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VReduMED

VR Pilot Testing

A transnational pilot on the pedagogical use of virtual reality

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Abstract

Within the VReduMED project, virtual reality applications were implemented and evaluated as part of a transnational pilot study in Austria, Czechia, Germany, Hungary, and Slovakia. The aim was to examine the pedagogical value of immersive technologies in healthcare education and to assess their practical integration into existing teaching structures. The pilot combined newly developed applications, including a CPR simulation focused on infants and children and the “Room of Horror” addressing patient safety, with established tools such as Human Anatomy VR.

The selection and design of the applications were informed by a structured needs analysis, expert consultations, and a review of existing best practices. Testing took place in diverse educational and professional contexts, ranging from short demonstrations to extended use within regular teaching over several weeks. This approach allowed for the evaluation of both immediate user experience and longer-term integration under real-life conditions. Regional VR laboratories and mobile deployment models supported access and facilitated experimentation in authentic learning environments.

The results show a high level of acceptance, with strong ratings for visualization, interactivity, and practical relevance. VR proved particularly effective in supporting decision making, strengthening confidence in action, and enabling repeated, risk-free training in complex scenarios.

Overall, the findings indicate that VR offers clear added value as a complementary learning tool when it is aligned with defined learning objectives and integrated into structured teaching concepts.

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1. Objectives and focus

Testing the VR applications was one of three pilot projects. 1) The CPR application developed with a focus on resuscitation of children and infants. 2) The "Room of Horror" application to promote patient safety. In addition, 3) the VR anatomy application Human Anatomy VR from the associated project partner Virtual Medicine was tested. Depending on availability and setting, other selected applications from the good practice collection were also used.

The aim of the pilot was to test innovative VR-based educational applications in healthcare under real-life conditions. The focus was on the question of what specific didactic and practical added value immersive learning technologies can bring to health-related educational scenarios and how they can be integrated into existing educational structures in a practical, didactically meaningful, and organizationally feasible manner. The introduction of innovative technologies into educational processes requires more than just technical availability. The decisive factors are pedagogical suitability, acceptance by teachers and learners, and feasibility in everyday education. Against this background, the pilot project was designed to systematically investigate in which learning settings VR offers recognizable added value, which areas of competence can be particularly promoted through immersive simulation, how learning motivation, concentration, and confidence in action are influenced, and under which structural conditions sustainable integration is possible. Particular attention was paid to promoting decision-making skills, situational decision-making ability, and risk-free repetitive learning.

The pilot project was transnational in scope and was carried out in all five partner countries (Austria, Czechia, Germany, Hungary, and Slovakia). The tests involved trainees and students in nursing-related educational programs, teachers and practical instructors, nursing and healthcare professionals in continuing education formats, and other regional actors from the fields of education, care, and innovation.

2. Selection and derivation of test applications

2.1. Conceptual basis: mapping, roadmap, and good practice

The selection and development of the test applications was based on a systematic analysis and conception phase within the project.

As part of a mapping process, existing VR infrastructures, competencies, and concrete application examples in the partner regions were surveyed. The aim was to make existing resources visible, to record existing experiences in a structured manner, and to identify relevant fields of application for VR in the context of nursing education. At the same time, there was an intensive exchange with experts from nursing education, including teachers, practical instructors, and representatives from training and further education institutions.

These discussions identified specific needs, existing gaps in training practice, and particularly challenging learning situations. The applications developed within the project were designed on this basis. Both the CPR application, which focuses on resuscitation of children and infants, and the "Room of Horror," which promotes patient safety, were developed based on specific feedback from educational practice. The aim was to develop scenarios that are either difficult to implement, resource-intensive, or particularly emotionally demanding in everyday training. In addition to the needs analysis, a roadmap for implementing VR in nursing education was developed. This roadmap bundles the results of the inventory, describes existing infrastructures and fields of application in the partner regions, and highlights potential and strategic starting points for the use of immersive technologies in education. In addition, a collection of good practices of existing VR

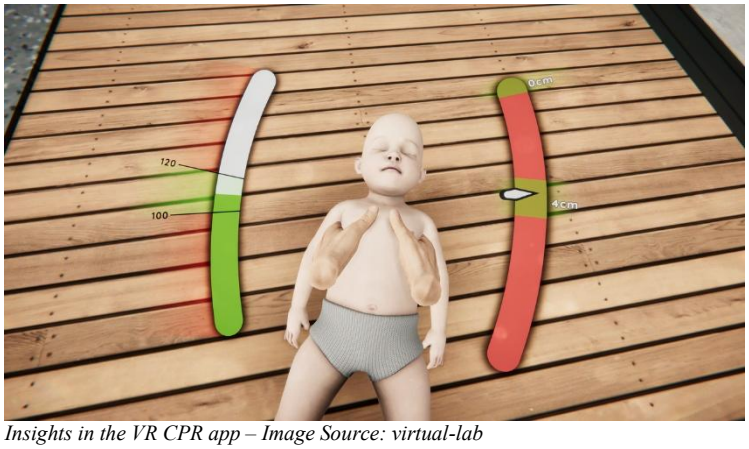
applications was created. This served as a reference framework for the selection of complementary applications and ensured that, in addition to the newly developed solutions, established and field-tested systems were also taken into account.

