

Visualization of Demonstration Sites Using VR

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Help us improve the materials further! If you find any mistakes or have any comments, we would be happy to receive feedback at lsebelikova@jcu.cz.

Explanatory notes

This material has been lacking in the field of restoration ecology until now. It is a textbook on the basics of restoration ecology, covering a broad range of topics from the basics of ecology, to the restoration of species-rich grasslands, and urban ecology. The material is intended primarily for students of secondary (vocational) schools and their teachers. However, its application can be much broader. We firmly believe that this material fills a gap in education in the field of restoration ecology, and that it will be useful as a teaching tool not only for students and their teachers, but also for others interested in restoration ecology. In addition to the sources used in the text as footnotes ¹, [references](#) are also used in the text which can be used to expand knowledge if desired. More information on the topic can also be found in the [green boxes](#). In the [red boxes](#) you will find tips for activities in class or as independent work related to the specific topic.



Further information: Further or detailed information on the topic is available under the links.



Article: Further information on the topic is available in the form of an article.



Video: Further information on the topic is available in the form of a video.



Activity tips: Tips for further work on the topic, either in class or as homework.



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6 Virtual Reality and its Utilisation in Education

6.1 Virtual Reality

Virtual reality (VR) is a technology that provides the user with a simulated experience and creates an immersive environment using computer-generated graphics, sounds, and sometimes physical sensations. VR has enormous potential, especially when combined with education and as an interactive teaching method. By immersive travel in a virtual world, complex issues can be conveyed, temporally divergent processes (seasons) can be depicted, and places that are logistically difficult to access can be travelled to. This makes it possible, for example, to experience phenological processes, work on agricultural machinery, or familiarise yourself with restoration measures. It was shown that these technologies can offer advantages over traditional teaching methods, such as for example a significant improvement in learning outcomes¹ or an improvement in communication and presentation skills². However, further research to determine the exact impact of VR on education is needed.

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Here, we use VR to bring various areas of ecological restoration to life. To do that, we focus on interactive 360-degree virtual tours. Virtual tours in particular offer the opportunity to impart knowledge in a simple way.

6.2 Interactive Virtual Tours

Virtual 360-degree tours have gained increasing importance in recent years and offer an innovative way to present and experience different topics interactively. Using 360-degree technology, learners can immerse themselves in a virtual environment and explore landscapes and restoration measures from various perspectives. This allows them to develop a deeper understanding of ecological restoration and the interconnected aspects of nature. Furthermore, virtual 360-degree tours provide an opportunity to make the importance of ecological restoration accessible to a wider audience. By utilizing mobile devices and VR headsets, people who are unable to physically visit a locality can still participate in the exploration. This not only increases the reach and visibility of projects but also fosters a general interest in and understanding of the importance and meaning of

¹ Villena-Taranilla et al. 2022: Effects of virtual reality on learning outcomes in K-6 education: A meta-analysis. *Educational Research Review* 35: 100434. doi.org/10.1016/j.edurev.2022.100434

² McGovern et al. 2019: An application of virtual reality in education: Can this technology enhance the quality of students' learning experience? *Journal of Education for Business* 95: 490-496. doi.org/10.1080/08832323.2019.1703096

ecological restoration. VR allows restoration measures to be brought to life. But virtual reality is already an important aid in the preparation phase. The individual steps of planning, realisation, and monitoring can be shown clearly in virtual space.

6.3 Didactic Possibilities

Virtual Reality (VR) offers significant advantages in knowledge transfer. This technology promotes active learning by allowing learners to interact directly with and explore content. Furthermore, VR simulates complex scenarios that would be difficult or dangerous to reproduce in the real world. These interactive elements can increase learner engagement and motivation, making knowledge transfer more effective. This approach enhances retention and understanding in specific areas, as learners can interact with complex concepts in a more meaningful way. Additionally, VR enables knowledge to be conveyed interactively and in a visually appealing format, which can boost learner interest and motivation, making the educational experience both engaging and effective. When creating educational content, it is essential to tailor it to the target audience. Choosing the right topic is key to capturing their interest. The content should be made as beginner-friendly and accessible as needed to ensure that it meets the learner's level.

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There are, however, also several challenges associated with using VR in education. One key issue is the exclusion of non-VR users; not all learners are able to participate in VR-based activities due to factors such as motion sickness, visual impairments, or other limitations. Ensuring equal access for all learners is essential. Additionally, the high costs associated with acquiring VR equipment can be prohibitive, especially for educational institutions in low-income areas. Another challenge is the lack of didactic concepts; concrete instructional designs, and theoretical discussions on the use of VR in education are still limited in research literature.

6.4 Tools for VR Documentation Creation

In this course, we will be using LUMI software. LUMI is an educational software that offers a variety of content types primarily focused on creating interactive learning experiences. LUMI is highly recommended for the creation of online courses on a basic level of complexity. LUMI is used to visualise the H5P (HTML5 Package, an opensource tool that enables educators, designers, and content developers to create, share, and reuse interactive HTML5 content) content and is very well suited for getting started with content creation. Another advantage is that LUMI is basically free of charge.

