PR2 Digital Platform – Education for Environmental Sustainability in Europe

Project Code: 2021-1-IT02-KA220-ADU-000029662

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Result Type: Open / online / digital education – Open Education Resource (OER)

Result Media: Interactive Resource

Immersive education through virtual and digital has a strong perceptive and multisensory impact.

Digital Platform is configured as a support of new digital concept for immersive training on topics of sustainability.

Platform characteristics:

1. **connected** – accessible online, from web browsers fixed and mobile, even at a distance,
2. **modular** - made up of several modules that can be developed over time and in relation to objectives and financial availability,
3. **multidevice** – compatible with access from different models of VR viewers, but also from PC and mobile devices,
4. **standard** –based on webVR and webGL technologies,
5. **measurable** – with specifications analytics, to track 3D navigation and immersive behaviour,
6. **educational** - usable within educational practices and available to educators, with specific immersive methodologies,
7. **interoperable** - accessible and shareable also by other institutes and national and international users.

The Platform is, first of all, thought as useful tool to integrate and empower the educator, guaranteeing him a vast set of tools and references useful to facilitate the introduction of Environmental Sustainability topics in the curriculum. The interactive and attractive physiognomy of the Platform also makes it highly usable by a wider learning audience. Several scenes will be designed specifically with reference to Project results, reworked virtually and in an immersive-interactive way.

The platform is under development and is a significant example of an integrated CMS-BACKEND solution for developing WebXR online applications.

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Sustainability immersive library

Carraro LAB will provide some basic content that will enable non-expert users to organize immersive lessons.

The Digital Immersion of the “Echo” Project is a virtual space made up of several scenes, dedicated to sustainability issues and the results of the project, also hosting multimedia contents and interdisciplinary links.

R1 Implementation of the IDRISI methodology in the Digital Platform

Analysis of documentation provided by IDRISI partner.

Design of a software compatible with the Good Practices on Environmental Education.

Orientation of the platform so that it can enable Environmental Education of the uploaded materials.

Comparison with IDRISI partner of platform features regarding R1.

Methodology is at the heart of the digitisation of content by Carraro LAB. Following the line of Good Practices on Environmental Education, the Digital Platform will be based on data sharing, transparency of the research/creative process and ease of use. This approach is intended to make the platform comprehensible to all social and age groups. The research results, made understandable and simple, are intended to be experienced directly by all users who want to inform themselves about environmental issues.

R3 coordinated graphics and concept definition

Study for the realisation of coordinated graphics.

Analysis of the objectives of the Pietro Barbaro Foundation.

Realisation of the cover of the Erasmus Days event on 13th, 14th, 15th October.

Analysis of recognisable elements that could lead back to the Erasmus Days project.

Realisation of background images and contents for 4/5 totem panels to be installed at Palazzo Trinacria.

Consulting on hardware to be purchased in view of the Erasmus Days.

The study phase for the Erasmus Days, the coordinated graphics, and the concept of a digital educational space will be made available for the exhibition at Palazzo Trinacria.

Carraro LAB's expertise will be shared with the Pietro Barbaro Foundation, and our aesthetic approach will be aimed at immersiveness and horizontal understanding of data. The line that unites R2 and R1 is creativity, conceived as a means to implement a new way of learning.

R4 Study of the materials provided by SEAL Cyprus in order to generate a digital layout of the Toolkit. Study of a virtual implementation of SEAL Cyprus' objectives within the Digital Platform using animations and interactive resources.

Analysis of SEAL Cyprus materials.

Implementation of the R4 section objectives within the Digital Platform.

Implementation of a modular model within the Digital Platform.

Development of an interoperable interface for the Digital Platform.

Web design that can enable emotional and participative involvement.

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Design of virtual spaces that can reproduce the qualities of real educational settings.

Design of a digital platform that allows stakeholders to implement their own feedback and results.