2.2. Applications developed within the project

As part of the project, two VR applications were developed that specifically address identified needs in nursing education.

2.2.1. CPR application with a focus on children and infants

Resuscitation situations involving children and infants pose a particular emotional challenge, even for experienced professionals. In discussions with experts in nursing education, it became clear that inhibitions and uncertainties often exist in this area. The fear of making mistakes or causing harm has a direct impact on confidence in taking action.



Insights in the VR CPR app – Image Source: virtual-lab

In addition, CPR training in education and first aid courses is predominantly carried out on adult dummies. Pediatric emergency scenarios are significantly underrepresented in comparison, resulting in a gap in practical skills. Against this background, project partner Virtual Lab (Czechia) developed a VR-based training solution focusing on child and infant resuscitation. The aim was to create an immersive training setting that enables repeatable, risk-free practice and specifically strengthens confidence in sensitive emergency situations. The application goes beyond purely technical instruction. It supports the development of stress resilience by placing users in emotionally realistic scenarios. This allows them to practice structured action under pressure.

A key element is the combination of virtual simulation and real haptics. Tactile feedback plays a crucial role in performing high-quality CPR. Pressure depth, pressure frequency, and pressure intensity can only be learned realistically if a physical resuscitation dummy is incorporated into the training. A special wrist sensor (CPR Sensor System) is used to objectively measure compression depth and intensity. The sensor can be flexibly attached to either wrist and records the relevant movement and compression parameters. The combination of physical action and virtual feedback enables precise performance review within the simulation. An integrated automated test mechanism also checks whether the measures are being carried out correctly


Insights in the VR CPR app – Image Source: virtual-lab

Insights in the VR CPR app – Image Source: virtual-lab

and efficiently. This makes it possible to determine whether users are able to act in a structured and error-free manner even under emotional stress. Another significant aspect is the situational context. Learners must actively involve bystanders in the rescue process, initiate the emergency call, and instruct another person to obtain an AED. In addition to technical resuscitation skills, this also trains communication skills, leadership behavior, and situational decision-making skills. During the evaluation phase, public demonstrations showed that even professional emergency responders have a healthy respect for resuscitating small children. This feedback confirms the high relevance of a protected, immersive training format for this scenario. The training solution is based on the ERC 2025 guidelines, which expressly support the use of virtual reality as a complementary tool for effective emergency training.

2.2.2. Room of Horror – Patient Safety and Error Identification

The Room of Horror addresses the issue of patient safety and the identification of sources of danger in the context of nursing care. In traditional skills lab environments, staging safety-related errors involve considerable organizational effort. VR enables a repeatable and controllable simulation in which sources of danger are generated from a defined pool and must be identified by the learners. Participants in the Care Education Forum from the participating partner countries were specifically involved as technical experts in the creation of the error pool. Teachers, practical instructors, and specialists from nursing education contributed typical safety-related sources of error from their everyday professional and training lives. These were collected transnationally, discussed, and systematically structured. This resulted in a professionally validated error pool that reflects real-life risk situations from everyday nursing practice. The random generation of these errors within the simulation means that each run of the scenario is varied, allowing for targeted training in observation skills, risk perception, and situational action. After completing a run-through, the recognized errors are displayed in green and the unrecognized or incorrectly marked errors in red.

Green (right) and red (wrong) colours indicates whether you selected the item right or wrong - Image Source: SZE

The immersive presentation reinforces the learning effects, as hazards are not only identified theoretically, but must also be actively recognized and assessed in the room. The scenario can be repeated as often as desired and enables structured, resource-saving training of safety-related skills.

2.3. Supplementary applications from the good practice catalog

In addition to the applications developed, other applications from the good practice catalog were included in the testing. The aim was to map different didactic application scenarios and to comparatively examine

the added value of different types of applications. These included the interactive anatomy application Human Anatomy VR from Virtual Medicine.

Insights in the app Human Anatomy VR - Image Source: Virtual Medicine

The application is particularly useful when it comes to better understanding anatomical structures spatially and illustrating complex relationships. Three-dimensional models make it possible to view organs, vessels, nerves, or muscle groups from different perspectives, to show or hide structures, or to display them in layers. It is particularly suitable for visualizing movement sequences, for example to understand which muscle groups are activated during certain movements or how joint structures interact functionally. This supports the transfer of theory into practice, for example in the context of mobilization or rehabilitative measures. The learning scenario is open-ended. Therefore, it is didactically necessary to define a clear learning objective before use. Ideally, the application should be embedded in a structured teaching concept: preparatory theoretical input provides the technical basis. The VR application serves to visualize and reinforce the material, and a subsequent transfer task consolidates what has been learned. Since no specific clinical pictures are integrated, the application is primarily suitable for teaching anatomical and functional basics. Pathophysiological references can then be established as part of an in-depth study. An additional advantage is the multilingual nature of the application. A simple language change supports heterogeneous learning groups and facilitates the understanding of complex technical terms. The user guidance is intuitive and low-threshold. With few interactive elements and clearly structured menus, the application enables a high level of content depth and visual impact despite its simple handling.

