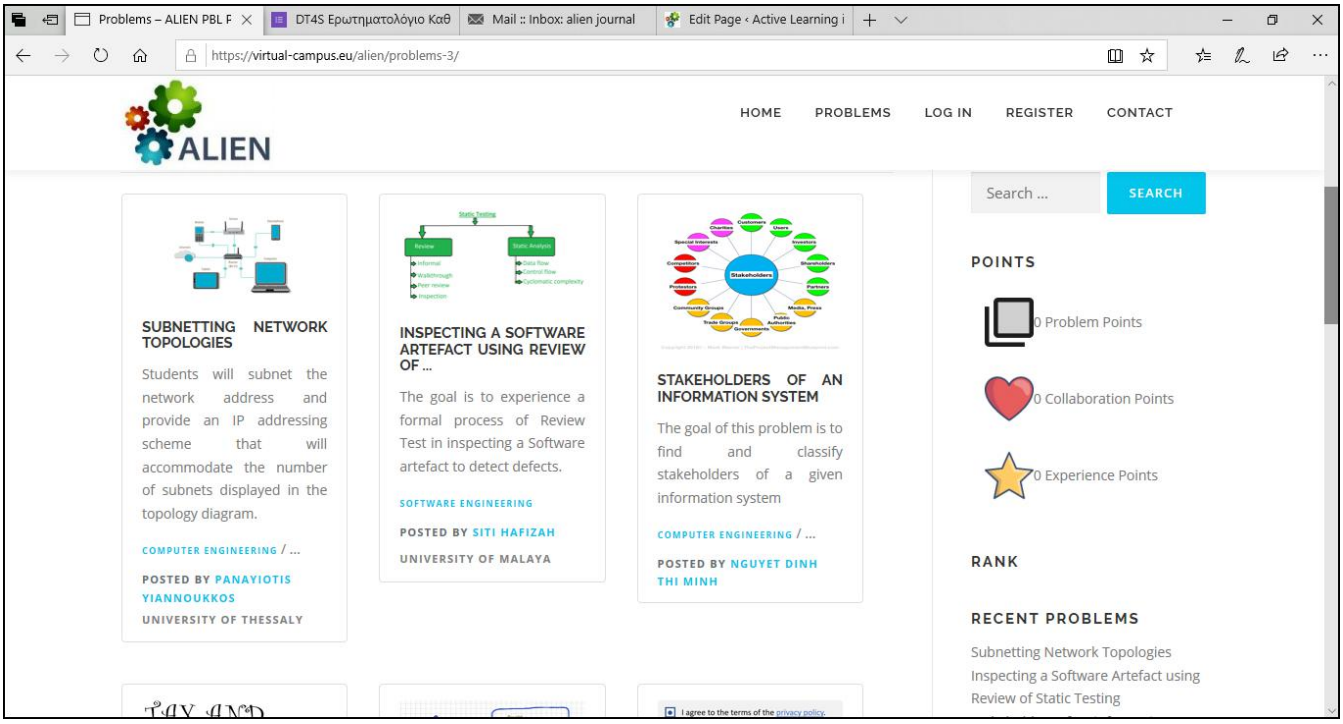
SOCIAL MEDIA
Facebook: www.facebook.com/CBHE-Project-ALIEN-1838215076248801

their critical, lateral and creative thinking, problem solving strategies, intrinsic motivation, group collaboration, communication skills, entrepreneurship, and integration into society. Supporting active learning through ICT tools (virtual social communities, games and VR/AR simulations) creates virtual learning environments (VLE) in which the new technologically-savvy generation of students feels comfortable.

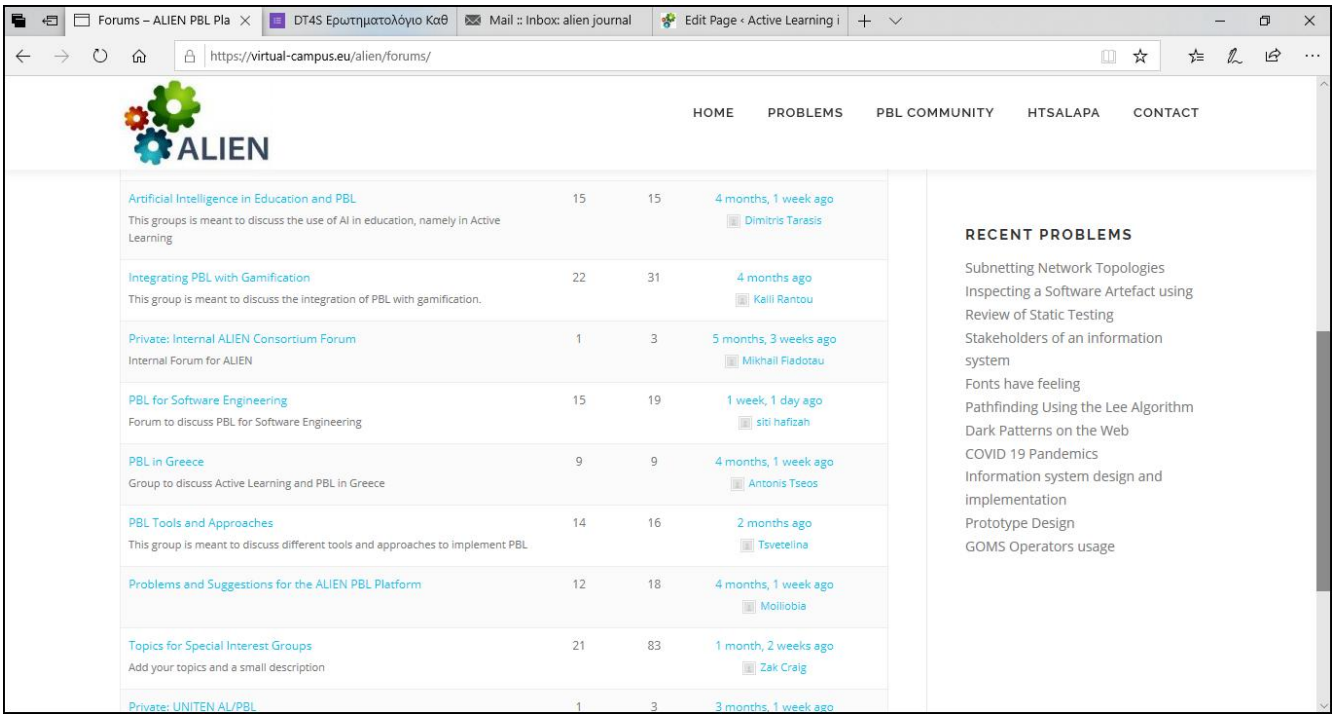
With ALIEN PBL, active learning intervention follows a holistic implementation that aims to make PBL a key pedagogical approach at participating institutions and beyond. The implementation involves pedagogical design, physical laboratories, a PBL digital learning platform, and instructor training for facilitating smooth deployment. The project is being implemented in a number of European and Asian countries: Greece, Portugal, Estonia, Bulgaria, the UK, Pakistan, Cambodia, Vietnam, Nepal and Malaysia. The broad implementation ensures that the project integrates input from diverse cultural, educational, and economic environments on how to best apply PBL approaches at HEIs for better preparing students to effectively enter the workforce.

ALIEN's aim is to improve the quality of higher education by providing more motivating, stimulating, and effective learning contexts that prepare students for their professional lives through the development of industry desired competences. The methodology will be supported by a virtual learning environment with a set of digital tools that will allow students to experiment, collaborate and communicate in an extended and multinational learning community that will also include other stakeholders like teachers and researchers. ALIEN's expected impact also includes the institutional strategical adoption of Active Learning as the primary pedagogical approach.

The ALIEN PBL intervention, which includes a PBL learning methodology supported by physical labs and a digital learning environment, aims to reach 1000 students at 17 institutions in 10 countries, namely Malaysia, Nepal, Vietnam, Pakistan, Cambodia, Portugal, Estonia, Bulgaria, the UK and Greece. Physical labs are being established at 12 partner sites in Malaysia, Nepal, Vietnam, Pakistan and Cambodia.



Co-funded by the Erasmus+ Programme of the European Union



The ALIEN PBL methodology will be deployed in a number of engineering courses, demonstrating its broad applicability. Courses include: requirements engineering, fundamentals of software engineering, multimedia design, computer networks, combined engineering projects, system analysis and design, computer-aided measuring equipment, hydraulic and pneumatic drives, automatic control systems, sensors in mechatronics, energy efficiency, renewable energy sources, parallel computing, mobile computing, multimedia, software engineering, soil mechanics, technology in education, game design, and more.

These courses are part of formal engineering curricula in programmes that include Electrical Engineering, Computer Engineering, Information Systems, Computer Science, and others.

KEYFACTS

CoTeach

Connected Teacher Education

Carolin Wienrich, Maria Eisenmann, Marc Latoschik, Silke Grafe

CoTeach develops and evaluates innovative teaching and learning contexts for student teachers and scholars. One work package couples the potential of VR with principles of intercultural learning to create tangible experiences with pedagogically responsible value.

ACRONYM
CoTeach

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Connected Teacher Education

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FUNDING PROGRAMME
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DURATION
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WEBSITE
https://www.uni-wuerzburg.de/pse/forschen/co-teach-connected-teacher-education
https://www.qualitaetsoffensive-lehrerbildung.de/de/projekte-83.php

The objectives of CoTeach

Many digitalised educational programmes have neglected prospective teachers and particularly their role-models, i.e., lecturers. CoTeach focusses on them by aiming for:

1. the identification of digital key competencies of prospective teachers and lecturers;
2. the inclusion of a diversity of digital devices and processes;
3. the development of innovative teaching and learning contexts in universities and schools;
4. the formative and summative evaluation of the progress achieved.

Approaches and Recommendations of CoTeach

To achieve these aims, CoTeach follows a multi-method and multi-perspective approach by addressing

1. a user-centred design approach;
2. the development-oriented educational research;
3. an interdisciplinary focus;
4. competency-learning and teaching at university.

CoTeach includes six work packages addressing different school subjects, school forms and technologies (including VR). An interdisciplinary research team cooperates within each work package and incorporates multi-methods. Hence, innovative pedagogical principles and knowledge about current technologies are incorporated into innovative digital teaching and learning contexts that ensure the competent reflection and use of digital devices in the field of education.

Since student teachers are relevant multipliers of teaching and learning with digital media in the future, CoTeach addresses this target group twofold. Firstly, the teaching and learning processes at the university set an example for the student teachers by imparting digital key competencies. The Julius-Maximilians University in Würzburg provides modern learning-, teaching- and media-laboratories. The prospective teachers can explore and experience various digital devices, and they are informed about the basic functionalities. They receive a reflected understanding of the benefits and limitations of digital devices and develop digital competencies by working on projects with digital media.

Furthermore, students learn how to use digital devices to implement pedagogical as well as methodological objectives. Finally, the students evaluate their material during the course, imparting knowledge about the appropriate use of digital equipment to attain didactical aims. Secondly, the prospective teachers prepare teaching units for practical implementation.

Thus, innovative teaching and learning contexts can be directly explored in realistic situations and transferred to real-life teaching scenarios at schools.

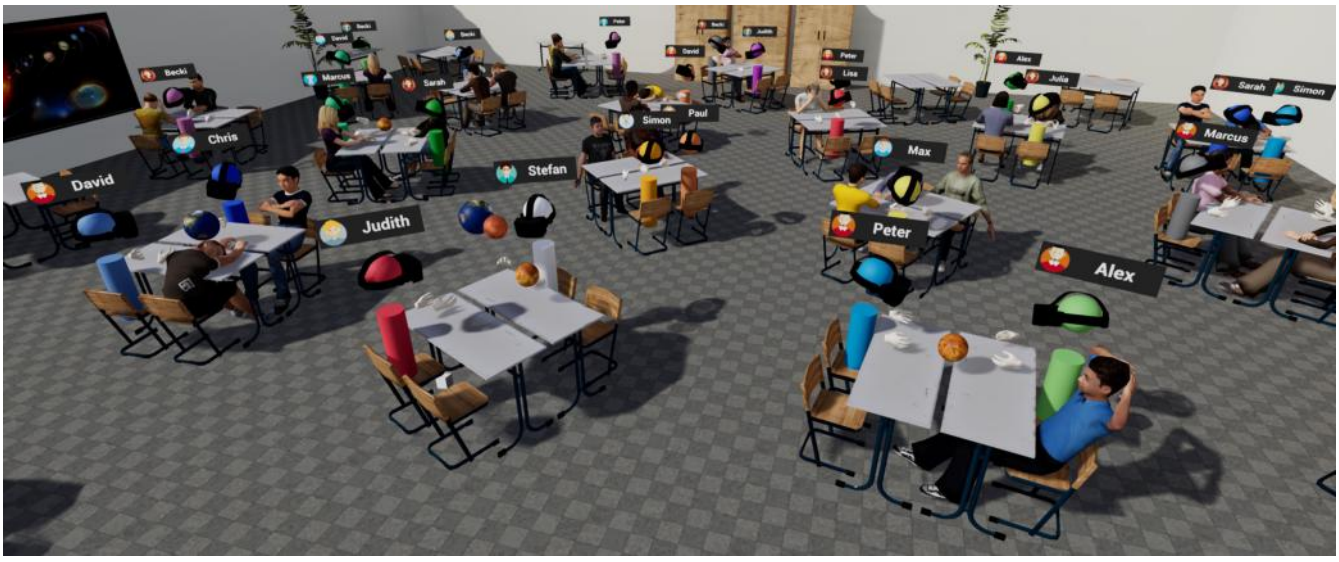
In summary, CoTeach develops and evaluates innovative teaching and learning contexts for initial student teachers, serving as a role-model for prospective teachers. Student teachers´ digital educational competencies will be fostered so that they will be able to apply these innovative formats in their future teaching within schools.

The potential of Immersive Technologies

Immersive technologies enable an active exploration of distant and diverse learning contexts, the highlighting of achieved milestones, the possibility of changing roles, and encountering the unknown in a literally tangible way. In particular the potential of immersive technologies draws on pedagogical principles focusing on competence- and action-orientated as well as situated learning, connectivity and co-construction. One CoTeach work package concentrates on learning environments with full spatial immersion (VR) for intercultural encounters in foreign language learning. The virtual environment is based on developments from another project.

Interdisciplinary psychology, including the perspectives of foreign language teaching, as well as human-computer interaction, interactive and social learning contexts and formats for intercultural encounters in foreign language teaching are designed, evaluated and critically reflected with regard to the promotion of intercultural competences and social interaction. The central elements of intercultural learning (ICL), being knowledge, skills, and attitudes, determine how the concepts of ICL impacts upon teaching methods, teaching-learning contexts, and teaching materials.

Coupling the potential of VR to the central principles of ICL is the starting point for the fundamental question of appropriate approaches and methods of how to develop and implement VR applications in the EFL classroom to give scholars tangible experiences with pedagogically responsible value.



DESK

An Adult Digital Education Skills Kit to Foster Employability

Maria Malliora

The aim of the DESK project is to develop a novel toolbox by which adult trainers can attract, reach out and assist adult learners to catch up with digital literacy.

The DESK project aims to provide adult trainers with the means to understand and efficiently use AR applications in education, and further integrate their own ideas into educational practice, as AR provides new ways of teaching and learning. In addition, the project aims to provide better training opportunities to adults who need to obtain/enhance their digital skills for employment. Seven partner organisations from seven different European countries are participating in this project.