The Digital Platform - Environmental Sustainability Education in Europe was developed specifically to enable organisations such as S.E.A.L. to make their goals and content, usable in an innovative way. Modular, as it consists of numerous thematic scenarios, it is interoperable as it can be viewed interactively and allows the creation of its own digital educational spaces. It allows the visualisation of case study galleries as visitable digital spaces.

R5 declination of the Digital Platform, to fulfil the objectives of the partner SDRUZHENIE WALK TOGETHER

Review of "good practices" collected by Association Walk Together.

Design of a virtual software that can be used by young adults.

Exemplification of the digital platform, so that it can be used by senior users.

Design of an interactive platform, to allow users to describe their green curriculum in an immersive way.

Implementation of the Digital Platform, to allow users to make the Green Economy curriculum, created by the Association Walk Together, engaging and immersive.

ECHO's Digital Platform will have a focus on the needs of its partner Association Walk Together. In fact, we designed the digital platform to be compatible with the inclusion of their green curriculum. To make the programme transparent, we took into consideration the readability of the medium by not only young adults, but also senior users. Such care would allow those who have collaborated in the realisation of the CV to be able to see the result of their work.

Each digital room will have a specific cognitive scenography:

- 360 images
- 360 videos
- 3D models,

related to the theme.

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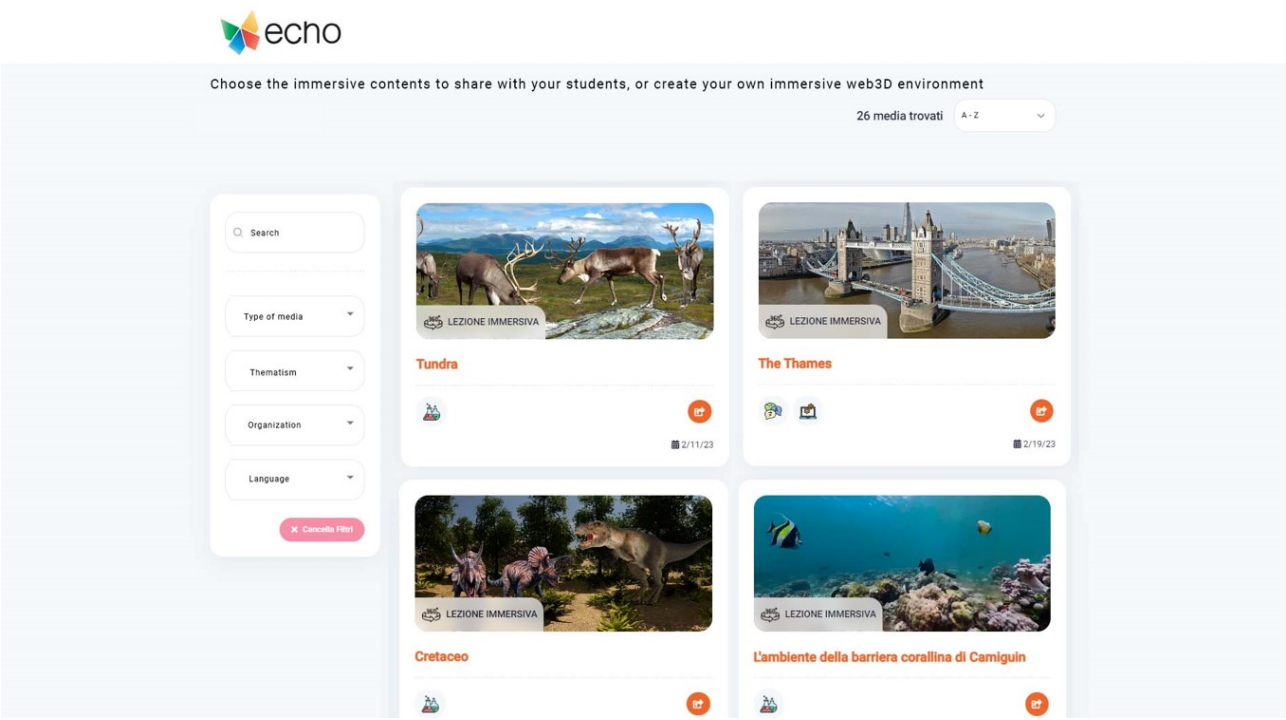

Among the content preloaded in the platform we will have:

- 360-degree environments of the earth's major biomes,
- some immersive natural and man-made landscapes of Europe and the Mediterranean,
- 3D models dedicated to renewable energy and other sustainable technologies.