3. Establishment of regional VR laboratories as test and transfer centers

Three regional VR laboratories were set up for the structured implementation of the test activities:

- Czechia (České Budějovice – South Bohemian Science and Technology Park, JVTP)
- Hungary (Győr – Széchenyi István University)
- Germany (Regensburg – OTH Regensburg)

The institutional anchoring of the laboratories varies depending on the partner region. While the laboratory in Czechia is embedded in a technology- and innovation-oriented environment, the laboratories in Hungary and Germany are affiliated with universities and at the same time networked in a practical manner. The laboratories serve as regional contact points for the demonstration and testing of VR applications. Educational institutions and practical partners are given the opportunity to learn about immersive learning technologies in a structured setting and to test them in practice.

In addition, a mobile lending model was established at OTH Regensburg. Educational institutions in the healthcare sector were able to borrow VR headsets for a defined period of time and integrate them into their regular lessons.

This model served to

- examine real-life conditions in everyday education and
- actively involve teachers in the testing process,
- allow institutions to gather their own didactic experiences,
- test the transferability of the technology outside of specialized laboratory environments.

VR lab for nursing research at OTH Regensburg – Image source: OTH Regensburg

The combination of stationary infrastructure and mobile use made it possible to test different implementation approaches.

4. Implementation of pilot testing in the project countries

The national pilot implementations are described below. The selected test formats were determined internally within the project and were designed to reach different target groups through various implementation formats. To better reflect the pilot nature of the measures, a structured approach to data collection was adopted in all partner countries. After each test phase, standardized questionnaires were used to assess user experiences, perceived benefits, and the applicability of the VR applications in educational and practical contexts. Additionally, qualitative data was collected through focus groups, particularly within the framework of the Care Education Forum, where participants were actively involved in the evaluation process. In Germany, the pilot approach was further supplemented by mobile testing formats and interviews with nursing educators. Transnational collaboration served as a central foundation for the planning and implementation of the pilot measures. Through regular meetings, continuous exchange among the partner countries, and joint development processes, testing strategies were coordinated and diverse perspectives from different educational systems were integrated. The quantitative data collection based on the standardized questionnaire is described in detail in a separate document by the Austrian project partner (see Sections 5.1 and 5.2), which comprehensively presents the methodology and results.

4.1. Austria

The VR testing was implemented through several events designed to demonstrate and evaluate VR-based training solutions.

In a pilot workshop jointly conducted by MTC and Education Group at the school for geriatric care, two best practice examples were tested with teachers.

The CPR application developed by the project was presented in a nursing school setting in cooperation with project partner MTC and Education Group, engaging nursing professionals and trainees in practical demonstrations.

Another workshop organized by MTC introduced the CPR and best practice Anatomy applications to regional government stakeholders, focusing on their relevance for healthcare education and policy development.

VR healthcare training demonstration during a pilot workshop- Image Source: Business Upper Austria GmbH

At the Education Group's premises, a further best practice application was tested in depth with a focus group from the Upper Austrian state school for geriatric care, and its didactic implementation was discussed.

Additionally, in the planned regional rollout event, also conducted with MTC and Education Group, all three pilot applications (CPR, VRoom of Horror, and best practice applications) were showcased to representatives from SMEs in the IT sectors.

Participant testing a virtual reality application during a workshop session. - Image Source: Education Group GmbH

Meta Quest 3 headsets were used for all activities, complemented by sensors and a CPR dummy (for the CPR application only) for realistic simulation. Target groups included nursing students, educators, healthcare professionals, and regional stakeholders. Educational formats ranged from short demonstrations to interactive workshops, ensuring hands-on experience.

Access to VR was facilitated through an introductory presentation and live demonstration, followed by guided hands-on sessions for participants. Mobile VR sets enabled low-threshold participation without the need for complex infrastructure. Only project-developed and best practice applications were used.

4.2. Czech Republic

As part of the VR testing the VReduMED project, approximately ten pilot testing activities of VR applications focused on cardiopulmonary resuscitation (CPR) training and anatomy education were carried out between October and December 2025 in a variety of educational and care settings, including secondary medical schools, university faculties, social care facilities, and within the framework of a professional conference focused on pedagogical practice. The pilot testing was conducted in real educational and care environments through structured testing sessions, practical demonstrations, and supervised hands-on use of the applications. The activities were jointly implemented by the South Bohemian Science and Technology Park and the University of South Bohemia in České Budějovice.