Project deliverables have been divided into five discrete Intellectual Outputs which are linked with one another and lead to the final creation of the Digital Education Skills Kit. These are:

IO1: State of the Art Review on Augmented
IO2: Reality Application in Education
IO3: Adult Digital Education Skills Kit (DESK) Curriculum
IO4: Case-Studies of AR for Adult Education DESK Tool Kit
IO5: Online Guide for Using DESK Toolkit

KEYFACTS

ACRONYM
DESK

FULL TITLE
An Adult Digital Education Skills Kit to Foster Employability

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FUNDING PROGRAMME
ERASMUS+

DURATION
01/11/2018 – 30/04/2021

WEBSITE
http://desk.e-sl.gr

SOCIAL MEDIA
Facebook: https://bit.ly/3dcddQm

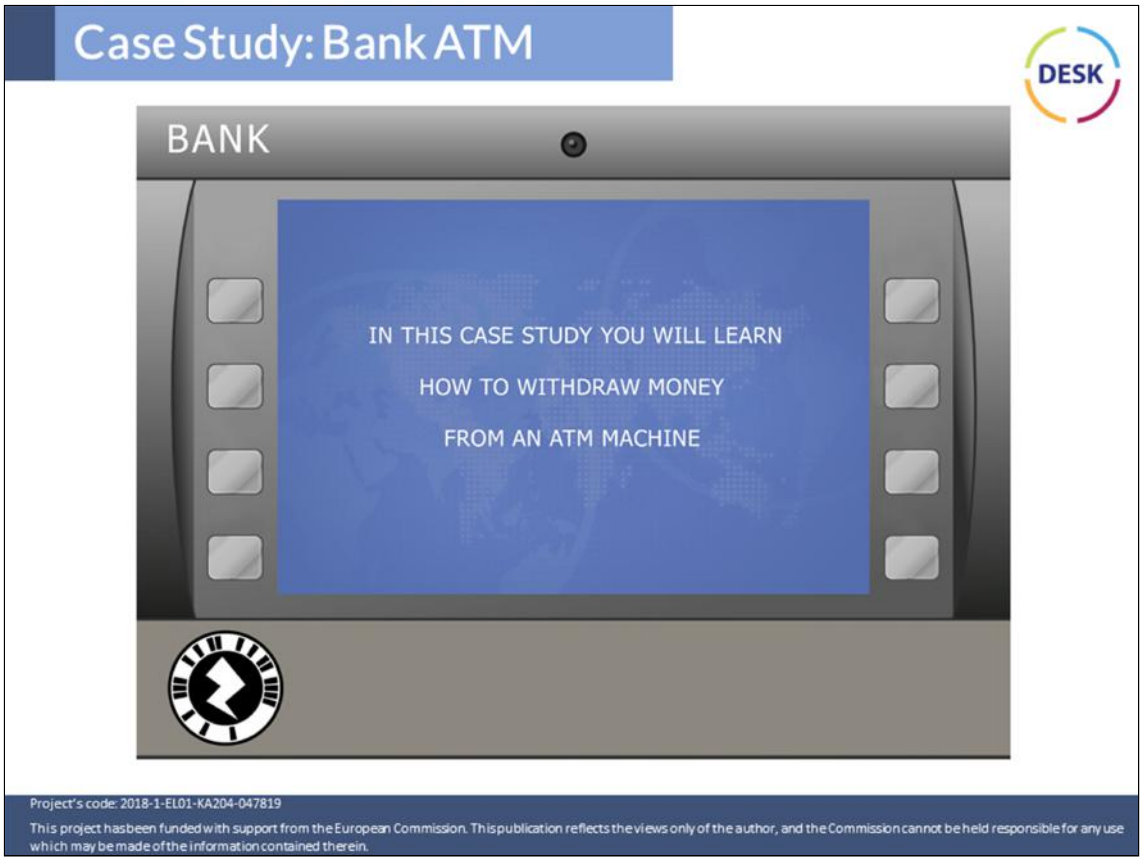
The research phase of the project has highlighted, among others, the following:

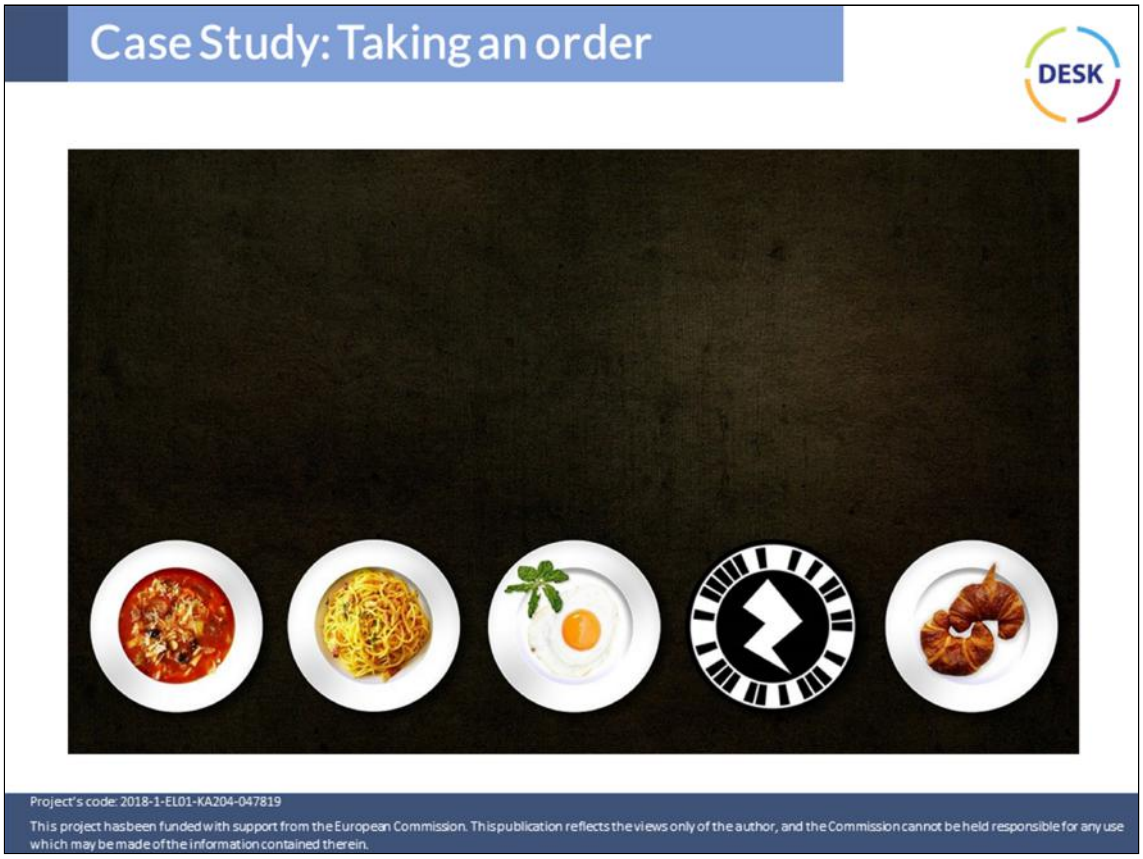
- AR systems' interfaces are user friendly but require prior experience in basic digital skills. Therefore, the DESK curriculum can help adults catch up with basic digital skills.
- AR can be useful in education at various levels including primary, secondary, tertiary and also adult/VET education.
- AR technologies have the potential to both enrich learning environments by structuring new knowledge in innovative ways, and to provide a deeper understanding of subjects through interactive learning.
- AR applications can also enhance learners' motivation and collaboration, while keeping their interest undistracted.
- In the modern workplace, digital skills are particularly valuable, as they enable adults to have direct and quick access to necessary information.
- AR has the potential to impact the educational field positively by making the teaching/learning process much more attractive, efficient, engaging, time-saving and entertaining.
- AR has the potential to be an effective solution for training programmes in an actual workplace and in a wide range of professional fields.
- AR can offer training and development to new and existing employees, thus reducing the skill gap.
- AR also assists in bridging the knowledge gap created by technology advancement.
- AR can provide each employee with personalised training, reducing the need for human resources for on-site support.
- AR can help adult learners complete a process by following step-by-step interactive instructions in a safe environment.
- AR can train employees in a safe working environment.
- AR can be an effective tool for employers by saving time and cutting costs.
- AR application supports employees to ensure a more sustainable knowledge transfer.

Eight AR working case studies have been developed under IO3 with a focus on the development of employees' digital skills needed in today's workplace. Two of them are presented in this article. The first one intends to help an adult with low or no digital skills who faces difficulties in using an automated teller machine (ATM). The second one concerns an old waiter who needs to be trained on how to take orders on a digital tablet. The case studies include Zapcodes. In order for users to be able to view the created AR content, Zapcodes need to be scanned via users' smartphones using the Zappar app.

In this phase of the project, the DESK educational material is developed as part of the DESK Tool Kit (IO4).

Co-funded by the Erasmus+ Programme of the European Union


Case Study: Bank ATM
DESK
BANK
IN THIS CASE STUDY YOU WILL LEARN
HOW TO WITHDRAW MONEY
FROM AN ATM MACHINE
Project's code: 2018-1-EL01-KA204-047819
This project hasbeen funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

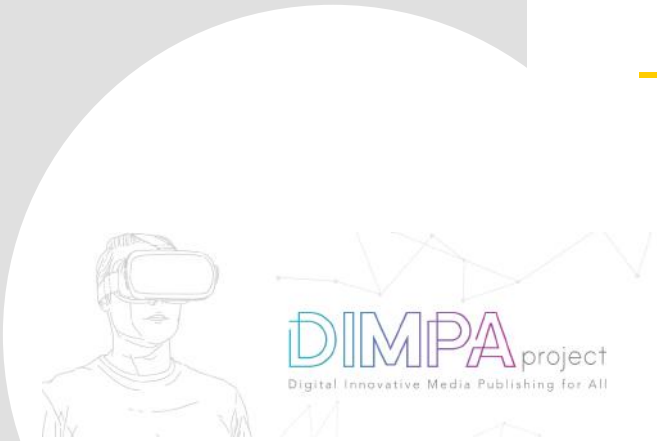

Case Study: Taking an order
DESK
Project's code: 2018-1-EL01-KA204-047819
This project hasbeen funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

KEYFACTS

DIMPA

Digital Innovative Media Publishing for All

Aleksandra Nowak Dupont



The goal is to create accessible learning materials and tools for people to remain employable in an increasingly digital workplace. This first European Massive Open Online Course provides adequate learning on six technologies including VR and AR.

ACRONYM
DIMPA

FULL TITLE
Digital Innovative Media Publishing for All

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FUNDING PROGRAMME
Erasmus+

DURATION
01/11/2018 – 31/10/2020

WEBSITE
www.dimpaproject.eu

SOCIAL MEDIA
#DIMPAproject

Digital publishing started actively in 1971 with the creation of the Gutenberg project but this beginning was slow: it took 18 years for the Gutenberg project to publish 10 books. Despite this slow start, eBooks and other digital publications have now become the reality in the publishing sector all over the world. Initially, creating a digital publication was rather simple: it was enough to publish a digital text file.

But today technology offers much more than that and readers also expect more than that. With "traditional" eBooks, the latest version of EPUB allows the adding of multimedia assets and interactive items in compliance with the accessibility requirements of web standards. This format has already clearly conquered the publishing sector and now other companies and organisations from various industries are becoming more and more seduced by this new format to disseminate their content in an innovative and effective way.

One big trend related to the digitalisation of the labour market that impacts all sectors, is the massive publishing of multimedia digital content, gradually replacing traditional printed

documents and opening doors to new types of publication.

Now AR and VR, but also 360° videos and interactive videos, have arrived on the scene. Each offers its own special features and these technologies offer tremendous publishing possibilities for all sectors, independently or combined.

Mobile devices and the massive expansion of social networks have incredibly fostered new ways of producing and publishing enhanced content. Enriched publications are conquering our screens, our cultural and professional practices and thus revolutionising the way we produce and consult content.

Although technology is evolving rapidly, it was fairly non-existent when many professionals started their careers, so therefore there is a certain lack of knowledge and know-how about it within the majority of professional sectors: communication, content publishing/production, marketing, sales, where traditional printed materials are being abandoned more and more in favour of interactive digital tools or where the use of digital tools is becoming the clear way of producing new forms of content and therefore it is vital to improve and strengthen the employability individuals by mastering these new tools. As stated on the Commission's website: there is an urgent need for digital skills for nearly all jobs where digital technology complements existing tasks.

The purpose of the DIMPA project is to create specific training and training material dedicate to the new ways of publishing and disseminating enhanced contents through 6 major technologies: AR, VR, 360° video, interactive video, EPUB 3 and augmented-printed materials.

Practically, the Digital Innovative Media Publishing for All project provides:

- a MOOC on the new technologies of enhanced content publishing;
- toolkits on tools of production and database of resources;
- reusable models;
- explanatory sheets;
- a training implementation guide.

Thus, we aim to allow professionals to improve their digital skills and boost their employability by providing them with practical tools to define a digital strategy regarding enhanced content publishing. Specifically, the project targets learners of all ages involved in VET sectors, including trainers and teachers.

In addition, this project pays special attention to making the content available to all in order to avoid leaving learners in the cold. Therefore, the content that is being created will be designed to be adapted as much as possible to individuals with Specific Learning Disorders (SLD) which represent 8% to 15% of the population in Europe, depending on the source.
The MOOC itself will start in September 2020 and the pre-registration is now open: http://tiny.cc/DIMPA

Co-funded by the Erasmus+ Programme of the European Union

KEYFACTS

EDUTECH

Teaching and Learning With Technology in Higher Education

Eva Ropero, Marina Mattera

The main aims are to prepare a platform to design teaching activities based on technology with learning analytics as well as to generate a guide and MOOC to help all professors to implement these methodologies and to create content based on these methodologies for disadvantaged people.

The main goal of the project is to improve the learning outcomes of the students, promoting the use of methodologies based on ICT tools, both within and outside the classroom, and to foster experiential learning. This technology will complement new active class methodologies, in order to train new generations of students so that they are prepared for an ever more ICT-based professional world. In doing so, the learner's experience is enhanced by improving employability and reducing the competence gap between the labour market's needs and the knowledge acquired through higher education.

In order to achieve these objectives, the project has brought together diverse institutions from across the EU: Universidad Europea de Madrid (UEM)/ES is leading the project, working alongside UNIMORE/IT, European University of Cyprus/CY and Stratesys/ES. All consortium members have special research teams

ACRONYM
EDUTECH

FULL TITLE
Teaching and Learning with Technology in Higher Education

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Universidad Europea de Madrid, Spain

FUNDING PROGRAMME
Erasmus+

DURATION
01/09/2019 – 31/08/2021

WEBSITE
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https://ec.europa.eu/programmes/erasmus-plus/projects/eplus-project-details/#project/2019-1-ES01-KA203-065558

SOCIAL MEDIA
LinkedIn: www.linkedin.com/company/edutech-erasmus-project

dedicated to innovation in different areas related to education, according to their fields of expertise, promoting specific successful initiatives. Specifically, UEM has become specialised in MR, while EUC has a significant track record in gamifying, while UNIMORE creates online and hybrid environments, catering to a variety of learner types.

The results of the project will be:

- A framework of development of ICT content called The Teacher Experience Suite. This tool will allow firstly the storage and analysis of learning experiences, including learning analytics through the implementation of artificial intelligence algorithms. Additionally, all professors who are interested in using ICT methodologies herein described can make use of the tools to create their own activities, as well as the learning analytics platform to evaluate results and student usage.
- A MOOC plus online best practice guide to enable other HEIs to implement these methodologies based on ICT.
- Open-source educational resources including, but not limited to, audiovisual content, games, tests, quizzes, etc. and testing activities for different areas of knowledge as well as the development of various skills, which should help other teachers who want to implement these methods in their classrooms. The learning will be structured in short content-based "pills" aiming at covering specific areas of knowledge within social sciences, which will enable individuals to access them at different stages of their professional life.

These resources will generate data to improve methodologies by understanding learners' usage of each of them. In addition, the contents will be at the disposal of any individual who is interested in using them beyond the scope of higher education. Specific emphasis will be

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placed upon long-term unemployment groups, women who do not have access to the job market, and among other disadvantaged social groups.

The COVID-19 crisis has shed light on the need for deepening the usage and understanding of these types of tools that enable distance learning while ensuring the knowledge transmission is as effective and efficient as if it were being carried out on-site. Within this context, virtual, augmented and mixed realities can be very helpful for knowledge areas such as healthcare, which would otherwise be difficult to transmit through distance learning. In addition, at UEM we have tested augmented reality in online learning with a focus group of students using some preliminary tools with satisfactory results. For more information, scan the QR code herein enclosed.

We would like to welcome institutions or individuals who may be interested in this project and invite them to test the different tools as we develop them, going through the process of prototyping and design thinking.

Scan this QR code to see the experience!

Co-funded by the Erasmus+ Programme of the European Union

first.stage

Fast and Easy Previsualisation for Creative Industries

Thomas Münder

Virtual reality glasses and newly developed software help directors, actors, stage designers and other participants to plan the scenes of a theatre or film production realistically in advance.

The planning of a theatre play, a film production or an animated film is complicated and expensive: numerous ideas are developed, tested and often discarded. When the actual production starts, many details still have to be redesigned, because in reality they have a different effect than expected in the pre-visualisation (previs) phase. As part of the first.stage project, eight partners have developed a virtual reality application that makes this previs phase significantly easier. A comprehensive evaluation of the project results has shown that VR can help creative professionals to save time and money.

The software, which was developed under the direction of the Center for Computing Technologies (TZI) at the University of Bremen/DE, is now being brought to the market by the British project partner Moviestorm/UK. At the same time, the TZI scientists used the project to investigate the intuitive interaction of users with VR technologies.

KEYFACTS

ACRONYM
first.stage

FULL TITLE
Fast and Easy Previsualisation for Creative Industries

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FUNDING PROGRAMME
Horizon 2020