Interactive and learning functions

Three levels of teaching interaction can be distinguished, enabled by the platform:

1. FRUITION - available content is enjoyed and presented in VR and AR,
2. REWORKING - basic modules are reworked by creating customized lessons,
3. CREATION - new content is produced and entered into the platform.

The heart of the Platform:

Creation of interconnected virtual thematic environments, and immersive scenes.

Design and construction of the scenes and their contents.

Several scenes will be designed specifically with reference to Project results (1, 3, 4, 5), reworked virtually and in key immersive-interactive.

Each piece of content is displayed in the authors' backend with an interface that enables several functions:

- displays the content,
- share the content with a group of users,
- edit the content, add elements or links,
- delete the content.

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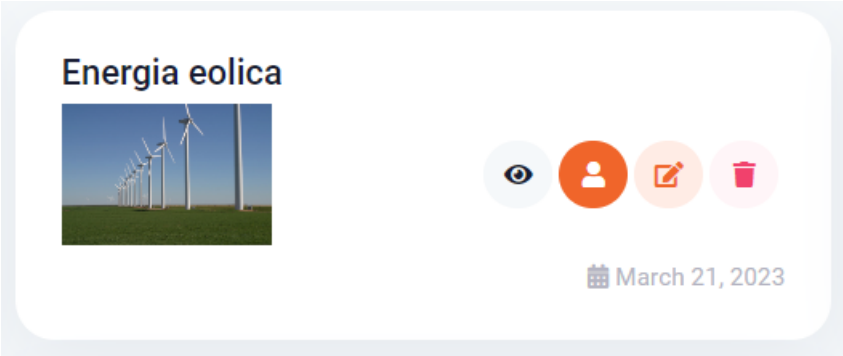

Teachers can customize and create immersive lessons by adding interactive points to virtual environments and 3D objects, with the following content:

- title and description,
- image,
- audio,
- video

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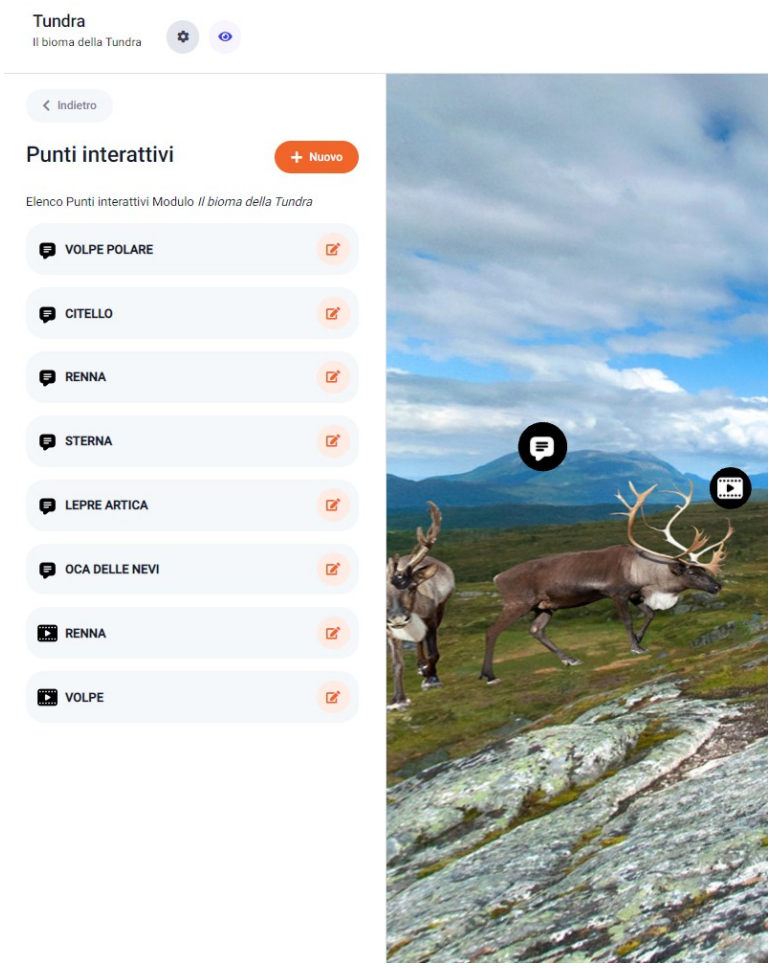