Participants testing a VR-based CPR training application in a classroom setting – Image Source: University of South Bohemia

A broad spectrum of target groups was involved in the pilot testing, including students from secondary and higher education institutions with a healthcare focus, university students from natural science and teacher education programs, educators, healthcare professionals, and staff of social care facilities.

Participant performing pediatric resuscitation in VR under instructor guidance – Image Source: University of South Bohemia

The pilot testing encompassed a range of implementation formats, including short-term testing sessions integrated into regular teaching, guided demonstrations, assisted hands-on testing in social care institutions, and pilot use during a professional conference. The parallel implementation of these formats enabled the collection of differentiated feedback from multiple institutional contexts.

Each pilot testing activity began with a structured introductory briefing covering the objectives of the project, the functionality of the VR applications, and basic safety considerations related to their use. Mobile VR sets were used, and most testing sessions were conducted in a guided and assisted manner. This approach proved effective in ensuring safe and inclusive access to VR technologies and in supporting their meaningful integration into educational and care practice. Overall, questionnaire-based feedback was collected from approximately 80 participants across the pilot activities using a structured evaluation questionnaire focused on user experience, perceived usefulness, and the applicability of the VR applications in educational and care practice.

Pediatric CPR exercise in VR on an infant manikin – Image Source: University of South Bohemia

4.3. Germany

As part of VReduMED VR testing the OTH Regensburg tested the innovative educational format across two parallel implementation settings. First, mobile VR units were loaned to nursing education institutions for six-week periods, enabling teachers and students to integrate the project-developed VR applications, along with best-practice applications from partner countries, directly into their regular teaching activities. In addition, we provided the institutions with extensive consultation and continuous support through on-site workshops at their facilities, external training sessions at our university, as well as ongoing telephone and digital assistance. Second, the VR applications were tested during numerous single-day events held in healthcare education centers, hospitals, professional conferences, and public fairs. Both testing formats were carried out in parallel, and Strategische Partnerschaft Sensorik e.V also participated in several of the events. These outreach activities enabled additional target groups—such as nursing professionals, medical staff, educators, and interdisciplinary stakeholders—to engage with the innovative learning tools in real environments. All test activities were supported by short introductory sessions to ensure low-threshold access to VR technology.

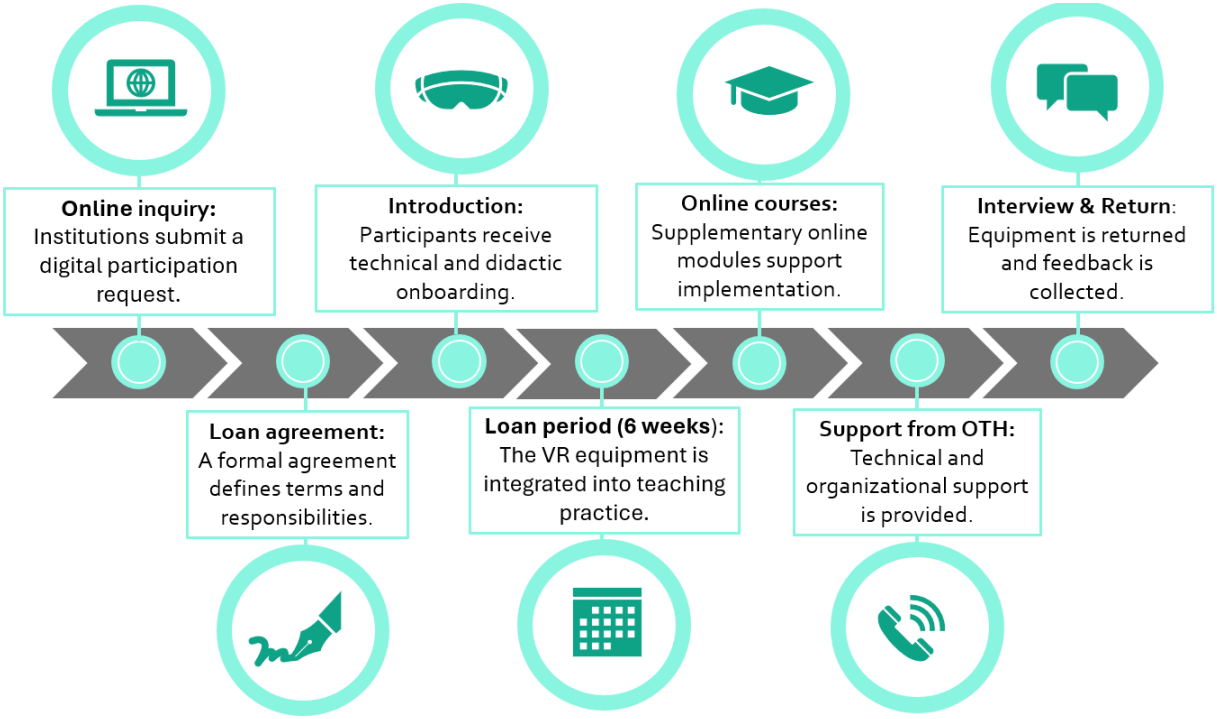
Nurse educators during an introduction to virtual reality training – Image Source: OTH Regensburg

The pilot loan procedure began with a digital expression of interest submitted by the institutions, who had learned about the Care Education Forum or other project-related information channels. Based on this, a binding agreement was concluded outlining the terms of use, obligations, and rights.