DURATION
01/06/2016 – 30/09/2019

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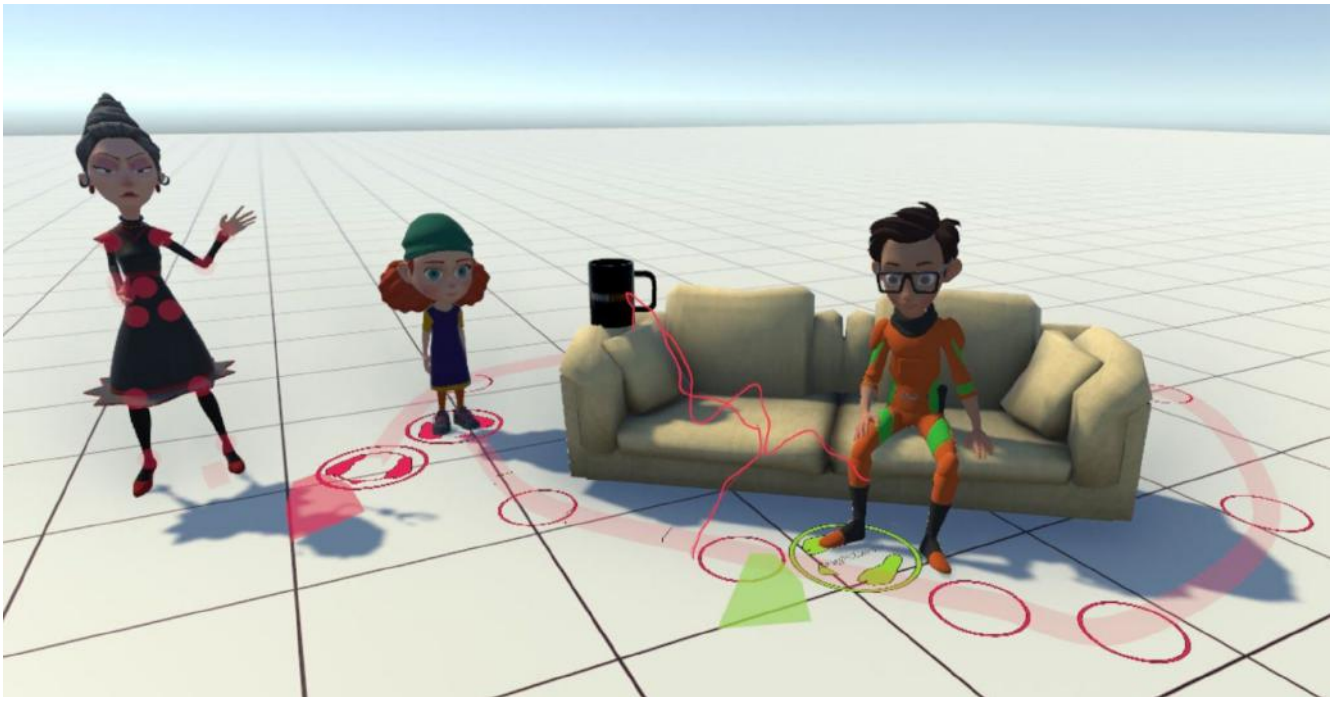
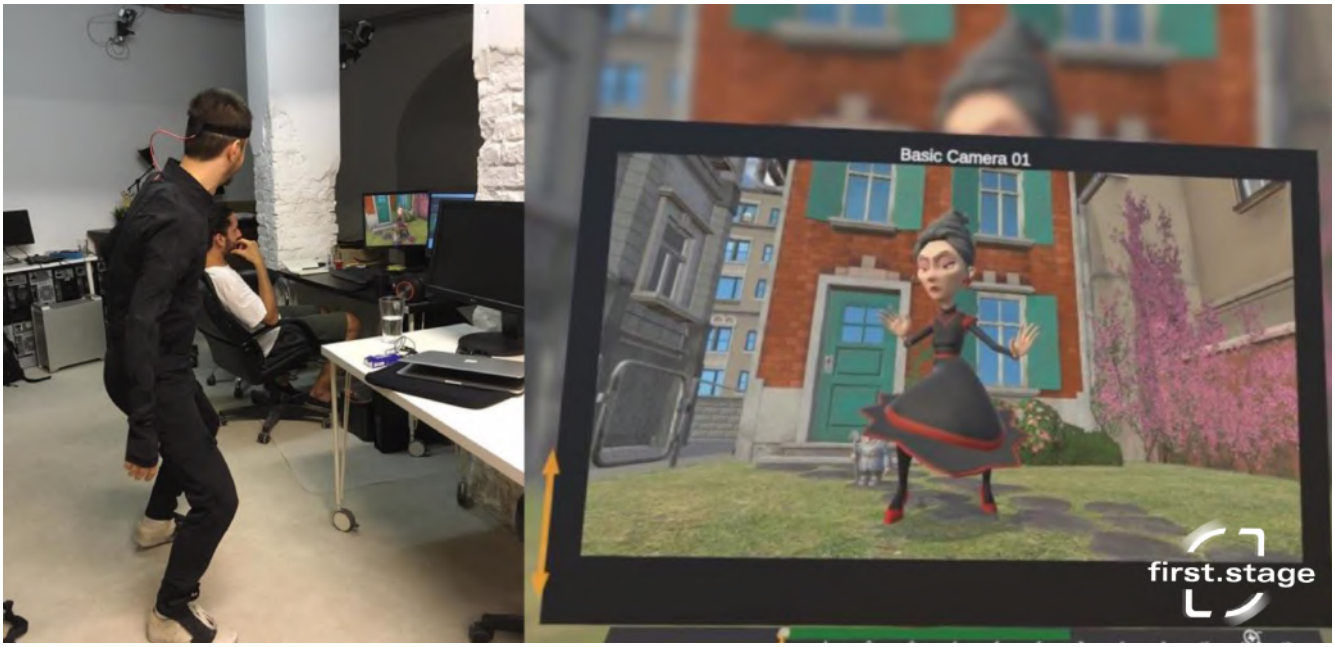
SOCIAL MEDIA
Twitter: www.twitter.com/firststage_eu



The project consortium has developed numerous prototypes of functions and brought them together in the first.stage system. Core functions include the import of objects, people or vehicles that can be put together and animated in the virtual world to create the desired scene. Users can also add special effects such as explosions, fires or moving waters with little effort.

The goal was to design a system that can be easily used by people who do not have any programming experience. For example, at the State Theatre Linz/AT, which tested the VR solution during the preparations for five different productions, one lighting technician was among the most engaged users. first.stage enabled him to recreate the stage set in the virtual world. He could then experiment with a

This project has received funding from the European Union´s Horizon 2020 research and innovation programme under grant agreement No 688244.



wide variety of light colours and lighting angles in order to arrive at the desired atmosphere. This saves a lot of time allowing the real stage to remain available for other rehearsals – a considerable benefit for large theatres where stages are fully booked.

For film producers such as project partner Vogel Audiovision/AT, first.stage is appealing because it allows participants to collaborate and create scenes in advance – without everyone needing to be in the same room. In addition, realistic advance visualisation helps to speed up the actual shooting because there are fewer surprises. The system makes it possible, for example, to test a wide variety of camera perspectives and record real film sequences in virtual reality.

The animation studio arx anima/AT also reported excellent experiences during the evaluation. This Austrian company cherishes the option of trying out many creative ideas over a short space of time to test their viability. With first.stage, this step in the production process could be completed much faster than usual.

The TZI placed the scientific emphasis on the question of how VR technologies can be designed so that even inexperienced users are supported as much as possible. One successful approach: users became acquainted with the technology quite quickly when they were able to build scenes with objects – comparable to a doll's house. In the VR world, for example, a real Lego figure can represent a fictitious person who the first.stage user grasps with his hand and places in the desired position while observing the scene with VR glasses.

In addition to the project partners mentioned above, the companies Next Limit Technologies/ES, Rokoko/DK and Info Consult/DE were also involved in first.stage. Further development of the system with added functionalities from the areas of artificial intelligence and AR would be desirable. It is important to make VR technologies available to small businesses and cultural institution in order to help them thrive in an industry dominated by large entertainment corporations.

This project has received funding from the European Union´s Horizon 2020 research and innovation programme under grant agreement No 688244.

KEYFACTS

Fit for 4.0

Training Teachers and Trainers for the 4.0 Paradigm

Luca Boetti

The project aims at improving teachers' skills to fully embed the 4.0 paradigm in their daily work. It will deliver and pilot a self-assessment tool, a train-the-trainer MOOC, plus policy recommendations to stakeholders and decision-makers.

ACRONYM
Fit for 4.0

FULL TITLE
Training Teachers and Trainers for the 4.0 Paradigm

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FUNDING PROGRAMME
Erasmus+

DURATION
01/09/2019 – 31/08/2022

Industry 4.0, digital transformation, the internet of things, big data, artificial intelligence, virtual reality, smart working, global interconnection – these are the keywords describing the present developments of the labour world. Vocational training can become "the first choice" to live this transformation, but at present only a few training centres in Europe can exploit the necessary equipment, and teachers and trainers are not always aware of the dimension of such changes, nor can they exploit the required tools (conceptual, methodological, technological). Some of them tend to adapt old methods to new topics; some do not know existing online tools for learning, teaching, assessing; some do not interact with each other as much as they could, assuming they have know-how to "defend"; some need a clearer picture of the nature, implications and real meaning of the 4.0 paradigm, which is both a technology and a human factor.

To make VET sustainable, it essential to update its methods and tools, favouring collaboration among teachers/trainers, learners, training providers, companies, social parts and local authorities.

Fit for 4.0 intends to take on this challenge, by describing a set of competences useful to VET teachers, and by developing and testing a set of 4.0 training modules, in strict cooperation with companies.

Project objectives are:

- describing a "minimum" of skills, namely didactical and transversal, needed by teachers/trainers, especially those involved in HVET, concerning the 4.0 transition;
- developing a competence self-assessment tool, allowing VET teachers to measure their readiness for the 4.0 world;
- developing and testing, in close cooperation with enterprises, a resource pack for trainers, a training programme delivered as a MOOC, complete with training material and innovative tools for training, learning, assessing;
- implementing the MOOC to train a sample group of trainers, who will pilot their learning by co-designing training modules/programmes for this new 4.0 concept, together with businesses;
- identifying a set of policy recommendations to local, national and European decision-makers, for the future updating of teachers' and trainers' competences.

To ensure concrete outcomes, the project is focussing on the mechanic, mechatronic and automotive sectors, where advanced digital competences are necessary, and in which the digital revolution has already started, and therefore meaningful company experience exists.

The train-the-trainer programme aims at improving skills for teaching, using innovative methods and tools, embedding the 4.0 paradigm in day-by-day work. It relates to topics like understanding the sense and the impact of the 4.0 paradigm on study and work, how to develop and run interdisciplinary 4.0 training modules together with colleagues and companies, how to make use of training methods and tools which anticipate operational processes at the workplace, how to assess competences in the digital era, and so on.

This train-the-trainer programme is practical and at the same time "intrinsically digital", built with the same instruments as it offers, that is, through transnational teams composed of trainers and company experts, making use of online cooperative platforms.

Trainers taking the programme will not sit in a classroom or in front of a computer, listening for hours to another trainer rattling off tens of slides; rather, they will learn by visiting companies, by discussing with peers (even at a distance), by exploiting Design Thinking and Instructional Design techniques, by exchanging views with experts and professionals, and by "seriously" playing.

Fit for 4.0 is being implemented by a strong consortium of 10 partners from IT, AT, BE, DE, FI, PT, SE and the UK.

Co-funded by the Erasmus+ Programme of the European Union

KEYFACTS

iMARECULTURE

Advanced VR, Immersive Serious Games and Augmented Reality as Tools to Raise Awareness and Access to European Underwater Cultural Heritage

Dimitrios Skarlatos

Raise public awareness of European identity by focusing on maritime cultural heritage. iMARECULTURE aims to bring inherently unreachable underwater cultural heritage within the digital reach of the wider public by implementing virtual visits, serious games with immersive technologies and underwater augmented reality.

The iMARECULTURE project raises European identity awareness by highlighting historic maritime interactions and exchanges in the Mediterranean Sea through the leveraging of underwater cultural heritage. Ancient commercial shipping routes intertwining Europe and the world beyond exemplified this cultural interaction. They left behind a legacy of shipwrecks and submerged sites that this project has brought within the digital reach of the general public through the implementation of immersive technologies (VR) and AR. "Dry visits" have been created using VR along with immersive serious games, and AR tablets enclosed in underwater housings have been deployed to enrich visits to the actual sites.

ACRONYM
iMARECULTURE

FULL TITLE
Advanced VR, Immersive Serious Games and Augmented Reality as Tools to Raise Awareness and Access to European Underwater Cultural Heritage

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FUNDING PROGRAMME
Horizon 2020

DURATION
01/11/2016 – 31/01/2020

WEBSITE
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SOCIAL MEDIA
Twitter: www.twitter.com/imareculture
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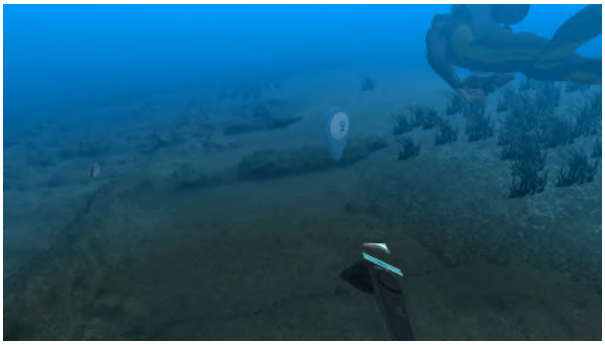
YouTube: www.youtube.com/channel/UCXA_AeZ6PbkPsGHbBJOeM4A

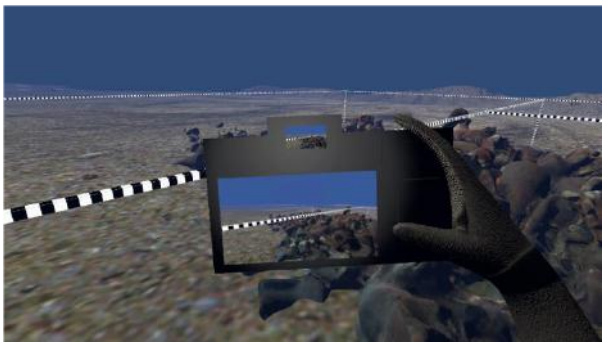
A major component of this project was the development of immersive virtual underwater visits or "dry visits" to the Phoenician shipwreck of Xlendi and the Baiae Underwater Park in Italy. They provide longer interaction times with underwater archaeological sites for both the public as well as for researchers and scholars. These "dry visits" can be accessed using commercial VR headsets such as the HTC Vive or Daydream HMD. They exploit the storytelling possibilities facilitated by VR, allowing users to obtain additional information about the displayed artefacts through a combination of textual descriptions, 360° videos, and infographics. The "dry visit" aplications are available through Google Play for Daydream devices, Steam for the HTC Vive, or directly from the iMARECULTURE site (www.imareculture.eu).

Initial expert evaluation showed that gamification is valuable for training within confined environments. Two training applications in immersive VR were developed as a by-product of the serious games released; one introduces maritime archaeology students to airlift usage and manipulation while the other exposes surveying students to photogrammetry. The former helps train students on the specifics of underwater excavation and familiarises them with the necessary instruments without the constraints of the underwater environment, which restricts not only time but also verbal communication. The latter tasks students with putting markers on a virtual site, measuring the distances between them, and taking photos of the site. The simulated photos can be post-processed using photogrammetric software to reveal areas of improvement. This allows students to gain experience prior to working on an actual site. These standalone software modules were implemented in the underwater serious games alongside a "search and discovery" module, in which the users search for artefacts embedded with videos and textual descriptions regarding the site formation process.

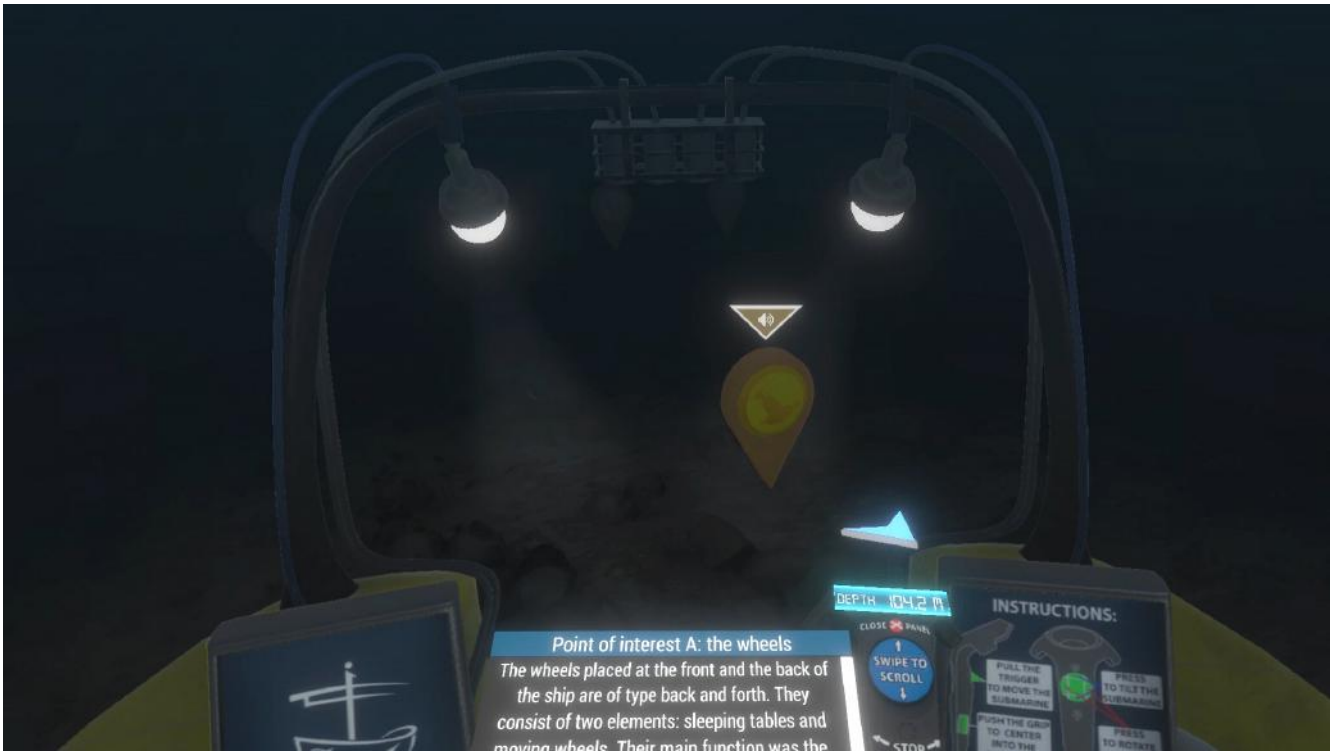
The AR tablets in underwater housing are equipped with hybrid tracking consisting of a combined acoustic and visual odometry system that estimates the location and rotation of the device. For example, divers visiting the Baiae Underwater Archaeological Park can see their current position on the extended site map and enjoy a hypothetical AR virtual reconstruction of the submerged ruins in their original condition.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727153.





Ultimately, many lessons were learnt during the three-years of the iMARECULTURE project. Given the amount of data required to create XR applications, content and data providers will become more important over the coming years. Technical challenges pale into insignificance in the face of data acquisition from the appropriate sources and the complex aspects of intellectual property rights involved in cultural heritage. Since all devices used in this project have now recently been discontinued, it highlights how the evolution of XR has largely outpaced the evolution of its hardware. However, storytelling was and will remain the cornerstone of any notable VR experience in the sphere of cultural heritage wishing to attract the general public.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727153.

INCEPTION

Inclusive Cultural Heritage in Europe through 3D Semantic Modelling

Roberto Di Giulio, Luca Coltro, Federico Ferrari, Ernesto Iadanza, Federica Maietti, Marco Medici, Emanuele Piaia

Semantic modelling of Cultural Heritage buildings using BIM to be managed through the INCEPTION platform for the advanced deployment and valorisation of enriched 3D models, for better knowledge sharing and enhancement of European Heritage.

The holistic fruition of cultural heritage based on 3D digitisation provides the grounding for conservation and the prevention of social, cultural and economic consequences resulting from damage caused by war, flood, earthquake, fire, etc. through the awareness and preventive maintenance and management of heritage at risk.

The strategic goal of the INCEPTION project is to support the process of digitisation, management, dissemination, enhancement of cultural heritage and built heritage, through BIM-based and semantic-web technologies and platforms, for structured sharing of digital and digitised information about cultural heritage, promoting broad accessibility and social inclusion.