Starting with a basic immersive module (e.g., a 360 photo or 3D model), the user can create a virtual lesson, inserting interactive content through an easy-to-use interface.

The task of inserting metadata is easy and within everyone's reach: just select "create a new interactive point," click on the area of the immersive environment where you intend to insert the new content, fill in the metadata title, and associate any media (text, audio, image, video).

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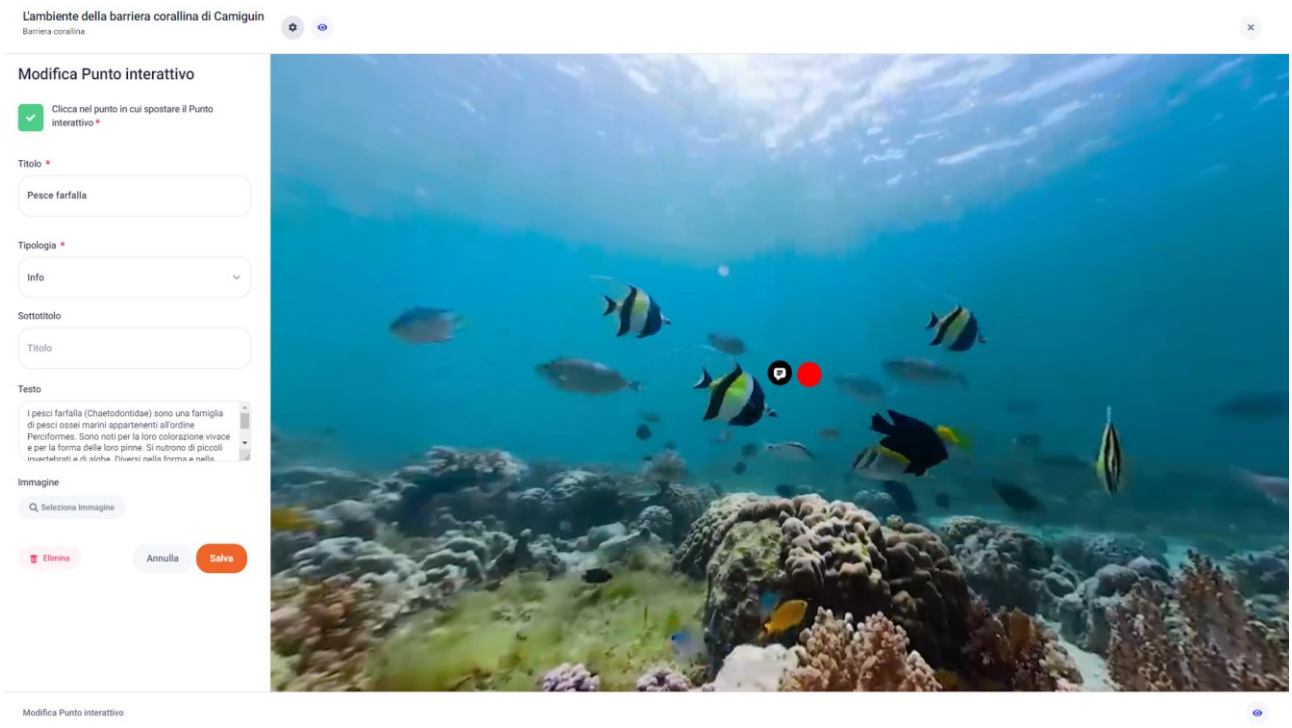

Immersive formats and digital products

The web APP presents the immersive formats and planned technological products of the ECHO project with dedicated pages.