Subsequently, the technical and organizational implementation was carried out on site by the OTH Regensburg team. The VR setup was installed at the respective institution, and the VR headsets and the provided applications were introduced and explained together with the nursing educators.

The six-week loan period was then used by the participating institutions to independently test and integrate the VR applications into their teaching units or practical training sessions. During this time, participants were provided with access to an online course containing instructions and project-related documentation. In addition, technical and organizational support from OTH Regensburg was available throughout the entire loan period and could be accessed whenever needed.

At the conclusion of the loan period, the VR setup was collected again, and the usage phase was reflected upon in an interview focusing on the experiences gained.



The pilot approach enabled evaluation beyond short demonstration settings, as the institutions integrated VR into their regular teaching over several weeks. This allowed teachers to test not only usability, but also organizational processes, curricular compatibility, and practical conditions for use in everyday school life. The longer-term use also made it possible to take typical conditions such as time resources, supervision situations, and technical infrastructure into account. This created a practical basis for assessing the feasibility of immersive technologies in different educational contexts of nursing training.

Within the pilot, particular attention was given to how the applications could be incorporated into everyday teaching practice. The institutions independently integrated the VR scenarios into existing teaching units and tested different forms of use, for example as an introduction to topics, to prepare for practical exercises, or as an accompanying in-depth offering. This made it possible to understand organizational processes, necessary preparation times, and integration into existing teaching structures under real conditions. The approach thus aimed to map concrete usage scenarios and framework conditions for application in regular everyday training.

In addition, Strategische Partnerschaft Sensorik e.V developed and implemented a hackathon-type format as part of the innovative educational activities.

The summer school was not comitted; rather, the originally planned transnational testing format was implemented under the more appropriate title of “hackathon” due to the actual timing and delivery structure of the event. The activity took place in October and was therefore no longer accurately described as a summer school in seasonal terms. Renaming the format was primarily a matter of correct and transparent reporting, not an indication that the activity was cancelled or not organized. The core objective of the original task remained fully unchanged. A transnational educational testing and innovation format was carried out in Germany, and it included the collaborative development and presentation of VR-based learning applications. In the beginning all three VR-labs connected in VR displaying ready to use and under construction tools . Participants from the relevant target groups were actively involved, including nursing students, nursing educators, and media informatics students. The event also preserved the intended interdisciplinary and innovation-oriented character foreseen in the application. In this sense, the implemented format fulfilled the same functional purpose as the originally planned summer school

The hackathon format ensured comparable quality of results because it provided a structured environment for intensive, practice-oriented, and collaborative work. Participants worked in interdisciplinary teams and directly applied the 360-degree VR best-practice tool PaneoVR developed and mapped in the project. This enabled hands-on testing, co-creation, and immediate feedback, which are key quality features of innovative educational formats. The transnational and cross-sectoral exchange originally intended for the summer school was maintained through the design of the event and the involvement of actors relevant to the project region. The shift in title therefore did not reduce the educational, methodological, or innovation value of the activity. On the contrary, the hackathon format offered a focused and outcome-oriented setting that was particularly well suited to generating concrete prototype ideas for low-threshold VR learning applications in nursing and healthcare education.

Hackathon day dedicated to developing training scenarios with the Paneo VR app – Image Source: Strategische Partnerschaft Sensorik e.V.