KEY FACTS

ACRONYM
INCEPTION

FULL TITLE
Inclusive Cultural Heritage in Europe through 3D Semantic Modelling

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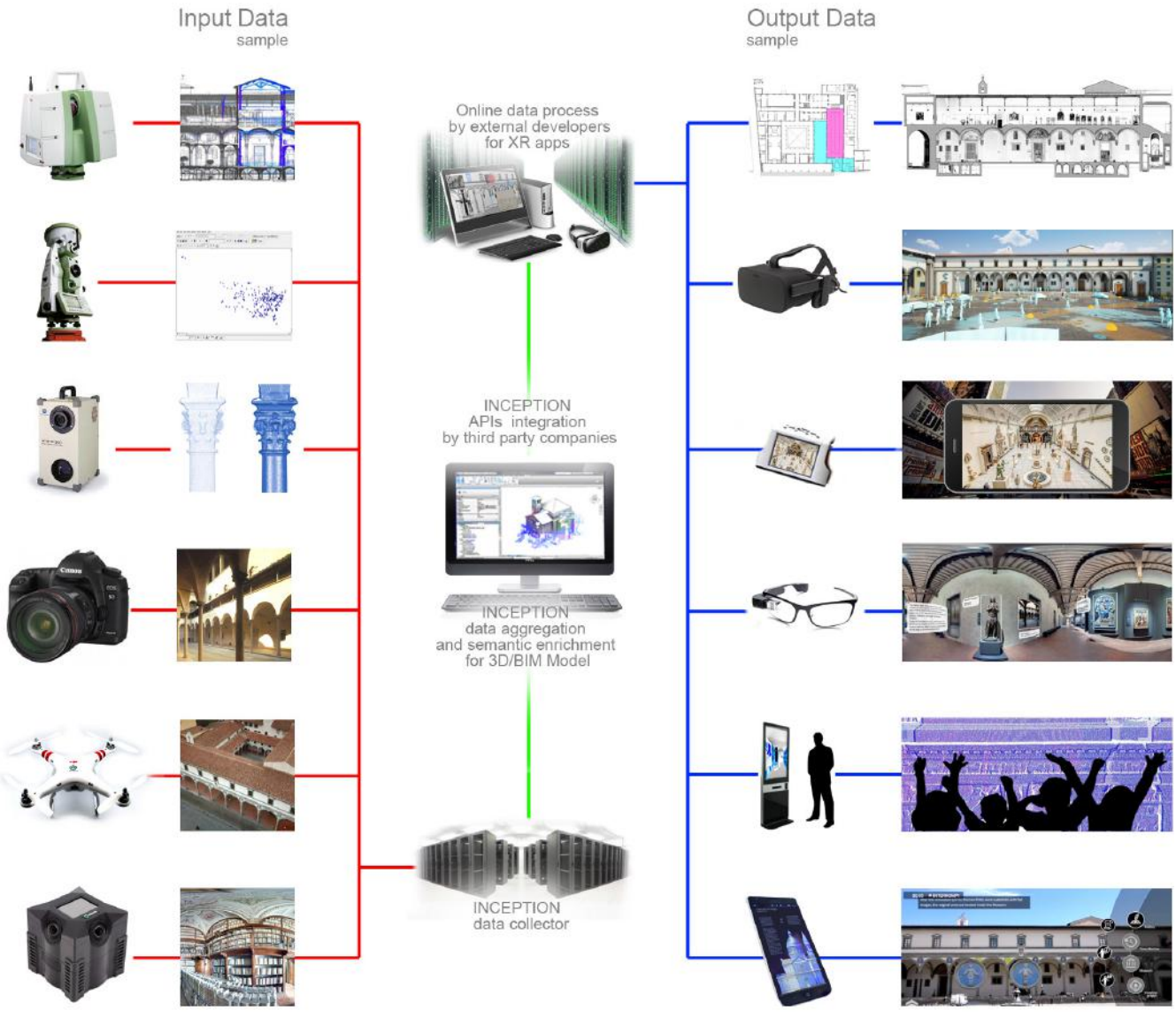
FUNDING PROGRAMME
Horizon 2020

DURATION
01/06/2015 – 1/05/2019

WEBSITE
https://www.inceptionspinoff.com
https://www.inception-project.eu/en

The project, which ended in 2019, resulted in the establishment of an innovative start-up company, INCEPTION Srl, accredited as a subsidiary of the University of Ferrara, according to Italian regulations for research exploitation. The company indeed exploits the outcomes of the EU project by empowering public administrations, museums, site owners, etc. with software solutions based upon the INCEPTION Core Engine and providing solutions for managing, visualising and archiving 3D or BIM models and all the related digital documents, aggregated by semantic technologies.

The INCEPTION platform consists of a framework of software tools and a set of programming interfaces (APIs) able to transform each element of an IFC (Industry Foundation Classes) BIM model into semantic RDF (Resource Description Framework) triples, storing them in a dedicated semantic triple store and linking them to metadata, documents and other linked data. These data are reassembled in a 3D model, navigable by means of a simple modern web browser (HTML5 + WebGL).



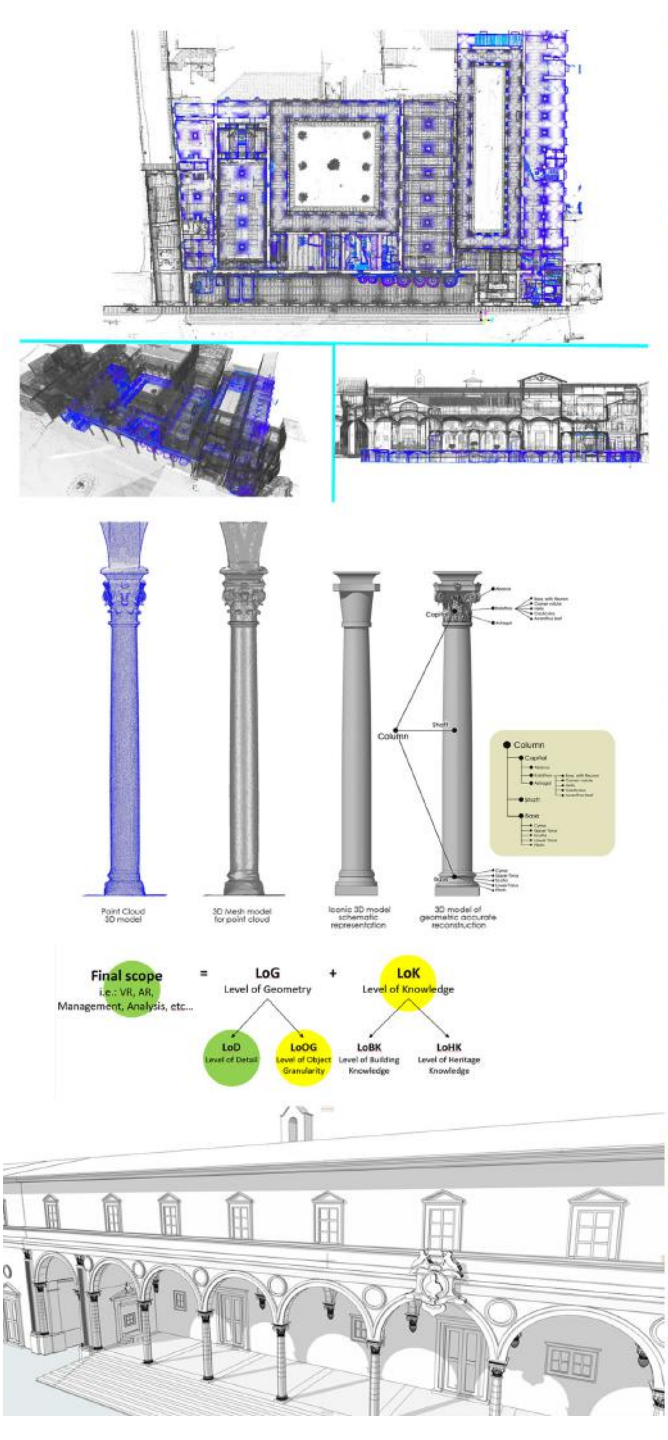
The INCEPTION research project has received funding from the European Union's H2020 Framework Programme for research and innovation under Grant agreement no 665220.

These solutions provide a wide audience, at different levels of competence and training, with easy to use (but complex) technologies.

The INCEPTION platform impacts on technical/managerial/maintenance/conservation and development aspects of cultural heritage, also exploiting XR.

Specifics APIs allow a link and integration between the structured data inside the INCEPTION platform and the development of XR Apps by third party companies, easing collaboration between different disciplines, technologies and research fields.

Several experiments have been carried out in the field of ludic/touristic and edutainment through VR and AR applications, testing the "static" and "dynamic" methods of data access to the platform.



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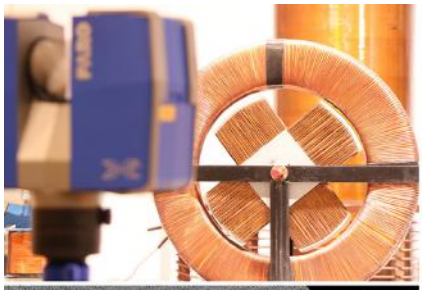





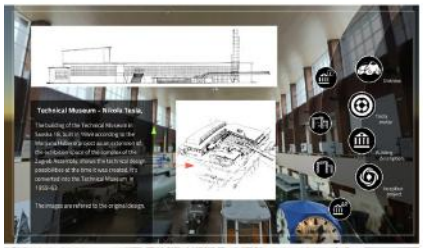


The INCEPTION research project has received funding from the European Union's H2020 Framework Programme for research and innovation under Grant agreement no 665220.

Currently, with several forms of accessibility changing due to the pandemic outbreak, digitisation is becoming an effective solution in making monuments and cultural sites virtually accessible to people. Therefore, improving VR/AR/XR policies and experiences will become more and more essential for empowering the cultural heritage sector with its digital transformation. The relevance of digital platforms, tools and virtual experiences is now at the forefront of public minds and many institutions are increasing or moving activities online. Therefore, INCEPTION project's impact upon the scientific and cultural community is proving to be significant, as demonstrated by several collaborations and agreements with national and international bodies and associations, such as Europeana (https://pro.europeana.eu) and the Italian Ministry of Cultural Heritage and Activities.

According to the experiences and lessons learnt, future research avenues will include digitisation in order to meet the need for the documentation and preservation of heritage at risk, but mainly for increasing the accessibility of heritage sites at risk to European citizens. High quality 3D models, interoperable formats and open-access digital cultural heritage assets are essential for the effective use of digital content, increasing digital engagement and fostering sectors such as tourism, education and creative industries.

SOCIAL MEDIA

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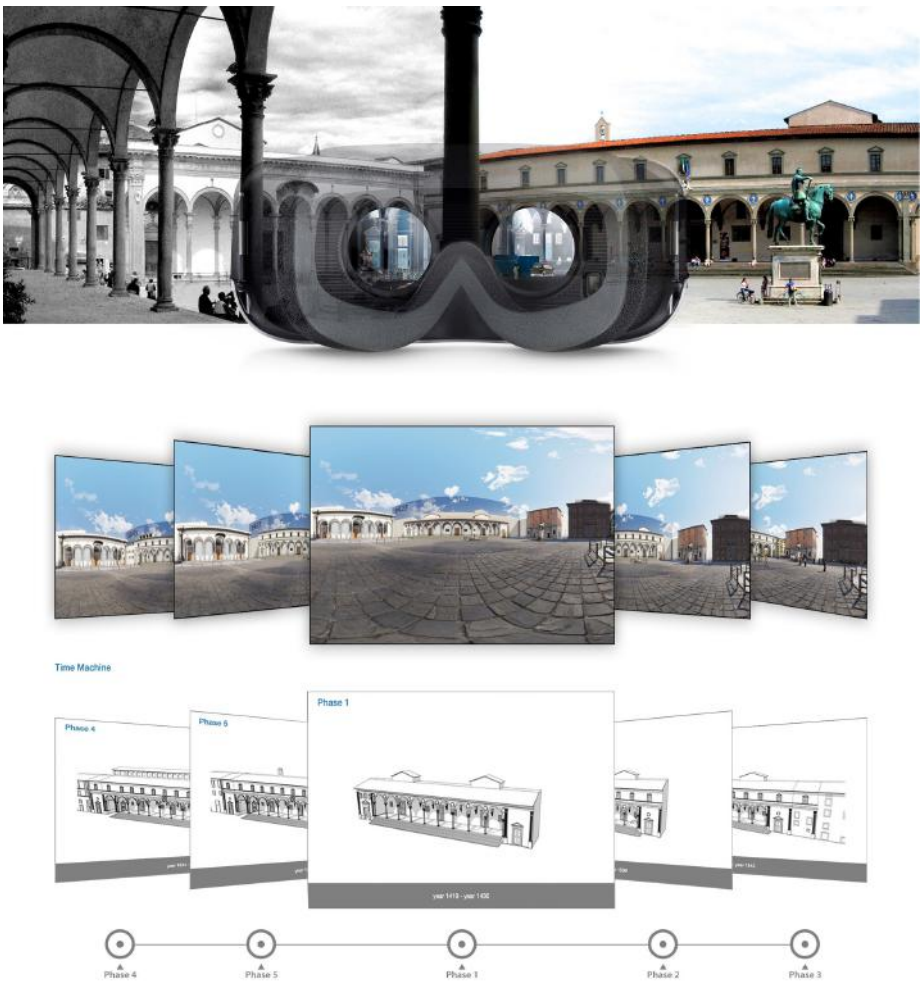

The INCEPTION research project has received funding from the European Union's H2020 Framework Programme for research and innovation under Grant agreement no 665220.

KEYFACTS

iv4XR

Intelligent Verification/Validation for Extended Reality-Based Systems

Marta Couto, Rui Prada, Pedro Fernandes, Wishnu Prasetya, Tanja Vos

iv4XR aims to develop an AI agent-based verification approach to test XR systems; a computational approach for automated appraising of human factors and user experience; and to deliver a framework and toolkit to support automated testing of XR systems.

XR systems are emerging in different areas such as entertainment (e.g. games), training (e.g. soldiers, healthcare professionals) and retail (e.g. Rolex, IKEA), amongst others. Testing these complex systems is critical to ensure, not only that they function correctly but also that they deliver a high-quality user experience (UX). However, as XR systems grow, so does their complexity, which entails a delicate balance between a fine-grained system and a high level of interactivity and realism, making XR systems very difficult and expensive to test.

ACRONYM
iv4XR

FULL TITLE
Intelligent Verification/Validation for Extended Reality-Based Systems

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FUNDING PROGRAMME
Horizon 2020

DURATION
01/10/2019 – 01/10/2022

WEBSITE
https://iv4xr-project.eu

SOCIAL MEDIA
Facebook: www.facebook.com/iv4xr
Twitter: www.twitter.com/iv4xr

Current XR systems testing procedures are rudimentary and have very little automation support. They typically do not support comprehensive test scenarios, and more importantly, the test cases are not easily replicable and do not accommodate changes to the system, making them quickly obsolete (Prada et al. 2020). This lack of suitable testing toolsets means that testing complex XR systems involves hours of manual work done by human testers, thus increasing costs and difficulty associated with testing the systems. Given the time it takes to test one version of one XR system effectively, this lack of an appropriate toolset actively hinders the industry's growth and ability to respond to market demands for sophisticated systems that provide a high-quality user experience.

Our goal is to create new verification and validation methodologies and a toolkit, based on artificial intelligence (AI) techniques to support automation. The toolkit defines a framework to support the integration of intelligent software agents and their deployment in the virtual worlds created within the XR systems. The agents will have diverse capabilities, that may be built with external tools (e.g. FAtiMA toolkit, designed to create characters with social and emotional intelligence - https://fatima-toolkit.eu; and TESTAR, a scriptless approach for completely automated test generation for event-based SUT - https://testar.org), and will be driven by testing goals that developers may define and configure. The agents will be able to test a wide range of functionalities but will also address issues of UX, an essential part of XR systems. Different people in diverse conditions and with different goals have different experiences with a system. Individual differences such as age, gender, social-economic status, mood and working memory ability, can alter how someone interacts with an XR system and additionally, this experience will change with time, as the mood or user skill change.

This project has received funding from the European Union's Horizon 2020 Research and innovation programme under grant agreement No 856716

We aim to develop socio-emotional and functional test agents to improve the validation and verification of XR systems, making it more systematic and cost-effective. Our main output will be a framework that allows developers and testers to formulate test goals, and to deploy intelligent agents that will interact with the system.

Intelligent agents can bring several advantages to automated testing, from "human-like" play-testing to the creation of personas, ensuring XR systems are adapted to all relevant demographics. Several agents can also be employed to test systems that can be used by multiple users simultaneously.

The iv4XR project aims to deploy the developed framework to three use-cases that will provide continuous benchmarking for the test agents developed:

1. an advanced training simulation system from THALES;
2. an advanced 3D game called Space Engineers from GoodAI;
3. an advanced structure/building monitoring system from Gameware Europe.

All three use cases require different interaction and visualisation technologies, each representing a unique virtual world, reflecting the diversity we have to deal with in the XR market.

This project has received funding from the European Union's Horizon 2020 Research and innovation programme under grant agreement No 856716

MVR

Learning Mathematics through VR

Aleksandra Nowak Dupont

The objective is to develop new tools by means of inquiry non-formal education, hands on pedagogical methodology and the usage of VR for enhancing current didactics of mathematics and increasing engagement with learning mathematics.

Despite being considered as "the Queen of sciences", mathematics suffers deeply from a "bad reputation" amongst youngsters. Learners often believe that the level of difficulty of mathematics is too high for them and that they cannot do anything about it. If active learning of mathematics does not grow from genuine student interest, it will never come in later school and adult life. Yet for most people (including teachers, educators and decision-makers), mathematics is considered to be a hard subject that can only be taught in a formal way. Thus, too many schools around Europe face the same challenge: students are not interested, they are disengaged and are often not even sure why they are taught this subject in the first place.