Another option for creating a VR tour is the 3D Vista software tool. LUMI and 3D Vista offer different focuses and functions (see Table 6.1).

Table 6.1: An overview of the LUMI and 3D Vista software tools.

	LUMI	3D Vista
Availability	open-source https://lumi.education/en/	free trial version https://www.3dvista.com/en/products/virtualtour
Focus	interactive elements (quizzes, videos, presentations...)	specialised software for creating virtual 360° tours and interactive 3D tours
User-friendliness	<ul style="list-style-type: none"> - suitable for beginners - simple user interface - requires no programming knowledge 	<ul style="list-style-type: none"> - specialized software for 3D tours - extensive and complex user interface - guides and templates to help beginners
Possibilities	<ul style="list-style-type: none"> - no 3D content support - no complex tours - linear learning interactions (quizzes, text links, drag-and-drop tasks) - suitable for providing interactive e-learning materials 	<ul style="list-style-type: none"> - 3D tours - virtual 360° tours and interactive 3D tours - integration of 360-degree images, videos, hotspots, text fields and other interactive elements - suitable for creating highly detailed, immersive 3D VR tours

6.5 Didactic Planning

Didactic planning is a structured approach to designing educational experiences. Here are several key steps to guide you through the content creation process:

- define learning objectives by clearly identifying what learners should know or be able to do by the end of the VR tour
- use techniques like [storytelling](#) or [gamification](#) to make learning engaging and attractive
- plan the structure and layout of the tour (Fig. 6.1). Organize the learning experience by selecting relevant themes and settings that support the learning objectives
- ensure that the content is presented in a logical and coherent order to build understanding step by step.
- create a storyboard for complex tours (like a film script). For more intricate sessions, outline the goals, content, and elements such as visuals or interactive components to maintain clarity and focus. For a better

understanding of the outline, it is recommended to create a profile for each scene (see our template). This also provides structure and ensures a standardised procedure

- develop interactive content, crafting engaging materials like quizzes or simulations to encourage active participation and reinforce learning.

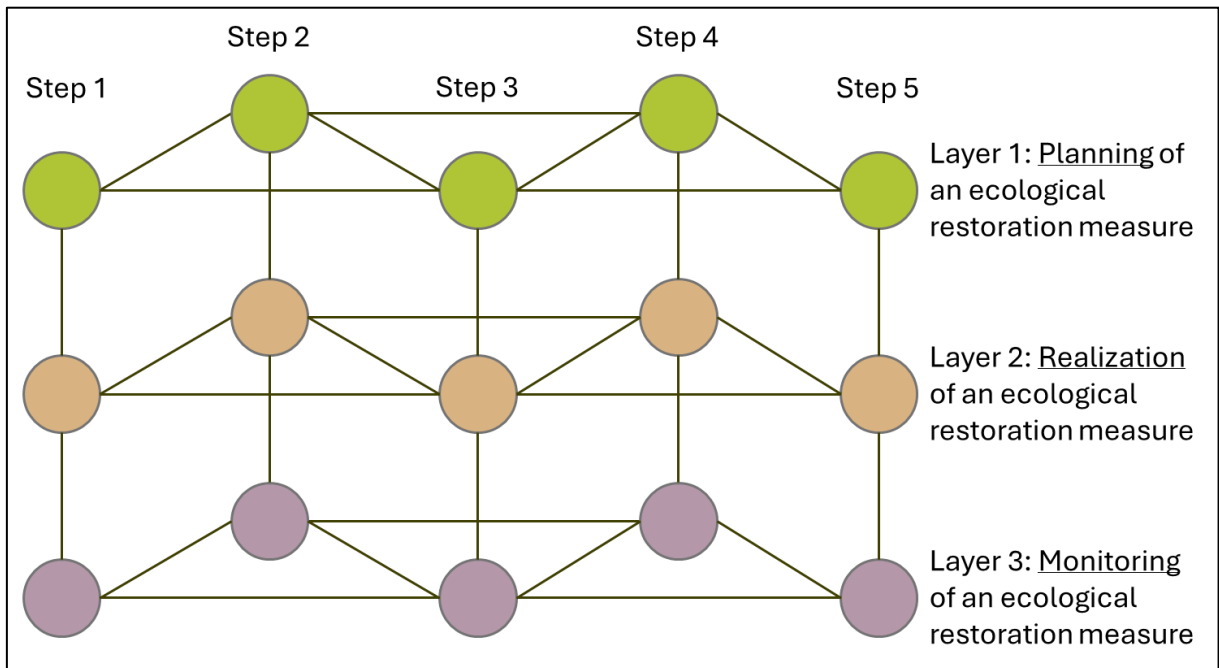


Fig. 6.1: An example of scene layout of a more complex virtual tour. The individual layers here show the phases of an ecological restoration project.

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6.6 Creating VR Tours in LUMI

As a first step in creating VR tours, it is recommended to create a profile for each scene. This provides structure for the whole VR tour and ensures a standardised procedure. You may utilize our template.

You can find the basic steps for the creation of your own VR tour in the

- (1) instructional video for creating interactive tours
- (2) handbook describing each step in more detail.