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The most advanced component of the platform includes the system for uploading and displaying immersive content.

The first step is the creation of the project, e.g., a virtual tour.

An environment is dedicated to the management of virtual tours, to develop the different formats provided by ECHO.

Each room will have a specific cognitive scenography: 3D models, videos, texts, images, related to the theme.

And each scene can be linked to other scenes.

Teaching methodologies

Two teaching methodologies are adopted:

- TEAL - Technology Enhanced Active Learning. Technology-enabled active learning involves several stages: activity presentation, content design and enjoyment, sharing and final analysis.
- ART OF MEMORY - the ancient mnemonics, based on the LOCI and IMAGINES described by Cicero (Constat Artificiosa memoria ex locis et imaginibus) and other classical authors. Virtual environments and interactive images stimulate learning and memorization.

Main Front end metaphor

The organization of the content delivered by the organizations.

Can follow various kinds of metaphors.

Metaphors can be:

- real environments (landscapes, ecosystems, real places)
- graphic environments (museums, theaters, other environments)

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Immersive content produced by the partners

The backend provides a screen for entering 360-degree photos and videos, produced with a 360 camera.

Cross-device

The platform provides for cross-device use:

- on PC
- on smartphones and tablets

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- on VR headsets

Architecture

The ECHO platform for immersive learning is a web application in cloud.

The backend allows you to upload and manage content and interactive modules.

The media server - content delivery system guarantees distribution.

The frontend allows cross device visualization on web browser, PC, mobile and tablets, with specialized interfaces and functionalities.

Standard file formats

For 360 degrees photos, the equirectangular format is **JPEG**

For videos, also 360 we indicate the format **MPEG 4**

For the original 3D models, you may indicate two formats for interchange **GLB** (it is the most comprehensive format)

Educational Transformation in the Context of Internet 3.0 and European Digital Evolution

Many educational projects are financed and inspired by the European community, which at its highest level gives quite clear indications on the context of the evolution of the Internet, now approaching phase 3.0. In the Letter of Intent on the State of the Union 2022, President Ursula Von Der Leyen states: "we will continue to look at new digital opportunities and trends, such as the metaverse. This also means continuing to work on investments and reforms through the NextGenerationEU, of which €700 billion remains to be invested in the coming years."

The European Union therefore invites all European players, public and private, to contribute to the construction of a European digital ecosystem. On these issues, and in particular on the metaverse, Commissioner Thierry Breton intervenes: 'This new virtual environment must incorporate European values from the outset. People must feel as safe in virtual worlds as in the real one. (...) Similar to the European Bauhaus, we will launch a creative and interdisciplinary movement, with the aim of developing standards, increasing interoperability, maximising impact with the help of IT experts, regulatory experts, citizens' organisations and young people'.

Hybrid and 'phygital' learning environments

The ECHO platform aims to realise hybrid learning environments that can merge the educational and teaching potential of innovatively designed physical spaces and digital environments.

The notion of physical-digital hybrid has generated the English neologism 'phygital', which today also applies to extended reality: thanks to Augmented Reality devices, it becomes possible to interact with virtual objects and environments displayed within physical environments.

From frontal, environmental education becomes participative and lived. The author of the immersive lesson must meditate not only about narrative coherence, but also about the environmental visualisation of the data itself. Placing data in a precise position within space means giving it additional meaning. More precisely, it means visualising the context around the data, the place where it comes from, the habitat.

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The virtual ECHO space will be a digital twin of the original, a digitised twin that will display the spatial and contextual characteristics of the data. The author of the place will then be able to choose a precise location for the data and give it a 'face'. In this way, one translates one's fieldwork reality into an interactive interface, which can restore the physicality of the research of each of the participants, to each of the users.