Einstein stated that "the only source of knowledge is experience". It is proven by many studies that we retain around 10% of what we read, yet 90% of what we experience ourselves. Being at school is the most important educational period when students create learning mechanisms, construct knowledge and develop acquisition methods.

KEYFACTS

ACRONYM
MVR

FULL TITLE
Learning Mathematics through VR

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ORGANISATION, COUNTRY
Marco Bertolini – Conseil et Formation (MBCF), France (coordinator)
Logopsycom, Belgium (author)

FUNDING PROGRAMME
Erasmus+

DURATION
01/10/2018 – 30/10/2020

WEBSITE
www.math-reality.eu

SOCIAL MEDIA
Twitter: www.twitter.com/MathReality

Co-funded by the Erasmus+ Programme of the European Union

Considering these two points, it is therefore essential to work on a way of improving the level of mathematics amongst European school pupils and make their learning experience less passive. Based upon their respective expertise and research, the organisations that have created the Math Reality project are convinced that using VR can play a very positive role in improving both general education and the learning of mathematics. The idea behind the project was to look beyond pre-configured curriculum resources and understand how usage of this technology can unlock a student's potential.

The objective is to use VR tools to increase engagement with learning mathematics. The project targets teachers and educators in secondary education, giving them access to a new range of possibilities for teaching this specific subject and potentially other subjects.

In addition to the above points, we believe that inclusion in education will never be achieved if projects are only made for "regular" students on the one hand or only for disadvantaged students on the other hand. Therefore, within the project we also focus on the inclusive aspect of teaching mathematics and creating content adapted for people with SLDs, for whom making sustained progress in learning maths is an extremely challenging process.

VR/AR/XR have been referred to as the "4th wave" of technological innovation and change in the world of computing. This technology helps users to feel immersed in an experience, gripping their imagination and stimulating thought in ways not possible with traditional books, pictures or videos, and it facilitates a far higher level of knowledge retention. Therefore, it is perfect for teaching mathematics!

The evolution of the market has recently made quality VR headsets available for € 200, allowing greater democratisation of the technology. Moreover, the project partners are from small or medium-sized towns, and participating in this project not only provides access to VR but also allows them to share good practice and experience with their European colleagues and to gain confidence in using innovative technology for teaching mathematics.

To successfully tackle the challenge of underachievement in mathematics through the application of VR the project provides:

- 1 booklet "VR for education" presenting how VR can be used in the education sector;
- 1 pedagogical guide "VR for mathematics";
- 15 analogue hands-on designs: creation of mathematics exercises that can be used alongside VR;
- 30 lesson scenarios to use with VR applications.

The booklet and guide are available via the project website in English, French, Italian, Greek, Romanian and Croatian. Other outputs will be available in October 2020.

Co-funded by the Erasmus+ Programme of the European Union

KEYFACTS

SHOTPROS

A Human Factors-Based (VR) Training Solution for Decision-Making and Acting Capabilities under Stress and in High Risk Situations for European LEAs

Valerie Schlagenhaufen

After validation of a human factors model for DMA-SR, the project defines guidelines for (VR) training for Europe's LEAs and develops a training curriculum as well as a VR training environment; finally, a European network and a policy maker toolkit for knowledge transfer on VR training are set up.

The SHOTPROS project began with the kick-off event in May 2019. A team of 13 European partners from high-ranked research institutions, business companies and international Law Enforcement Agencies (LEAs) are cooperating for 3 years to implement the project. With the help of VR training, SHOTPROS will firstly train responders' decision making and acting capabilities under stress and in high risk situations to fight crime and terrorism.

ACRONYM
SHOTPROS

FULL TITLE
SHOTPROS - a Human Factors-Based (VR) Training Solution for Decision-Making and Acting Capabilities under Stress and in High Risk Situations for European LEAs

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ORGANISATION, COUNTRY
USECON – The Usability Consultants GmbH, Austria

FUNDING PROGRAMME
Horizon 2020

DURATION
01/05/2019 – 30/04/2022

WEBSITE
www.shotpros.eu

Objectives of SHOTPROS

Better decision making and acting performance enhanced by VR training

The project has created a Human Factors Model for Decision Making and Acting under Stress and in High Risk Situations (DMA-SR). This model is vital for understanding how decisions in the presence of diverse stress factors are made and it will be evaluated and validated by practitioners during the course of the project. For this purpose, SHOTPROS is developing a VR research solution to experimentally assess the degree to which various human factors influence DMA behaviour. Subsequently, the project will develop a human factor-based training curriculum and a corresponding VR training solution to provide a comprehensive framework for practical training in order to improve DMA-SR performance. Stress influencing factors can be manipulated in this virtual environment to individualise training and to make it more valuable. VR training that adequately prepares police officers for real-life incidents improves the success of police operations and contributes to the civil security.

Markus Murtinger, coordinator of SHOTPROS, highlights the relevance of this project: "Existing training mainly focusses on skills training. Processes of decision making and acting and the impact of stress on these processes are neglected. We aim to set up a training framework, enhanced with virtual reality, to change the training methods within LEAs to improve decision making processes and to minimise the use of force, causing collateral damage and the escalation of situations."

Knowledge exchange and European standardisation of VR training

During the project, a pan-European network of international LEAs is established in order to transfer knowledge gained from the project and to spread the results within the European Security Network. A tight integration of end users is a vital part of the SHOTPROS project, and this creates competitive advantages in fighting terrorism and radicalisation. Furthermore, strategies and toolkits for policy makers will be derived from the project results and which will take into consideration policy goals and identified policy questions and problem areas. The toolkit compiles materials that are relevant to policy strategies and decisions, helping policy-makers understand the requirements of LEAs concerning training and VR training methods. This toolkit will be developed further by the network as a work in progress, reacting to current policy questions and issues and different situations within national and European contexts.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 833672. The content reflects only the SHOTPROS consortium's view. Research Executive Agency and European Commission is not liable for any use that may be made of the information contained herein.

First achievements and outcomes of SHOTPROS

In the first year of SHOTPROS, the consortium has established a solid basis for achieving the project objectives. Comprehensive requirement workshops were conducted with all LEA partners to understand the desires and needs regarding (VR) training of European police. Also, a large-scale analysis of existing training curricula has been performed and validated by site-visits to all LEAs to identify "best practice" training. Based on these findings, a DMA-SR model and a research agenda for validation have been developed. Moreover, SHOTPROS has conducted several large-scale studies with practitioners to compare VR training with real-life training and to measure stress-levels in the training. Next steps are the implementation of the outcomes to develop prototypical scenarios in VR and the execution of human factor studies.

Within the first year of the project, SHOTPROS has received a lot of positive feedback from practitioners, the media and policy-makers. The fact, that VR training is becoming increasingly important in the security domain affirms that we are contributing to the future of police training.

SOCIAL MEDIA

Facebook:
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www.linkedin.com/groups/8797842

ResearchGate:
www.researchgate.net/project/SHOTPROS-A-HUMAN-FACTORS-BASED-VR-TRAINING-FRAMEWORK-FOR-DECISION-MAKING-AND-ACTING-CAPABILITIES-UNDER-STRESS-AND-IN-HIGH-RISK-SITUATIONS-FOR-EUROPEAN-LEAS

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VAM Realities

University Business Cooperation for Promoting Virtual, Augmented and Mixed Reality Applications within Small and Medium-Sized Manufacturing Companies.

Carsten Domann,
Ian O'Donovan

The project aims to support European SMEs to become familiar with immersive technology and to assist with the integration of this technology into business operations through cooperation between SMEs, HEIs and technology providers.

In the age of industrial digitalisation, companies are being challenged to seek out the right technological opportunities that will streamline their business operations and guarantee their sustainability into the future. In recent years, technologies that enhance or recreate real world environments are increasingly influencing industry and business. With VR and AR as well

KEYFACTS

ACRONYM
VAM Realities

FULL TITLE
University Business Cooperation for Promoting Virtual, Augmented and Mixed Reality Applications within Small and Medium-Sized Manufacturing Companies.

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FUNDING PROGRAMME
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WEBSITE
www.vam-realities.eu

the combination of both (MR/XR) it is possible to simulate almost any process carried out in the physical world. These technologies are changing the way companies operate, by changing the conventional workstation, empowering workers to learn more efficiently and transforming how customers interact with products.

When compared to our competitors, European SMEs still have a long way to go in utilising immersive technologies. Within manufacturing SMEs in particular, all studies suggest a lack of awareness, as well as insufficient investment and training. Subsequently, Europe's educational and economic actors will need to confront these challenges and seize the opportunities. The VAM Realities project will help to initiate promising developments and effective cooperation between the HEI providers and industry, to equip SMEs with the knowledge and tools they need in order to compete.

With a university-business cooperation model that includes 11 partners from around Europe the VAM Realities project is tackling this situation by raising general awareness about the role of VR/AR/MR as well as working specifically hand in hand with industry to integrate immersive technology into businesses. These objectives will be realised through the following project deliverables:

EU-wide Survey – SMEs' Awareness, Demands, Skills Gaps and Training Needs with regards to VR/AR/MR business solutions:

- gaining an insight into the current situation within Europe's SMEs with regard to VR/AR/MR, in terms of practical application, attitudes and perceptions towards these technologies, possible investment barriers etc.;
- identifying the demands and needs of SMEs and highlighting the skills gaps.

VAM Realities State of the Art Analysis and Experts' Panel:

- providing an overview of the current state of the art with regard to the VR/AR/MR hardware and software available on the market and their usability for manufacturing SMEs;
- formation of an expert panel for immersive technologies to guide industry and HEIs; if you are interested please sign up at www.vam-realities.eu/network-registration.

VAM Realities Online Platform and Community:

- creating a European VR/AR/MR platform with 500+ members where HEIs, SMEs, service providers, business representatives and policy makers can meet, exchange and jointly develop new approaches for integrating immersive technology into industry; you are warmly welcome to register at www.vam-realities.eu/network-registration;
- providing access to all outcomes and results developed during and beyond the project's lifetime.

VAM Realities Call for Tender – New hard- and software Solutions for the SMEs of tomorrow:

- launching a call for a tender competition for students and start-ups to create small VR/AR/MR solutions for SMEs (November 2020);
- promoting, testing and piloting the chosen solutions with European SMEs.

Skills Gaps Detector for SMEs and Training Gaps Detectors for HEIs:

- providing SMEs with useful tools so they can self-evaluate where they stand with regard to VR/AR/MR technologies and what action is needed to improve their situation;
- providing HEIs with a tool to self-assess whether or not their curricula provide students with the skills required by the markets and how to improve their business consulting potential.

HEI VR Coaching Scheme for SMEs:

- to implement pilot coaching schemes between HEIs and SMEs across Europe and to integrate immersive technologies into business operations;
- setting clear standards and guidelines on how HEIs and business consultants can best approach and support SMEs.

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KEYFACTS

ViRAL

Virtual Reality Archive Learning

Werner Matt

ViRAL is a project that aims to develop non-formal adult education using digital tools, such as virtual reality, augmented reality, and 360º videos, with information from archives, museums or initiatives of post-industrial cities.

Today the terms "digital" and "virtual" are synonymous for progress, simplified access to information, the democratisation of knowledge and have an almost youthful attractiveness. Placement projects using virtual technologies in digital spaces overcome geographic barriers and pave the way to information, that would otherwise remain as highly guarded and difficult to access treasures in archive vaults and museum reserves. The same techniques allow people who do not possess any highly specialised qualifications to access historical information. Ideal for an Erasmus+ project related to adult education.

The EU project ViRAL goes a step further. By using free software and low cost devices, virtual technology becomes affordable for the many small and medium-sized archives, libraries and museums. Didactic tools, good practice examples and training courses allow experts and adult trainers to use these technologies effectively. Therefore, existing human knowledge can be used, chances increased and new skills acquired.

ACRONYM
ViRAL

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Virtual Reality Archive Learning

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WEBSITE
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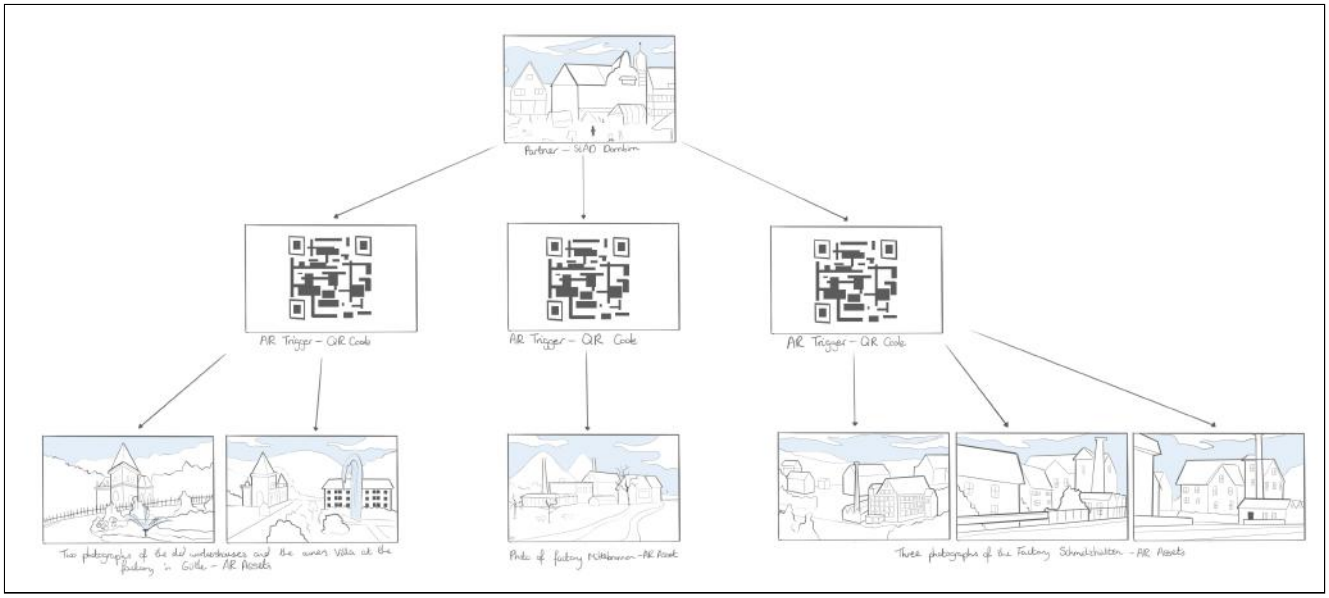

This project is being developed together by seven partners from six nations, including Coventry University/UK, City Archive Wuppertal/DE, Museum of Slavonia/HR, Museum Fábrica Grande/PT, E-Learning Studios/UK, Elderberry AB/SE and the City Archive Dornbirn/AT. By focussing on industrial heritage, broad sections of society are included. Personal experience, stories of family members and neighbours or the presence of bygone or still existing industrial areas in the immediate personal habitat should fascinate and encourage the participation of people who would otherwise be hard to reach through traditional educational means.

For example: within the ViRAL training outputs a virtual reality scenario will be created that will follow a digital trail through Dornbirn's industrial past led by three different narrators. A worker, an engineer and a factory owner will accompany you digitally through the industrial site. As you travel virtually through the factory your chosen narrator will tell the story from their point of view, and other digital artefacts will be used to illustrate the history. For example, when an engineer is telling his story a gallery of images appear that show the products made in the factory, which stood in that part of the city in 1923. If you choose the worker, he/she will talk about working and living conditions at that time.

In a former industrial city affected by significant structural changes, there is a great need to catch up on continuing education. The post-industrial landscapes have left a rich cultural heritage and thus, the material and immaterial culture of this industrial heritage can be used as an educational resource. This can be done by raising up the knowledge and treasures of the industrial culture - factory halls, machines, the stories of the workers who served them, etc. - and the associated archive materials, the collection, preservation and editing of archival documents and the abilities of the teachers and trainers.

Digital formats allow the user to play an active role. Their own working, family and consumer experiences allow many to participate in such projects or learn to take part in such a process. Ex-workers ask different questions and tell different stories than the unemployed. Youths see things from their own perspective. Questions of migration, gender, and class are, of course, paramount issues for industrial labour. All them can be prepared via prepared tasks (so-called quests) or selected examples for a variety of groups. With this prepared and active participation, new skills and competences can be acquired. Archives and museums need to ensure that those stories, reports, research activities and explanations find their way back

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into their collections. This is a congenial supplement to the archive documents created by the forces of production and profit, and the collections of museums created by aristocrats and the bourgeoisie. It is an important, democratic opening of what seems to be an otherwise impregnable fortress inside formal and official institutions for a large amount of the population. Learning comes through the breaking down of barriers by accessing oriented archives and classic museums, through active and interpretative participation and through the exchange of information. A long-held dream is coming true, as archives, museums and libraries open up, the teacher learns from the student.

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VIRAL SKILLS

Fostering Virtual Reality Applications within Adult Learning to Improve Low Skills and Qualifications

Carina Posch

Virtual reality allows learners to immerse themselves in complex topics, with actively experiencing learning content taking the place of memorising. To exploit the full potential of this new medium, VIRAL SKILLS offers comprehensive supporting materials.

Humans are evolutionarily wired to learn through personal or observed experiences, and even though we have learnt to communicate in abstract concepts, this basic learning channel still holds direct access to our mind. VR puts a learner into a simulated environment, allowing them to directly experience hands-on otherwise hard to grasp information. In the case of AR and MR, the real world is complemented by additional information that allow deeper insight and illustrative simulations.

KEYFACTS

ACRONYM
VIRAL SKILLS

FULL TITLE
Fostering Virtual Reality Applications within Adult Learning to Improve Low Skills and Qualifications

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These technologies hold immense potential for the education sector at all target group levels such as school education, VET, HE and adult education. This potential should be pursued even more to extend and enhance the methodical repertoire of teachers and trainers. The technology has advanced to a level that makes it almost impossible for the human brain to distinguish between the virtual and real environments, and the experiences made in a VR space are processed as if they were real – even though the logical mind knows it is just a simulation. The possibilities and fields of applications of VR, AR and MR are limitless: from experimenting with mathematical and physical concepts, to learning languages and public speaking, to travelling through time and space and to exploring a complex machine and its functions through interactive 3D.