4.4. Hungary

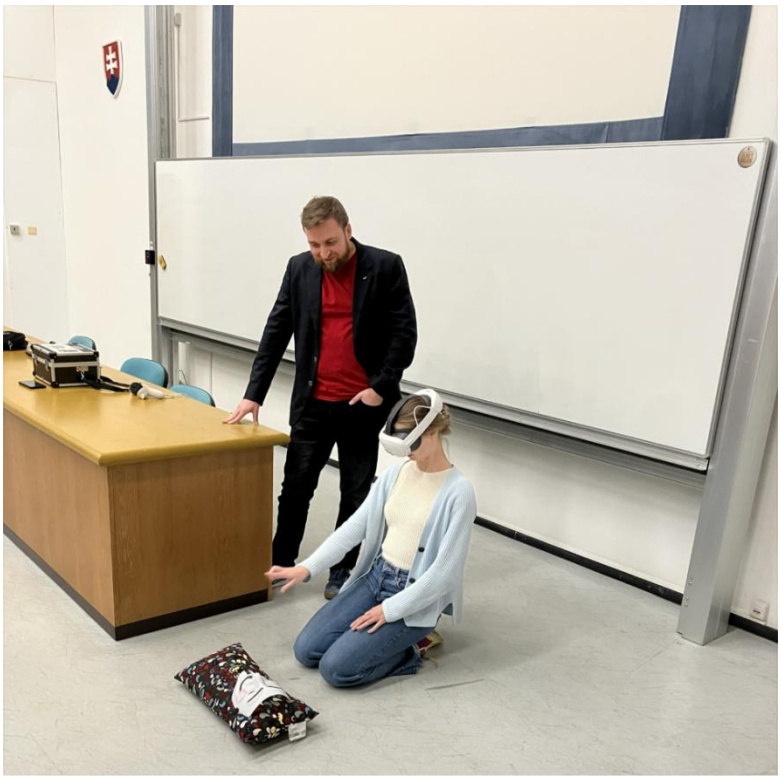
A workshop participant testing the VRoom of Horror application– Image Source: Széchenyi István University

As part of the pilot action, Széchenyi István University participated online in the hackathon event, where we presented the VRoom of Horror application. Within the framework of a targeted visit, the VReduMED project's "VR-CPR" and "VRoom of Horror" applications were presented and made available to teaching staff of the Faculty of Health Sciences and nursing students at Széchenyi István University. The use of the applications and their integration into education were presented under the leadership of Dr. Emese Sánta. We held a two-part session with Dr. József Tollár and his team in the teaching hospital in Kaposvár. In the first part, we held an online workshop, we presented our findings and results of the project, especially the TtT concept. Then in the second part, participants visited the VR laboratory at SZE and had the opportunity to test the applications during a four-hour workshop. In addition, in cooperation with InnoSkart and Petz Aladár University Teaching Hospital in Győr, we introduced the applications to physicians and nursing professionals who work at the hospital and are involved in education and mentoring, within the framework of a two-hour workshop, followed by a hands-on trial opportunity for the participants. Beyond the targeted workshops, SZE and also hosted an event to which we invited representatives of the Faculty of Health Sciences, the hospital, and previously identified SMEs involved in VR development, for a presentation of the Hungarian VReduMED VR lab. During this event, we introduced the operation of the lab and informed participants about the possibilities of using the VR headsets provided by us. Furthermore, we are planning an additional regional event in Budapest, where we will also present the applications, the innovative educational format, as well as the VR lab and the opportunities for using the VR headsets.

A workshop participant practicing chest compressions using the VR CPR application - Image Source: Széchenyi István University

4.5. Slovakia

As part of the VReduMED pilot activities, the Bratislava University of Economics and Business (EUBA), in cooperation with the National Institute of Children's Diseases (NUDCH), conducted testing of innovative VR-based educational tools in two distinct implementation settings. Both sessions were held on the same day at EUBA premises, with the first group participating before noon and the second in the afternoon. Each session lasted slightly over two hours, constrained by the battery life of the VR headsets.



Student of EUBA going through setup of VR CPR application on a placeholder dummy Image Source: EUBA

The first session targeted twenty-five students from EUBA and was organized in the form of a workshop. Its primary focus was on cardiopulmonary resuscitation (CPR) and work safety applications, while additional VR tools were introduced to demonstrate their potential relevance in various aspects of future business careers. Due to time limitations and participant preferences, the format combined introductory explanations and demonstrations with hands-on testing for those interested. The second session engaged six medical students from the Faculty of Medicine at Comenius University Bratislava. In this case, all participants actively tested the VR applications, which were directly relevant to their future roles in healthcare.

Students of Comenius University testing the Room of Horror application Image Source: EUBA

The applications tested during the pilot included both project-developed tools and best-practice solutions identified within the consortium. Among the project-developed applications were VR CPR, designed for cardiopulmonary resuscitation training, and Room of Horror, which focuses on identifying patient safety risks in healthcare environments. In addition, participants explored Feartherapy, a simulation for exposure-based therapy, Human Anatomy VR for interactive anatomical learning, and Oxford Medical Simulation, which offers immersive clinical scenarios for medical training.

Access to VR technology was facilitated through introductory briefings, as many participants had never used a VR headset before. These briefings covered general headset handling and navigation, followed by detailed instructions for each application, including control schemes, menu navigation, and movement within the simulations. The sessions employed standalone VR headsets, with the live image mirrored to a projector or widescreen display to allow other attendees to observe the ongoing simulation. Continuous

support was provided by representatives from EUBA and NUDCH throughout the sessions; however, participants were encouraged to explore independently and experiment with the applications, as this approach was intended to generate authentic feedback on user interface and user experience beyond the project team's perspective.