Hybrid learning environments can thus also be called 'augmented classrooms' or 'virtual laboratories'.

The dematerialisation of teaching laboratories

In several cutting edge fields, the dematerialisation of scientific and technical laboratories has already taken place. Astronauts and pilots have been training for decades with virtual simulators. But virtualisation has already made its way into everyday life and professional activity. According to research by Vision Direct, the average Italian, i.e., those living at least 65 and a half years, spends as much as 47 years of their life in front of a screen: be it a TV, mobile phone, computer, tablet, e-reader or console. Education, entertainment and work are largely dematerialising, with increasing exposure to the web, today still consisting of 2D pages and tomorrow of the 3D environments of the metaverse.

It therefore becomes logical to develop an immaterial approach to teaching labs as well, enabled by immersive technologies.

The dematerialisation of teaching laboratories offers many advantages:

- Interdisciplinarity: with the same technological tools, different subjects can be taught and a wide range of topics experienced.
- The versatility of learning environments, which can be reconfigured for different learning experiences.
- The measurability of data and the analysis of behaviour, thanks to the cloud connection
- Immersive and playful interaction
- The sharing of the same laboratory between several classrooms and schools, even remotely

The ECHO digital platform intends to bring together and integrate all modes of immersive education: projections, virtual reality experiences and augmented reality.

Immersive education

There is already a scientific literature on the pedagogical implications of immersive media.

It should be noted that cognitive development and learning are fostered by a sequence of channels with increasing effects:

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- Sensory channel
- Multisensory channel
- Interactive multisensory channel (sense + action)

Virtual reality enables interactive multisensory stimulation. With high realism, combined with control over the stimuli provided, and levels of perceptual intensity and difficulty.

In Virtual Reality, the virtual is perceived as real.

"Virtual reality activates the motor cortex as real experiences do. The brain adapts immediately and perceives virtual reality as real." (Teresa Farroni, University of Padua)

Carraro LAB has developed projects and research in the field of immersive education, in collaboration with several universities, the *Indire* institute, the *Impara Digitale* association, large companies and publishers.

ECHO software can therefore steer toward a change of course. It can do so because it allows the acquisition of the artistic process into that of knowledge creation. Such interpenetration is already taking place in several disciplines, for example, the Ingoldian approach to anthropological knowledge.

Adding "making" to environmental epistemology means experimenting with one's own knowledge. Indeed, the teacher, by creating interactive scenarios would test the effectiveness of his or her teaching. Not only because he would have a practical example that he could evaluate, but also because this example can be evaluated by others, obtaining important feedback.

Such an approach ultimately enables collaborative knowledge creation and makes its use common.

Digital, sustainability and the professions of the future

Increasingly, the professions of the future will be dematerialized, particularly with the metaverse trend.

All economic sectors will be invested in the sustainable economy by the evolution toward Internet 3.0: the Internet 3 Academy course conducted in Lombardy analyzes 16 genres of the metaverse (from therapeutic to industrial, from education to art...), commented on in Roberto Carraro's speech at the *stati generali della scuola digitale 2022*.

"Not one but many metaverses are being developed as a new generation of digital platforms offers people the opportunity to interact in completely innovative ways. Not only for entertainment purposes, but also for working together, developing artistic creativity, doing real-life simulations aimed at medical interventions, cultural preservation, environmental protection or disaster prevention, and much more..." (EU Commissioner Thierry Breton).

Virtual and augmented laboratories thus fit into the emerging trend of dematerialization of professions, the subject of the European research project "videogames for teachers," curated for Accademia di Brera by lecturer Roberto Carraro.

ECHO: immersive didactics for learning about sustainability

ECHO's immersive didactics focuses on the production of digital products and content. Through workshop activities, transversal skills and soft skills such as creativity, problem solving, collaborative work, and communication are developed.