Unlocking this potential and equipping adult education trainers with the necessary know-how about VR technology and available software applications suitable for educational purposes is one of the main aims of the VIRAL SKILLS project. A partnership of seven European organisations from Austria, Germany, Ireland, Italy, Cyprus and Spain has developed three intellectual outputs that cater to the needs of pedagogical personnel, especially those involved with adult learners as well as low-skilled and low-qualified learners.

The VR Digest, which is a comprehensive survey report of the state of the art in VR, presents the knowledge and estimations of technical experts for further developments in this sector in all partner countries. It is complemented by an in-depth VR hardware analysis, including SWOT

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analyses that shed light on the strengths, weaknesses, opportunities and threats of VR solutions in the educational setting. One main outcome is that VR hardware solutions differ in their performance, hence they need to be used with care and the safety of learners must be guaranteed during any VR training session.

In the VIRAL SKILLS Compendium, the partnership has created a versatile handbook for educators, featuring a technical introduction to VR, a pedagogical view of VR and learning, a country comparison of the international state of the art in VR, results of a broad target group survey amongst adult educators in all partner countries and a specific focus on the application of VR when working with low-skilled and low-qualified persons. Furthermore, the compendium is complemented by a collection of suitable VR software applications, including descriptions of content, application potential, recommendations for use and more.

In order to foster the VR skills of adult educators even more, the VIRAL SKILLS Training Programme enables participants to become familiar with VR solutions and to learn how they can include this new technology in their didactic teaching and training repertoire.

Experiences made during the VIRAL SKILLS project show great demand for innovative teaching methods and when the collaboration between the education sector and the software developing sector intensifies, a huge increase of specific educational VR software is expected. Become a pioneer and start spicing up your training now – the materials are right at your fingertips.

KEYFACTS

VleaRning

We Learn to Apply Augmented and Virtual Reality in Our Technology Classes

Vicenta Ferrer, Ignacio Segui

The VleaRning project aims to adapt and introduce AR and VR technologies in European schools. Stakeholders can learn how to integrate these technologies into their classrooms through the Vlearning eLearning platform.

ACRONYM
VleaRning

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We Learn to Apply Augmented and Virtual Reality in Our Technology Classes

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Twitter: www.twitter.com/vlearning1
YouTube: www.youtube.com/channel/UC7ftetSyl4omrF16jCepb0Q

The VleaRning project is coordinated by the Spanish school Colegio Paidos and involves three other secondary schools: OS Vizmarje Brod/SI, Säynätsalon yhtenäiskoulu/FI and the Academy at Shotton hall/UK. The consortium is completed by the technology centre, AIJU/ES, whose mission is to support both teachers and students with the implementation of AR and VR. The aim is to ensure that teachers and students are able to use these technologies, as well as to generate content for mobile devices, VR glasses, to create 360° videos, and to develop their own activities so that all these new resources can be used by other students, including those in elementary education.

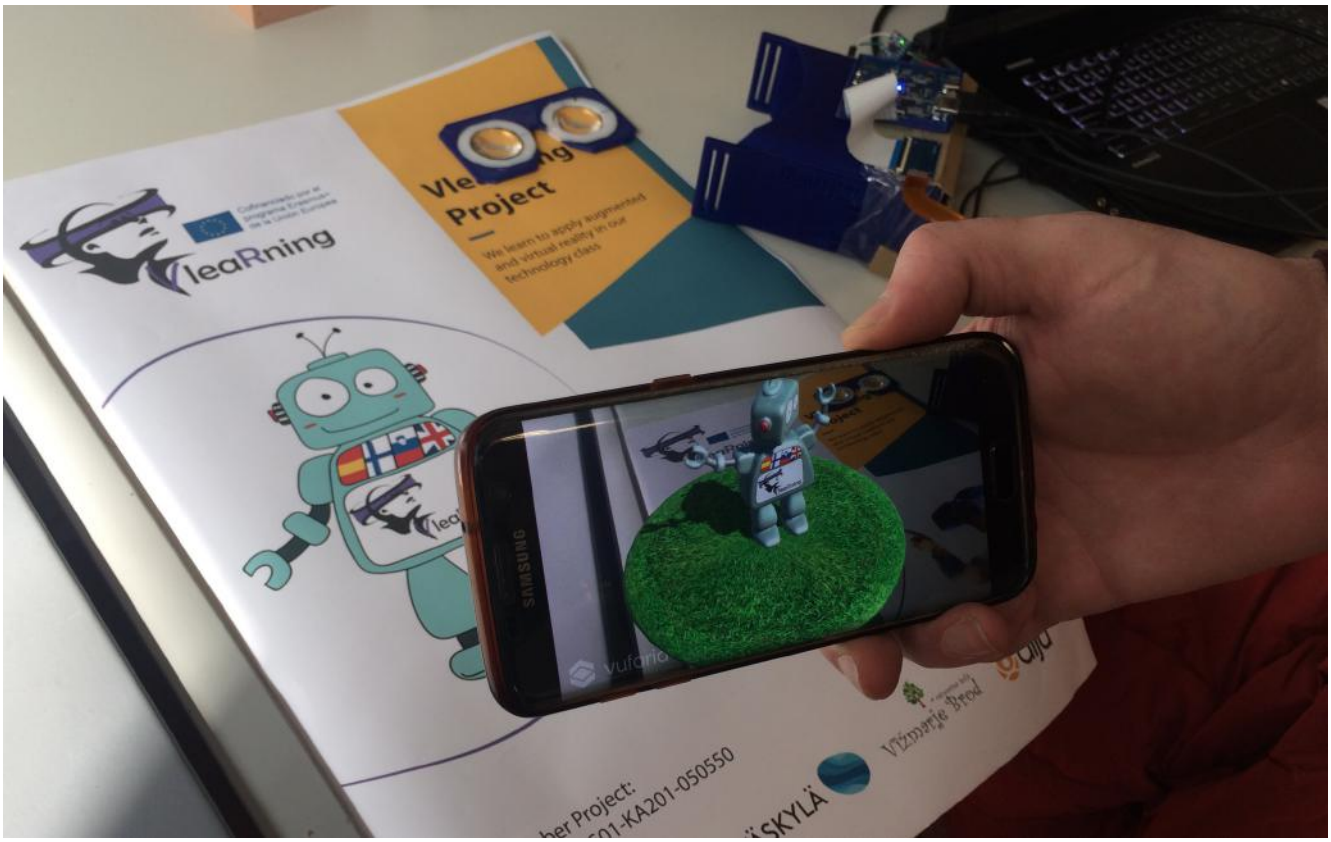
School education is the most important educational period as pupils create learning mechanisms, construct knowledge, and develop basic skills and acquisition methods. AR and VR experiences can help pupils to develop strategic problem-solving skills, using pedagogies that

favour student-centred learning, exercising creativity and visualising abstract concepts concretely, increasing student engagement and frequency of authentic learning, improving critical thinking and providing a constructivist model of learning. When we realise that technology is popular and the younger generations are enthralled by using it, it is important to know how we can integrate technology into the teaching and learning process.

In addition, the use of these technologies allows us to offer alternatives to the most disadvantaged groups, favouring social inclusion. Thus, they can support students with the development of their social and civic skills. Barnett et al. (2005) demonstrated that constructing virtual simulations allows low-achieving students to improve. The aim is to motivate students towards STEM careers, paying special attention to gender considerations, so that girls are also attracted to these careers. Studies show that students have better retention with these technologies. They prefer them over traditional methods, and they demonstrate greater commitment.

All the knowledge generated is collected on an eLearning platform that allows stakeholders to learn about these technologies, and they will also find application examples developed by schools, with more than 70 educational experiences of AR or VR in topics as diverse as the carbon footprint and recycling, the water cycle, learning mathematics and geometry, arts and music, adding elements of AR to encourage reading among the elementary pupils. Moreover, the students record 360° videos and build their own VR glasses in various formats: Cardboard models, but also using 3D printers for smartphones, even using Arduino to generate low-cost VR headsets (imitating models like HTC Vive or Oculus Rift).

Students themselves define their projects and develop their activities through the use of these technologies. In this way, active students and entrepreneurship skills are encouraged.



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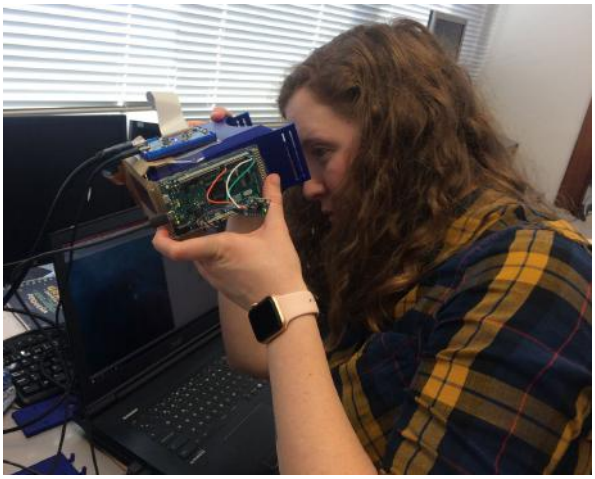

In addition to these tangible results, relevant intangible results are expected using AR and VR:

For teachers:

- methodological and technological knowledge to apply AR and VR technologies in their classes;
- practical experiences prepared for use;
- one more tool for student motivation and commitment;
- educational material to explain abstract concepts.

For students:

- completing their key competences, especially digital competences;
- developing linguistic competence in the English language;
- improving STEM skills;
- developing the important feeling of European citizenship;
- improving socio-civic competence, also knowing about cultural heritage thanks to the use of 360° videos;
- training creativity and critical thinking, as well as the entrepreneurial spirit, skills so necessary to be future professionals in the 21st Century.

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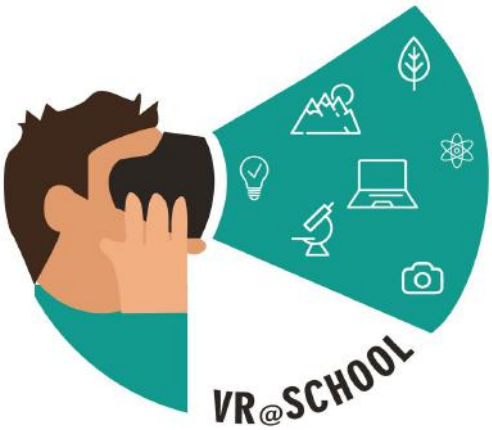
VR@School

Future Schools Using the Power of Virtual and Augmented Reality for Education and Training in the Classroom

Adina Mihaela Romanescu,
Maria Cristina Fulop

The project's main aim is to create a collection of online tools to facilitate teaching and to motivate students to use VR and AR in class. Train the trainer sessions as well as VR lessons for STEM classes will be developed and implemented in VR labs at different schools.

The project gathers specialists from the partner instituions Liceul Teoretic de Informatica "Grigore Moisil" Iaşi/RO (coordinator), EuroEd Foundation/RO, Make Up Your Business/RO, Pixel - Associazione Culturale/IT, CIPAT/IT, a consortium of 43 schools in the Tuscany region, Instituto Politécnico de Bragança/PT, Soros International House/LT and Vilniaus Karoliniskiu Gymnasium/LT.



KEYFACTS

ACRONYM
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FULL TITLE
Future Schools Using the Power of Virtual and Augmented Reality for Education and Training in the Classroom

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WEBSITE
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SOCIAL MEDIA
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The coordinating school is very active with the transfer of good European educational practices into the Romanian education system, especially with the implementation of modern teaching strategies based upon the use of new technologies. The members of the project team from the coordinating institution, the project manager Adina Mihaela Romanescu as well as Maria Cristina Fulop, Maria Rados, Daniela Liliana Zaharia and Marius Smirnov, have identified innovative teaching contexts that respond to the learning needs of students connected to the fast pace of technology development.

Virtual reality, a unique way to captivate students of all ages, adds value to teaching scenarios by delivering new experiences and types of interactions. VR can become a teaching method that helps students to feel part of an experience that stimulates both their imagination and their thinking.

We want to contribute to building an open attitude amongst teachers towards the use of new technologies and online educational resources during classes, to prepare teachers for the use of VR and AR in the classroom and to produce an impact on student learning. VR is one of the most powerful technologies that can help improve and enrich the learning experience and it can help us change the way we learn forever.

Through the introduction of this new concept into educational technology, virtual and augmented reality will stimulate the creation of efficient learning activities, connected to the learning needs of students. The project is creating open educational resources. The Teach@School Online Library (https://vr-school.eu/lectii) and the Teacher's Guide to Education through the Use of Virtual Reality in Schools (https://vr-school.eu/io2) are available in English, Romanian, Italian, Portuguese and Lithuanian. During the project period, all partners are developing VR-type educational resources for scientific and transdisciplinary classes, to create 40 lessons in which VR@School technology will be used. VR equipment has also been purchased to set up a VR laboratory in each partner school in the project.

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The project also aims to develop teaching skills for designing VR-based learning activities for project team members in the partner institutions. Thus from 16th to 20th September 2019, 22 teachers and ICT specialists from all partner countries undertook training in Romania. The training activities were coordinated by Liceul Teoretic de Informatica "Grigore Moisil" Iaşi and EuroEd Foundation, in partnership with the Faculty of Automatics and Computers (Technical University "Gheorghe Asachi" in Iaşi, Faculty of Informatics "Alexandru Ioan Cuza" University of Iaşi) and the Centric IT Solutions Romania Company.

Among the demonstrative project activities, we staged classes (Communism in Romania and Gravitational pendulum) piloting the use of new technologies, with students presenting various online educational resources, coordinated by their teachers (members of the project team) as well as workshops on the modules of the curricula created by the project partners. Centric IT Solutions Romania also organised a workshop on the benefits of XR technologies for education during the training held in Iaşi.

The students in our school have also participated in didactic activities to test digital resources based on virtual reality created by the project team members and they appreciated the fact that it stimulated them to understand better certain events, phenomena and concepts, especially those applied to STEM classes. According to our experience with the project activities and with their implementation in the school environment we expect that the approach of teaching scenarios in Romania and other countries will change in the near future by integrating virtual, augmented and mixed reality into lessons.

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KEYFACTS

VR_Education

Virtual Reality in Higher Education: Application Scenarios and Recommendations

Jan vom Brocke, Jennifer Fromm, Tim A. Majchrzak, Jaziar Radianti, Stefan Stieglitz, Charlotte Wehking

ACRONYM
VR_Education

FULL TITLE
Virtual Reality in Higher Education: Application Scenarios and Recommendations

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WEBSITE
Project on researchgate:
https://www.researchgate.net/project/Virtual-Reality-in-Higher-Education-Application-Scenarios-and-Recommendations

SOCIAL MEDIA
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Firstly, the project aims to identify virtual reality application areas in higher education. Secondly, the project will result in recommendations enabling lecturers to implement virtual reality in their teaching activities. The project mainly targets educators in higher education and will provide material to ease the first steps with VR-enhanced practices.

The Erasmus+ project partners from the University of Liechtenstein, the University of Duisburg-Essen/DE and the University of Agder/NO have identified VR application scenarios within higher education. They combine the findings of a systematic literature review, market analysis and survey distributed amongst educators throughout Europe. Furthermore, they have developed new application scenarios for design-thinking workshops with lecturers and students. All three project partners will implement VR applications in real university courses to elaborate recommendations for lecturers. The European Center for Information Systems (ERCIS) and the University of Nebraska Omaha/USA support the project as associated partners.

What is the current state of the art in research and practice?

The results of our systematic literature review and market analysis provided an overview of the current state of educational VR applications in research and practice. We found that researchers often develop applications to support engineering, computer science and astronomy courses. The most common application areas on the market are biology, zoology, and astronomy. Most researchers and professional software developers aim to convey procedural-practical or declarative knowledge with their VR applications. We also identified 14 design elements used by researchers and professional software developers with realistic surroundings and basic interaction with virtual objects being implemented most often.

How do students and lecturers imagine the future of VR-based teaching?

Together with lecturers and students, we developed new VR application scenarios in design-thinking workshops. The students expressed a strong wish for more practice-oriented learning content in university teaching and space for discussions with other students. Their ideas for new VR application scenarios reflected these needs. For example, they suggested enriching a course about social media analytics with a collaborative VR case study that allows them to practice analytical skills and improve their teamwork. Compared with the current state of the art, the workshop participants suggested more complex design elements such as interaction with other users and even with virtual agents. We concluded that the combination of VR and artificial intelligence opens up new opportunities for experiential learning in higher education.

What hinders lecturers at implementing VR in their courses?

Our survey of 128 lecturers from 16 European countries revealed that all participants are aware of the technology and approximately half of the respondents have already integrated VR into their teaching activities at least once. But the main challenges for lecturers in integrating VR into their teaching activities are (1) their lack of knowledge and experience with VR in general, (2) the lack of sufficient hardware to equip an entire class, (3) solving technical issues with the VR hardware or applications, and (4) time-consuming preparation. Besides these challenges, which can be solved, lecturers see the benefits of integrating VR into teaching activities. For instance, approximately 90% of the respondents think that VR motivates students to participate actively in learning. We think that this is an important result as the motivation of students to learn is crucial and if new technologies strengthen the student's motivation to do so, then we are on the right track.

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Recommendations

In summary, lecturers hesitate to use VR in higher education because they lack equipment, awareness about use cases and knowledge about hardware and content creation. A solution could be to set up a central VR lab at each university allowing teachers and students to try out different VR headsets and applications. A VR-enthusiast could manage the lab and help lecturers or students to adjust the headset or use the controllers. The lab manager could offer courses in which lecturers learn about VR use ases, how to use VR hardware, and how to create VR content. The courses could take place in the lab so that the participants can use the available equipment to practice what they have learnt. Besides, universities could offer accessible funding opportunities for teachers who are willing to implement innovations in their teaching.

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VR-T

VR-Together

Gianluca Cernigliaro

VR-Together offers new VR experiences based on social photorealistic immersive content, creating an end-to-end pipeline integrating state-of-the-art technologies and off-the-shelf components and introducing new methods for social VR evaluation.