The pilot aimed to evaluate the practical applicability of VR-based educational tools in both business and healthcare contexts, while also assessing their integration potential and usability. The insights gathered during these sessions will inform further development and refinement of the applications within the VReduMED project.

5. Results

The results of the quantitative data collection during the test phase are presented below. This is based on the standardized questionnaire that was completed by the respective target groups following the implementation of the VR testing. This survey refers exclusively to the evaluation of the tested VR applications.

In addition, selected qualitative findings from the Care Education Forum interviews are used. These interviews were not primarily related to the evaluation of individual applications. Rather, they aimed to identify current challenges, structural conditions, and opportunities for the use of VR in an educational context. The experts interviewed did not necessarily try out all of the applications tested themselves; their assessments relate to the general implementability and relevance of immersive technologies in nursing education. The results were documented in country-specific articles: Hungary (article 1) and Hungary (article 2), Slovakia (article 1) and Slovakia (article 2), Austria (article 1) and Austria (article 2), Czechia (article 1) and Czechia (article 2), and Germany (Bavaria).

In addition to the quantitative evaluation, an in-depth qualitative survey was conducted at OTH Regensburg as part of the lending concept during the implementation of the VR testing. The aim was to go beyond the immediate evaluation of individual applications and examine how VR can be integrated into real school settings in terms of organization, didactics, and structure. At the time of writing this report, not all evaluation results are yet available. The final overall evaluation will be carried out by the project partners at OTH Regensburg after the project has been completed.

5.1. Quantitative results

The quantitative evaluation of the pilot actions was carried out as part of the activity "Evaluation of the VReduMED pilot actions by the Care Education Forum". The detailed results and analyses will be available in the deliverable of this activity at the end of the project.

A total of 239 people from 107 organizations in the five partner countries took part in the survey, the majority of whom were from the healthcare and education/teaching sectors and thus from the core target group of care education. The participants first evaluated the pilot actions as a whole and then the VR applications implemented as part of the pilots.

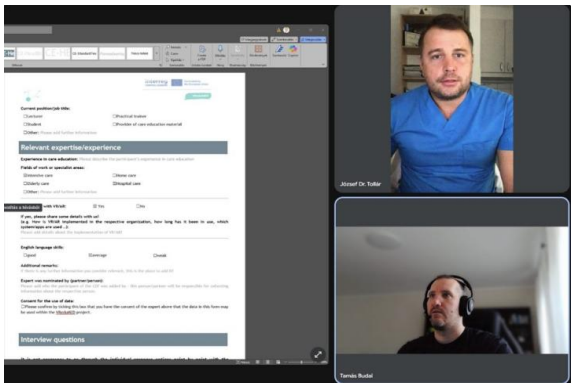
More than three-quarters of respondents said that participating in the pilot actions had given them a good insight into the possibilities of VR in care education. The CPR application developed for the project was rated very positively overall, with 87% of care education participants and 90% of all respondents rating it as "very good" to "good." The "Room of Horror" received significantly improved ratings after technical revisions during the course of the project. The anatomy application Human Anatomy VR, developed by virtual medicine, was also included in the testing from the good practice catalog and received very positive ratings. 96% of care education participants and 96% of all respondents gave it a rating of "very good" to "good." The clear and three-dimensional visualization of the content was particularly highlighted. Overall, the presentation

and visualization, interactivity, and didactic approach of the tested applications were rated positively. Critical feedback mainly related to technical aspects or individual controls.

These assessments support the general and personal experiences gained in the pilot, according to which VR applications are perceived as particularly useful when they depict practical, clearly structured scenarios and are embedded in a didactically prepared learning setting or can be easily embedded.

5.2. Qualitative results

The following section summarizes the results of the interviews conducted as part of the Care Education Forum with regard to the opportunities and challenges of VR in nursing education.



Interview with Dr. habil. József Tollár from the Faculty of Health Sciences at the University of Pécs and Tamás Budai - Image Source: Széchenyi István University

The cross-national interviews reveal recurring structural conditions that are relevant for the implementation of immersive technologies. In particular, they mention staff shortages, high workloads in training and practice, and organizational challenges in nursing education.

In Hungary, language barriers, communication problems, and motivation issues are also identified as key issues. VR/AR scenarios are considered particularly useful for method training and communication, with the importance of haptic feedback being emphasized. Several country reports emphasize that VR can only deliver sustainable added value if it is used in a didactically sound manner. In Austria, this is described with the guiding principle of "didactics before technology." At the same time, it is pointed out that technical hurdles or additional organizational effort can impair learning processes. In Czechia and Slovakia, VR is primarily seen as an opportunity to train practical skills in a standardized, safe, and repeatable manner. A gradual introduction with accompanying support for teachers is considered crucial. In Germany, VR is understood as a complementary format that can address different types of learners. At the same time, the need to carefully coordinate technical infrastructure, data protection requirements, and curricular integration is emphasized.