At the heart of the course is the construction of virtual and augmented experiences, supported by the content and software provided by the ECHO platform. In the learning environment, examples of virtual tours and augmented objects are presented, and the design of an immersive experience is initiated, which can range from disciplinary topics (e.g: journeys in the reconstruction of an epoch of evolution interaction with 3D elements of biology, guided tours of a natural environment or a technological plant...) to current topics on sustainability(ex:

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ecofuel, hydrogen, sand batteries, drought, ...) to the documentation of educational activities carried out in the territories (ex: educational visits to natural parks, wind farms...).

The methodology draws from the TEAL, "Technology Enhanced Active Learning" and IDeAL, "Iterative Design for Active Learning" approaches.

Laboratory approach: Active learning supported by technology

In ECHO's educational approach, the Focus is not the content itself but the path of knowledge acquisition that sees the student as an active subject in the construction of his or her own knowledge. The user of the content of the ECHO platform will not deal with the data as one does in the archives, that is, in a linear and chronological way, but by going through an interactive educational space. This approach allows for an immersive experience of the data collected in the field. This is because the software allows the field experience to be transferred to a virtual place.

The collaborative and laboratory approach involves different configurations of the learning environment in relation to the various phases:

Presentation of the activities

Activation takes place with the teacher's presentation of the activity and working tools to the class through front-to-wall immersive projection of similar virtual or augmented experiences (e.g., virtual tours, augmented three-dimensional models, 3D manuals, simulation tests, immersive courses...). The teacher also demonstrates the content available in the platform and the basic functionality of the educational application software (loading 3D content, organizing the virtual path, inserting hot spots and other materials), including through short video tutorials.

Design

The design phase follows with students being divided into groups with different tasks, such as dedicated to devising the experience, editing the tour, writing accompanying texts, finding images and producing other related materials.

Production of content from scratch

In some creative pathways, special technologies (e.g., 360 cameras, PCs, 3D processing software) are used for students to produce immersive content from scratch. This activity can be considered an advanced level of the training process.

Processing of the immersive module

Next comes the elaboration of the immersive project, through the collection of materials produced by the groups, software assembly using a specific module of the ECHO platform, and publication of the realized digital product so that it can be shared.

Sharing in VR and AR

In the sharing phase of the immersive experience, the learning environment is organized for individual student enjoyment of the 3D content produced, in the two possible modes: in virtual reality by having students wear VR viewers on swivel seats, and in augmented reality with special devices (tablets or glasses) equipped with cameras and software for viewing 3D objects in the center of the classroom. In this phase, the class is guided verbally by the teacher, and each student can make different virtual experiences, either in simple navigation mode or by interacting with the content in the form of tests. The sharing phase with devices in VR and AR will be short in duration (5-10 minutes on average) but perceptually intense and with strong mnemotechnical value.

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Summary of the course

The teacher gives the summary of the course, with the visualization in the front projection of the virtual content produced. Reflection is made on what the final product turned out to be with respect to its design, and possible improvements in future experiences.

Publication

Based on the result achieved, a decision can be made whether to keep the produced content for internal classroom use only, or to publish it in the platform and make it usable for others. A dedicated software module makes it possible to manage the different levels of publishing the content. The immersive lesson can become part of the modules made available to students.

Cognitive, organizational and communicative aspects

The methodological approach enabled by the ECHO platform makes use of technology at several levels:

Cognitive

Because it enables the development of understanding of complex phenomena and content with interactive experiences, 3D resources, simulations.

Organizational

Because it leads to sharing materials and digital content created during the work done in the learning environment

Communicative

Because the teacher follows students' work in real time, provides immediate feedback, guides group contributions, guides the immersive experience, customizes the entire learning project and defines its possible sharing and communication to the outside world.

GANTT with an idea of the timeline for implementation:

- March 2023: descriptive and functional analysis document
- June 2023: platform development and English translation
- July 2023: functionality testing
- September 2023: Digital platform delivery and operator training

Palazzolo sull'Oglio (BS), 31/03/2023

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