VR and 360° video are reshaping the media landscape, creating a fertile environment in which VR social networks have appeared. AltspaceVR and vTime offer virtual spaces where users, represented as avatars, can come together and interact. At the intersection of immersive and interactive experiences, a few companies, like LivelikeVR and Facebook are aiming to enable shared experiences between individuals in remote locations, providing solutions in which avatars representing users can interact and communicate while watching the same media content or sharing an activity. While this is a step in the right direction, it is insufficient to provide a strong feeling of being in a shared physical space with others because of the low-level of realism of the human representation.

Experiments have shown how the use of immersive displays can bring a new social and interactive VR format where audiences connect more empathically with the content and with

KEY FACTS

ACRONYM
VR-T

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VR-Together

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other viewers. The combination of such approaches with photorealistic capture techniques, which have now become computationally tractable problems, will enable the cost-effective creation of hyper-realistic social VR experiences. For the first time, it is possible to adopt off-the-shelf consumer hardware to deliver and evaluate photographic-quality social VR experiences, with a significant impact upon the scientific community and industry.

VR-Together offers photorealistic immersive virtual reality content which can be experienced together with other remote users, and demonstrates its use for domestic VR consumption, delivering VR social experiences through the orchestration of innovative media formats.

VR-Together addresses five specific objectives:

1. developing and integrate new media formats that deliver high quality photo-realistic content and create a strong feeling of co-presence in VR experiences.
2. adapting the existing production pipeline to capture and encode multiple media formats and integrate them with state-of-the-art post-production tools.
3. re-designing the distribution chain so such innovative content format can be orchestrated and delivered in a scalable manner.
4. developing appropriate Quality of Experience (QOE) metrics and evaluation methods to quantify the quality of new social VR experiences.
5. maximising the impact that VR-Together can have upon content creators, producers, service providers and the general audience.

This work has been funded by European Union's Horizon 2020 program, under agreement nº 762111 (VR-Together project).

Photo credit: SrMunera, Mark Nazh/Shutterstock.com, Monkey Business Images/Shutterstock.com, Egal/iStock, Justin Schüler/Unsplash, Katarzyna Białasiewicz/123RF

The several outcomes of the project can be exploited both technologically and industrially. VR-Together has indeed created:

- a whole VR framework to provide social VR experiences;
- the possibility of applying such a framework, or parts of it, to other industries and sectors, beyond media entertainment;
- a set of tools and solutions for VR/AR immersive applications;
- a benchmark methodology to determine the QOE in social VR applications.

Apart from state-of-the-art technology, VR-Together is developing novel solutions to incorporate real-time volumetric video communication pipelines, based on Meshes or Point Clouds, in the SVR experiences. This brings a lot of potential in the relevant use case, like holoconferencing or immersive training, but also in media broadcast sectors, enabling the integration of live presenters, and novel forms of interaction, including the holoportation of the audience inside TV programmes.

VR-Together is building a technology that makes possible the creation of a new hybrid medium which blends end-user photorealistic representations with broadcast quality content, giving opportunities to different European players in the media industry to position themselves in the rapidly changing landscape of virtual reality content production and consumption.

This work has been funded by European Union's Horizon 2020 program, under agreement nº 762111 (VR-Together project).

KEYFACTS

VR4GIFTED

Integration of Experiential Learning and Virtual Reality into Gifted Education

Ilke Evin Gencel

The main objectives of the project are to develop a new reference curriculum based upon experiential learning theory and VR resources to be used in teacher training with a focus on inclusive education of gifted and talented children.

The main objectives of the VR4Gifted project are to develop a new reference curriculum based upon experiential learning theory and VR resources to be used in teacher training with a focus on the inclusive education of gifted and talented children.

The VR4GIFTED project has two intellectual outputs: (1) the Teacher Training Curriculum for Gifted and Talented Children in Inclusive Classrooms, and (2) VR Resources which include scenarios related to possible situations which prospective teachers can face when having gifted children in their classrooms.

ACRONYM
VR4GIFTED

FULL TITLE
Integration of Experiential Learning and Virtual Reality into Gifted Education

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ORGANISATION, COUNTRY
Canakkale Onsekiz Mart University, Turkey

FUNDING PROGRAMME
Erasmus+

DURATION
01/11/2018 – 30/04/2021

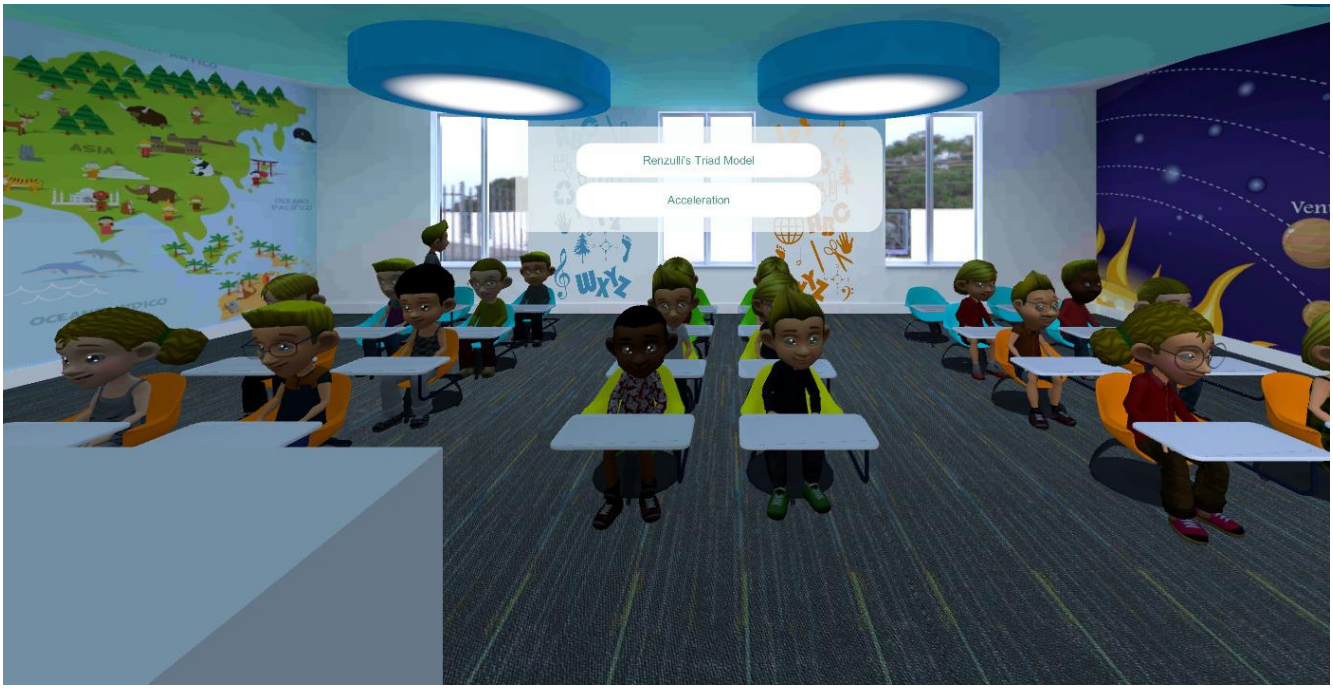
WEBSITE
http://vr4gifted.com

We, the Canakkale Onsekiz Mart University, established the partnership at the end of a series of dialogues by email. The partnership includes organisations from the HE sector (Spoleczna Akademia Nauk-SAN/PL, Fundacion Universitaria San Antonio-UCAM/ES, the University of Macedonia-UOM/GR) as well as from the private sector working closely with schools and involved in developing technology innovations such as Nara EdTech, Apec and the NGO Experiential Training Center (all three from Turkey). We determined the final partnership structure on the basis of the following criteria; partners with great experience in primary school teaching, special education and inclusive learning environments; broad knowledge and practical experience of experiential learning, effective studies on ICT education and capable of establishing VR resources, considerable networking capacity at the European level to help with disseminating project outcomes. The higher education partners prepared national knowledge papers that clearly show the current situation concerning the education of gifted children in Turkey, Greece, Poland and Spain. It has been shown that there is great need for an innovative curriculum for gifted and talented education within teacher education. Eight experts from four different partner countries confirmed the need for such a curriculum.

As the first intellectual output of the project, an elective course curriculum was developed to foster the efficacy of teacher candidates to practice inclusive gifted education in regular classrooms. The curriculum is based on Kolb's experiential learning cycle. The modular approach was adopted during the curriculum development process. Since the lengths of academic years differed between the partner universities, the modules were not organised according to weeks, but rather in total, a 28 hour programme was developed. The lecturers at the partner universities decided that they would be able to allocate 28 hours of training into weekly schedules.

The second project output is the VR Resources, which are being developed and integrated into the experiential learning cycle. It has been suggested that through the experiential learning cycle, VR resources should be used, in particular, as the first concrete experience and the last phase (active experimentation). Using VR resources in teacher training is innovative and provides important advantages. Above all, VR resources, which use 3D visual objects, will make training more interesting and increases motivation. Within this context, VR technology will also affect the imagination and creativity of the learners in a positive way. Through this project, Kolb's experiential learning theory has been integrated with VR technology for the first time. It is believed that this international project handling gifted education (that has been emphasised more and more in recent years) and techno-pedagogic education together will act as a pioneer in relation to virtual reality practices in the field of teacher education.

VR4Gifted will be completed in April 2021.



Co-funded by the Erasmus+ Programme of the European Union

VR4REHAB

Virtual Reality for Rehabilitation

Beatrice Palacco,
Anouk den Ambtman,
Remco Hoogendijk

VR4Rehab enables the co-creation of VR-based rehabilitation tools. Combining forces from SMEs, research institutes, clinics and patients, VR4Rehab aims to create a network in which state-of-the-art VR-technology could maximise rehabilitation potential and adheres to the needs of patients and their therapists.

VR is booming worldwide with its revenue projected to exceed $ 16 billion by 2022. In healthcare, specifically rehabilitation, VR is still in its early days in terms of breakthrough treatment paradigms and widespread clinical adoption.

What is VR4Rehab?

VR4Rehab is part of the Interreg NWE programme, focussing on developing VR-based rehabilitation tools in co-creation with seven partners from five countries, including the lead partner Sint Maartenskliniek/NL as well as the European Association of Virtual Reality and Augmented Reality/BE, St. Mauritius Therapieklinik and Aachen University (both DE), Teesside University and the Royal Free London NHS Trust (both UK), and Université de Lille 1 - Sciences et Technologies (FR).

KEYFACTS

ACRONYM
VR4REHAB

FULL TITLE
Virtual Reality for Rehabilitation

AUTHORS
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ORGANISATION, COUNTRY
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FUNDING PROGRAMME
Interreg NWE

DURATION
20/09/2017 – 19/03/2021

WEBSITE
https://www.nweurope.eu/projects/project-search/vr4rehab-virtual-reality-for-rehabilitation

Although VR technologies are widely diffused in several industries, there are no tools specifically designed to provide patients with an environment that enables them and their therapists to safely extend rehabilitation extramurally. VR can help with optimising rehabilitation protocols, accelerating patient recovery, promoting treatment adherence, and easing reintegration of patients into daily life. VR4Rehab particularly addresses the rehabilitation of children affected by chronic diseases and disability, as well as adults stricken with fatigue and pain.

From ideas to applications

VR4Rehab focusses on the development of VR technologies aligned with the needs of patients and their therapists. Using the innovation potential that emerges from the intersection of VR technologies and the demand from rehabilitation clinics, VR4REHAB establishes an open co-creation platform for knowledge exchange and collaboration between SMEs and medical experts.

We organised five hackathons (one per participating country), which connected entrepreneurs, students, patients, rehabilitation experts and technical specialists. Each hackathon delivered a long list of ideas concerning rehabilitation with VR. The most favourable ideas were taken to the game jams. Pilots were then developed and accompanied with strategic recommendations for implementation. The five challenges - one for each theme (pain management, engagement and immersion to promote treatment adherence, behavioural and cognitive training in children with brain injuries, lower limb and mobility and training of upper limb movements) - represent a combination of business development, scientific studies and user confrontation. Challenges are the first step towards testing the prototypes before the final products can be developed and introduced to the VR market.

Looking to the future, VR4Rehab will develop an Innovation Blueprint to sustain the developed expertise and practical guidelines of how to organise hackathons, game jams and challenges. This Blueprint facilitates future innovation processes to support creators, researchers and healthcare professionals with progressing from ideas to working VR-prototypes. Additionally, VR4REHAB will establish an open European co-creation network to ensure that collaboration initiated will lead to long term and sustainable collaborations. The consortium will develop an Online Library, in which the ideas and relevant information about the current state of the art of VR for rehabilitation will be stored and made available to interested parties for practical use.

Good things only come to those who wait

As part of the "creative media", VR and simulation technology have already found their way into healthcare training and education. The continuing advances in VR have prepared the technology for unique application with a wide range of rehabilitation protocols. However, due to the complexity that comes with building, testing and maintaining VR rehabilitation applications, only a few commercially based VR systems offer flexibility that meets individual patient needs. What is currently missing is a structure capable of bringing relevant stakeholders together. The NWE region needs to build a virtuous circuit, gathering professionals with different backgrounds and expertise, and promoting new synergies, in order to share and exchange knowledge. Through innovating the method of collaboration we can make a difference, addressing the challenges together (e.g. VR at affordable prices and opening up the health sector to faster innovations and new techniques) and facilitating new VR technology based applications being successfully brought to the market.

SOCIAL MEDIA

Twitter:
www.twitter.com/VR4RehabProject

Facebook:
www.facebook.com/VR4RehabProject

Linkedin:
www.linkedin.com/company/vr4rehab

KEYFACTS

VRACE

Virtual Reality Audio for Cyber Environments

Vasileios Chatziioannou,
Alex Hofmann,
Wilfried Kausel

VRACE aims at providing physically correct and perceptually convincing soundscapes in VR. This goal is pursued through training ESRs in all VR-related domains, namely physical modelling, sound propagation, audio rendering and psychoacoustics.

ACRONYM
VRACE

FULL TITLE
Virtual Reality Audio for Cyber Environments

AUTHORS
Vasileios Chatziioannou, Alex Hofmann, Wilfried Kausel

ORGANISATION, COUNTRY
University of Music and Performing Arts Vienna, Austria

FUNDING PROGRAMME
Horizon 2020

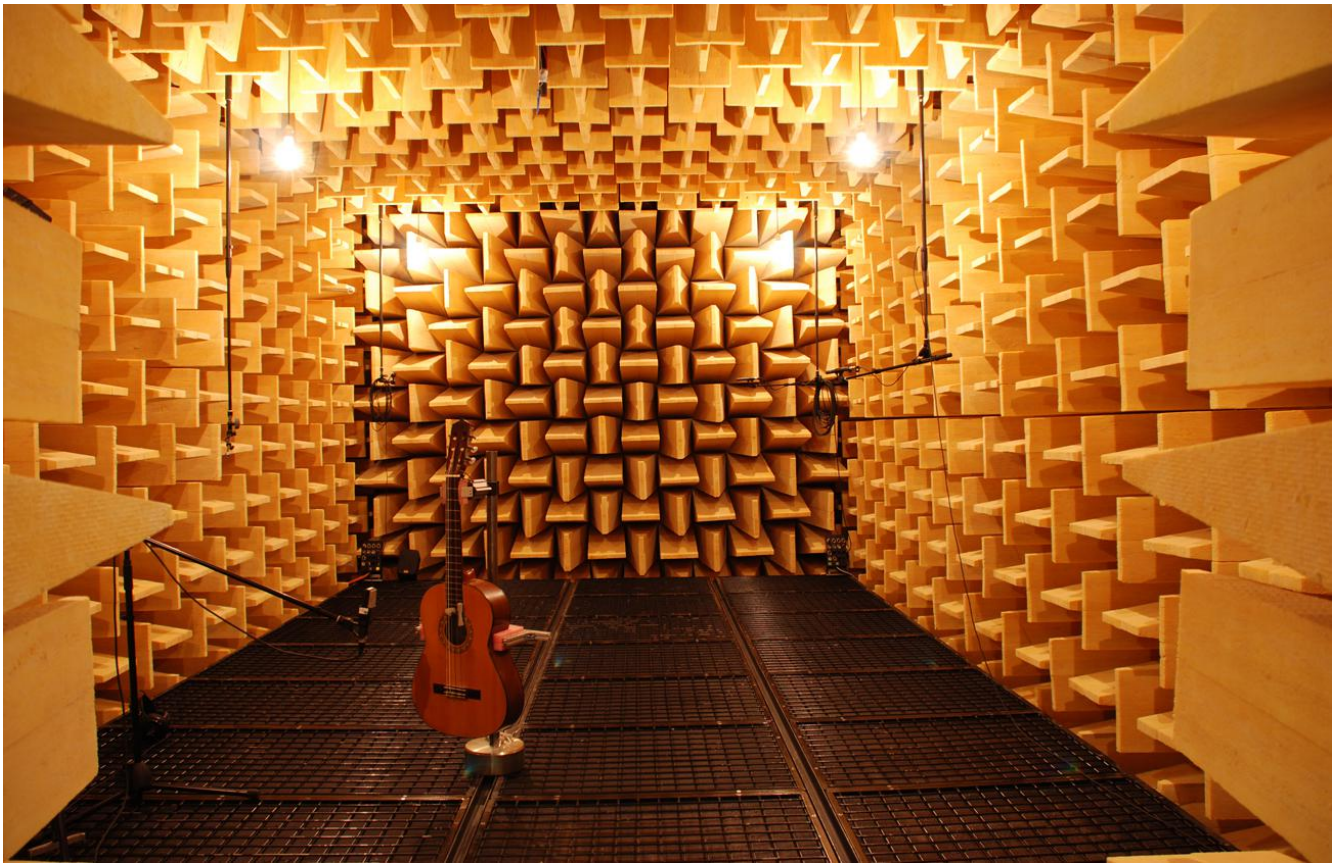
DURATION
01/03/2019 – 28/02/2023

WEBSITE
https://vrace-etn.eu

SOCIAL MEDIA
Twitter: www.twitter.com/vrace_etn

Many believe that VR/AR/XR will not only dramatically change the gaming and entertainment industry, but that it will also revolutionise education, social networking, healthcare, real estate, transportation and technology. While current products are already good enough to attract and excite gamers, there are several areas where significant technological improvements are required, in order to make VR acceptable for applications beyond gaming.