Focus group interview with nurse educators conducted by Prof. Dr. Christa Mohr - Image Source: OTH Regensburg

The qualitative survey conducted as part of the testing at OTH Regensburg was carried out after a six-week loan period with teachers in educational institutions, mainly nursing schools.

The results currently available do not yet include all of the interviews conducted. The evaluation is based in part on final theses by bachelor's students in nursing at OTH Regensburg.

The results show that VR lending was rated very positively overall and is perceived by the participating teachers as an innovative and

beneficial stimulus for teaching. Even the first impression was often described as impressive, especially with regard to the technical possibilities and didactic potential of the applications. This positive assessment was confirmed during the test phase. The VR scenarios were understood as an additional learning environment that meaningfully complements existing teaching formats and opens up new perspectives on nursing content. Particular emphasis was placed on the possibility of preparing complex procedures, decision-making processes, and emergency situations in a structured manner, as well as presenting content in a more vivid and comprehensible way through visualization. At the same time, it became clear that VR is not considered a substitute for practical training situations, but rather a preparatory training environment that strengthens cognitive confidence. Overall, the loan is described as having added educational value, allowing certain content to be conveyed differently, in some cases more efficiently and comprehensibly, without questioning the importance of real training settings.

6. Recommendations

The pilot phase has shown that the successful use of VR applications in nursing education depends less on the technology itself than on its structured didactic and organizational embedding. The different implementation formats – from short test settings to integration phases lasting several weeks – illustrate that sustainable implementation requires careful planning and clear objectives.

The following recommendations for action can be derived from the findings gained during the pilot phase:

Virtual reality headset used for immersive medical training simulations – Image Source: OTH Regensburg

6.1. Didactic framework conditions

The use of VR applications should be consistently geared towards learning objectives. Before implementation, it is necessary to define which verifiable skills are to be promoted—for example, confidence in practical situations, clinical decision-making, structured communication skills, or the ability to grasp and reflect on complex content in a targeted manner. Without a clearly formulated learning objective, there is a risk that the application will be used primarily for exploration or play, without any lasting increase in competence.

VR can be used at different points in the learning process:

- as an introduction to a new topic, especially in scenarios involving a change of perspective or role-playing,
- to prepare for practical exercises and structure sequences of actions,
- to repeatedly practice decision-making situations,
- to visualize complex content that can only be represented to a limited extent using conventional means (e.g., anatomical structures or procedures in an emergency context).

The pilot phase also shows that a one-time use of VR often produces only limited learning outcomes. In the initial use, the focus is on operation, orientation in virtual space, and gamification effects. Only with repeated use and curricular integration does the actual increase in competence come more into focus. Sustainable integration into existing teaching structures is therefore clearly superior to an isolated single event.

It should be noted that a higher degree of complexity in the application does not automatically lead to a higher learning effect. The decisive factor is the fit between the application, the learning objective, and the target group. Regardless of the format, a structured preliminary discussion and a targeted debriefing are essential components of the learning process. Classifying the experience, reflecting on decision-making processes, and transferring the knowledge to real-life situations are central prerequisites for sustainable learning.

6.2. Curricular and institutional integration

When selecting and implementing VR applications, it is important to bear in mind that curricular content varies from region to region and from institution to institution. VR scenarios may therefore not correspond in every detail to the standards or chains of action taught locally.

Any discrepancies should be addressed transparently and used as an opportunity for reflection. Comparing different approaches can stimulate professional discussions and deepen decision-making processes. VR should therefore not be understood as a normative replacement for existing teaching models, but rather as a complementary tool within existing training concepts.

VR setup for pilot lending, including a mobile router, Meta Quest 3 with controllers, transport case, and HDMI cable – Image source: OTH Regensburg

Institution-specific preparation of selected scenarios—for example, in the form of proprietary didactic guidelines or module concepts—supports curricular anchoring and facilitates repeated use.

6.3. Organizational and structural implementation

Comprehensive technical equipment is not necessary for successful testing and subsequent implementation. The pilot phase shows that mobile, temporary, or loan-based usage concepts are practical and resource-saving alternatives.

The following factors are crucial:

- clear responsibilities,
- realistic scheduling,
- technical preparation, and
- early involvement of teachers.

The format chosen should correspond to the respective goal. Short-term test formats are suitable for raising awareness and initial exploration, while integration phases lasting several weeks allow for a structural examination of suitability for everyday use. A moderate number of devices is sufficient if VR is specifically integrated into individual teaching sequences.

6.4. Final assessment

The pilot phase shows that VR applications in nursing education particularly demonstrate their potential when they are understood as a targeted didactic tool. Sustainable implementation requires a combination of clearly defined learning objectives, curricular integration, organizational planning, and reflective application. The chosen pilot format enabled practical testing under real conditions and thus provides a solid basis for the gradual, realistic, and resource-sensitive integration of immersive technologies into nursing education.