One of these areas for research is the audio part of the virtual environment. In the industry's literature there is broad consensus that the degree of immersion in VR is strongly dependent upon the plausibility of the soundscape in which a user moves. The international consortium of this project (see vrace-etn.eu/consortium) includes 10 academic and 7 industrial partners with profound experience in EU research



projects. It has the vision that the sounds you hear whilst in a VR environment are not pre-recorded surrogates but are physics-based simulations of vibrating objects or object parts radiating sound into a physically correct virtual world, which is then efficiently rendered for binaural perception via headphones or speaker arrays. Whilst it is obvious that massive parallel computing power is required for the visual rendering of complex VR scenes, the fact that physics-based audio will require similarly powerful parallel hardware needs to be pointed out.

The main objective of this project is to raise VR to the next level beyond gaming and entertainment, striving to make significant progress on the way towards a physically correct virtual reality and thus towards a true world simulation. Due to the interdisciplinary and intersectoral composition of the network, different partners have different but complementing requirements depending upon their interests and their fields of expertise. Musicians need convincing sound simulations, room acousticians need tools for realistic room simulations, engineers dealing with virtual acoustics are interested in improving the computational efficiency of the whole audio rendering process. Especially for audio rendering it is essential to take human perception into account. This will ensure that no processing power is being wasted by rendering acoustic details which cannot be heard. Furthermore, perception modelling and psychoacoustic experiments may give clues on how sounds contribute to deepen immersion and make virtual environments more convincing.

The VRACE research and training programme is unique because it aims to push forward the state of the art in VR audio and simultaneously improving the methodology for physical modelling of sound generation and propagation. It will pave the way to "virtual testing" which allows developers to handle their products and listen to their sounds before manufacture. This includes products for everyday life, machines

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 812719.

and environments such as concert halls or urban spaces. The 15 Early Stage Researchers (ESRs) involved in the project will develop skills empowering them to start a research career in industry through advanced training seminars and secondments. Considering the growing importance of acoustics, it can be stated that the career prospects of all fellows are excellent. Although this network puts a strong focus on possible applications in VR, training and research are equally relevant for e.g. vehicle acoustics, room acoustics, psychoacoustics and musical acoustics.

Such large-scale EU projects can significantly contribute towards the international networking of participating research institutions. They also offer the opportunity to attract highly qualified researchers, who are given direct access to both industrial and academic infrastructures, while the participating institutions receive generous funding from the EU.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 812719.

VROAD

Virtual Reality Applied to Roadwork Training in European Construction Industry.

Ainara Maria Ruiz Olavarría

Tackling specific needs for work-based training and hazard prevention in roadwork training through the development, testing and implementation of a training system based on VR.

Roadworks are essential for the proper maintenance of roads and highways, as this affects the free movement of road traffic. Therefore, the simultaneity between traffic flow and roadworks involves a significant danger, both for motorists and for road construction workers. For these workers, exposure to danger occurs during the preliminary phase of temporary signposting, during the execution of the construction itself and in the final phase of removing signposting, so that traffic can return to its normal state.

KEY FACTS

ACRONYM
VROAD

FULL TITLE
Virtual Reality Applied to Roadwork Training in European Construction Industry.

AUTHOR
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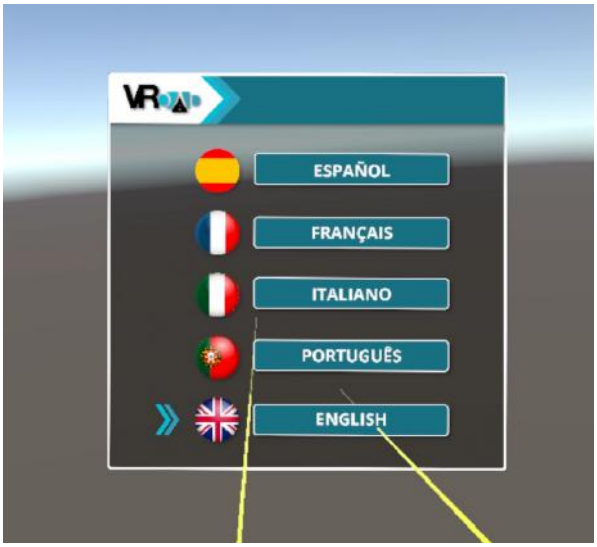
ORGANISATION, COUNTRY
FLC, Spain

FUNDING PROGRAMME
Erasmus+

DURATION
01/10/2018 – 20/09/2020

WEBSITE
http://microsites.fundacionlaboral.org/vroad?idioma=1

SOCIAL MEDIA
Facebook: www.facebook.com/VRoadEU
Twitter: www.twitter.com/VRoadEU
LinkedIn: www.linkedin.com/groups/8709816



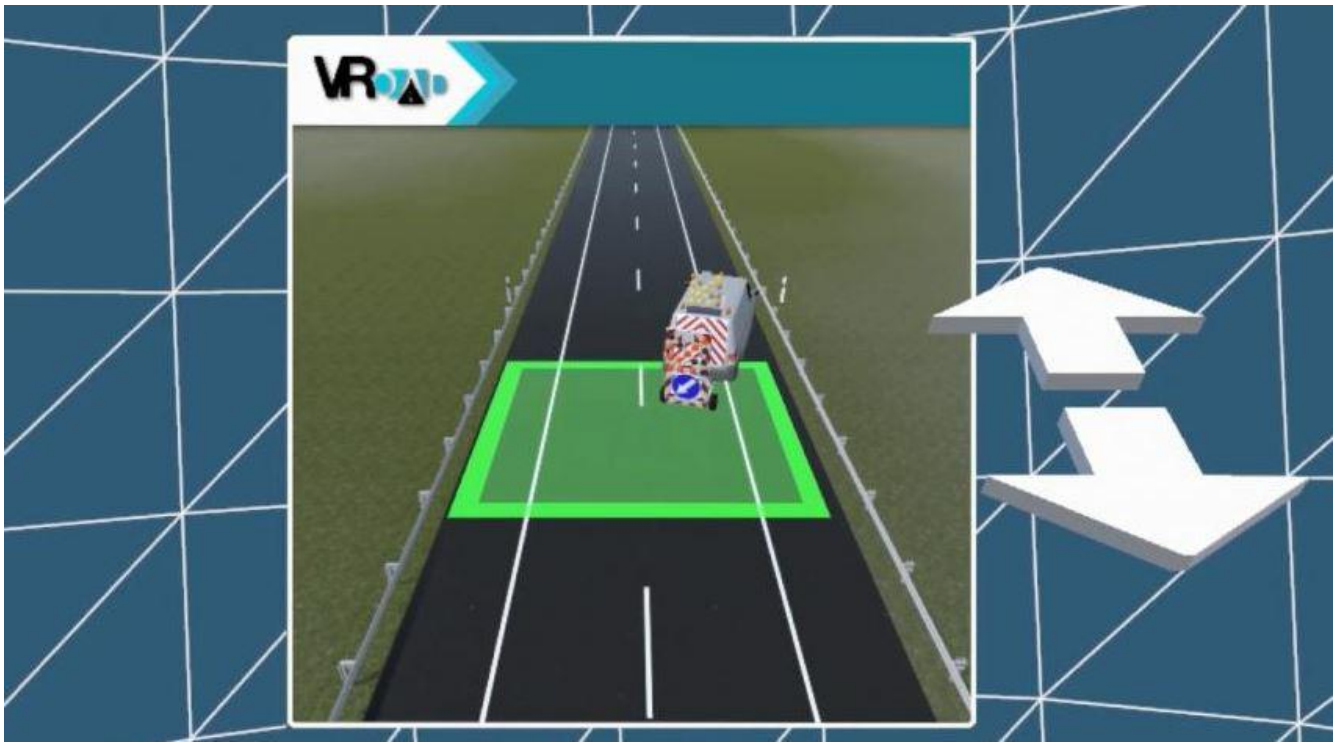
If the construction industry is where the most fatal accidents occur, then in its roadworks sector the accident rate is even higher due to frequent accidents involving vehicles. Roadworks are essential to extending the life of the transport infrastructure, which benefits the social and territorial cohesion of the European Union as it promotes economic development and job creation.

Consequently, the project VROAD aims to tackle the specific needs for work-based training and hazard prevention in roadwork training through the development, testing and implementation of a training system based upon VR.

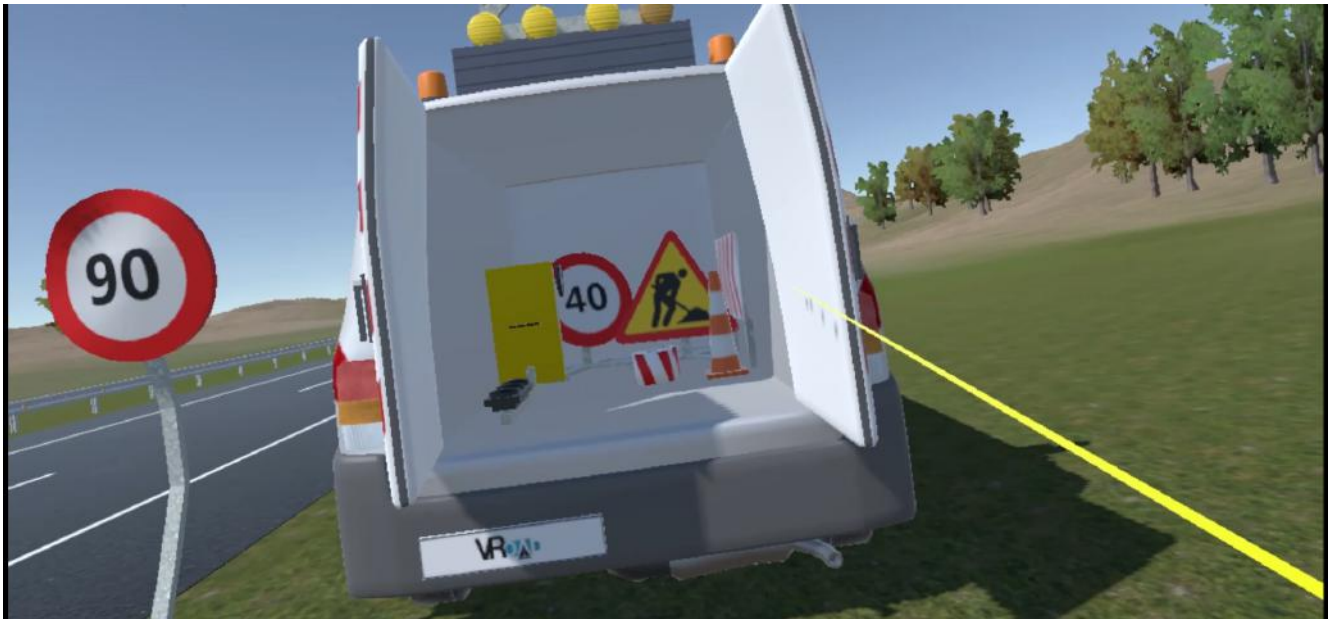
The main objectives of this project are to:

- define a theoretical and practical learning framework to develop a training system that fulfils pedagogical as well as health and safety goals;
- tackle specific needs for work-based training and hazard prevention in roadwork training developing a training system based on VR;
- propose an innovative educational approach to practical learning through VR focused on lane closure, guardrail and traffic signs repair and protocols in case of accidents;
- ensure full exploitation and accompaniment for Vocational Education and Training (VET) trainees and trainers in the use of the training system;
- to design a roadmap to establish the standards and necessary steps to facilitate the recognition of the training system developed under European Qualification Framework (EQF) terms, according to the European frame and European Quality Assurance Reference Framework (EQAVET) recommendations.

The partnership of the European project VROAD is composed of experts in VET and the development and application of ICT tools for training.



Co-funded by the Erasmus+ Programme of the European Union



The consortium consists of five partners: Fundación Laboral de la Construcción/ES, GA Group/ES, Comité de Concertation et de Coordination de L'Apprentissage du Bâtiment et des Travaux Publics/FR, FORMEDIL Piemonte/IT and the Centro de Formação Profissional da Indústria da Construção Civil e Obras Públicas do Sul/PT.

The project is expected to impact upon the following groups:

Target groups

- low-skilled workers, improving their H&S skills for roadworks and - as a transnational project, workers' knowledge will receive EU-wide validity - boosting their European mobility;
- VET providers, benefiting the modernisation of their training content, more adapted to the demands of companies;
- VET trainees and trainers, having at their disposal a user-friendly resource to improve the teaching process under safe conditions.

Stakeholders

- relevant public educational organisations responsible for determining training schemes;
- building companies that dedicate resources to modernising and adapting activities to new scenarios in the construction sector;
- training providers, private and public, devoted to training related to building activities and related sectors;
- public and private health and safety institutions and companies.

The **benefits** expected to be achieved by this project are as follows:

- improvement of the construction VET providers' activity to include an appealing training offer for the current and potential construction sector worker;
- strengthening the preventive culture amongst construction workers, in particular by treating road workers as a subsector of the construction industry, framed in a way that the specific characteristics and peculiarities of their work require a different and therefore clearly well-differentiated approach;
- enhancement of workers' qualification for the management and use of ICT;
- improvement of the sector image, offering an innovative and safe method of teaching how to avoid one of the greatest risks that is commonplace with roadworks; avoiding being run over by a vehicle cannot be trained without exposing workers to the dangers of real-life traffic conditions and so thanks to VR it is possible for trainees to be immersed in a virtual real-life situation.

Co-funded by the Erasmus+ Programme of the European Union

KEYFACTS

XR4ALL

Extended Reality for All

Leen Segers

By creating a pan-European community the project discovers existing XR technology to develop an agenda for further research. It also awards grants to innovative projects and seeks to increase the levels of investment and technology transfer to help high quality products reach the market.

Interactive technologies such as AR and VR are set to transform the ways in which people communicate, interact and share information. The XR industry has now reached a stage, following years of research and development, at which technology has become commercially viable. However, the European XR scene is fragmented and there is a risk that big US companies will dominate the XR market (as they already do with B2C).

XR4ALL aims to become a meeting point for the EU XR community. Innovative and groundbreaking EU XR technology and research will be featured on the XR4ALL portal forging a competitive and sustainable ecosystem of European technology providers active in XR.

ACRONYM
XR4ALL

FULL TITLE
Extended Reality for All

AUTHOR
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contact@xr4all.eu

ORGANISATION, COUNTRY
LucidWeb, Belgium

FUNDING PROGRAMME
Horizon 2020

DURATION
01/12/2018 – 01/12/2021

WEBSITE
http://xr4all.eu

SOCIAL MEDIA
Twitter: www.twitter.com/XR4ALL
Facebook: www.facebook.com/XR4ALL
LinkedIn: www.linkedin.com/company/xr4all/?originalSubdomain=be
Instagram: www.instagram.com/xr4all
Medium: www.medium.com/@XR4ALL

The project has set itself the following central objectives:

1. unite the XR community through the XR Forum (community and support portal for knowledge exchange and visibility);
2. provide access to XR solutions on the XR Platform;
3. increase XR innovation through the funding of sub-projects;
4. monitor trends, visions and technology developments to create a Strategic Research and Innovation Agenda (SRIA) for interactive technologies;
5. boost the take-up of XR through a technology transfer strategy and VC involvement;
6. carry out efficient dissemination activities to pave the way towards sustainability.

All activities are implemented by a consortium of five partners with complementary expertise: the coordinator EUN/BE (cascading funding management, access to market and industry users) and I3D/NL (10 years of XR community building and events organisation), Fraunhofer HHI/DE (XR research), BCOM/DE (XR platform building and integration) and LucidWeb/BE (XR communication and community building with a strong focus on women in XR).

Providing financial support for the development of XR solutions

XR4ALL launches the open call to attract, select and provide financial support to third parties (outstanding XR research teams from organisations such as SMEs, industry, research institutions, and academia) to develop new XR solutions (e.g. plugins for games engines such as unity, low-level components based on open APIs, standards, and frameworks such as SolAR, any XR application or hardware).

The total funding to be granted by XR4ALL is €1.500.000. This is broken down into a maximum of 50 projects in phase 1, each receiving funding of €10.000 (€500.000 in total). Following phase 1, up to 25 projects will be admitted to phase 2 with corresponding funding of €40.000 per project (€1.000.000 in total). The maximum amount granted per project is, therefore, €50.000.

Interested parties can apply before one of the three cut-off dates for the open call, which are:

- 29/11/2019 at 17:00 (Brussels time)
- 26/06/2020 at 17:00 (Brussels time)
- End of October 2020

Who can apply

XR research teams from legal organisations based in one of the EU Member States (MS), one of the Overseas Countries and Territories (OCT) linked to a MS of the EU, a H2020 Associated Country (AC) or one of the other countries listed in the General Annex A of the H2020 Work Programme 2018-2020.

Language

Application forms can only be filled in English. The working language for all XR4ALL support will be English.

Web link for further information

www.xr4all.eu/opencall

Email address for further information

opencall@xr4all.eu

XR4ALL has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N° 825545.

VR inSight

GREEN PAPER

E.N.T.E.R.

European Network for Transfer and Exploitation of EU Project Results

focus europe

special edition 2020

VRinSight

WHITE PAPER

PROJECT COORDINATOR

Staatlich anerkannte, private Fachhochschule des Mittelstands (FHM)

PROJECT PARTNERS

UNIVERSITY of NICOSIA

E.N.T.E.R.
European Network for Transfer and Exploitation of EU Project Results

FVEM
FEDERACIÓN VIZCAÍNA DE EMPRESAS DEL METAL
BISCAY FEDERATION OF METAL COMPANIES

KU LEUVEN

Tampere University

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