LIEPĀJAS VALSTS TEHNIKUMS

3D BEAR

WKO STEIERMARK

SKILLS DIVERS

UNIRI Sveučilište u Rijeci University of Rijeka



XRGREEN.CON

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1. Programme description and development approach

The online training programme was developed within the Erasmus+ project to provide educators with a structured introduction to the use of XR technologies in vocational education and training in the construction sector, particularly in connection with sustainable construction and green skills. The programme content was developed jointly with the involvement of all five project partners – Finland, Spain, Latvia, Croatia and Austria. The Spanish partner had a leading role in coordinating the content, and therefore had a broader involvement in the joint content development. After the common English version was prepared, the content was translated into all five partner languages – Latvian, German, Spanish, Croatian and Finnish.

The programme was structured into three modules, distinguishing between understanding the technologies, creating XR learning scenarios, and using XR in the actual educational process. The Curriculum document emphasises that this division is necessary to avoid content overlap and to ensure a coherent course structure across the partners. Module 1 is conceptual, Module 2 is more practical and focused on creating XR scenarios, while Module 3 focuses on implementation, facilitation and assessment in the learning process.

Module	Number of topics	Indicated duration	Main content
1. XR in Construction Education	6	6 h	XR fundamentals, AR, VR, MR, sustainability and XR pedagogy
2. Creating XR Learning Scenarios	10	20 h	Quality criteria, scenario design, GenAI, prototyping, ethics, documentation, 360° content, testing
3. Using XR in Education	4	4 h	Curriculum integration, technical management, lesson facilitation, assessment and reflection

Overall, the curriculum document contains 20 learning units. Module 1 covers the basics of XR technologies, the application of AR, VR and MR in construction, sustainability and XR, as well as XR pedagogy. Module 2 contains 10 topics, including XR quality criteria, AR and VR scenario design, the use of GenAI to improve workflows, storyboarding and prototyping, digital content ethics, collaborative scenario development, documentation standards, 360° content creation and coding, as well as testing and iterative improvement. Module 3 covers XR integration into the curriculum, technical management, lesson facilitation, and assessment/reflection.

An important principle in the programme development was to clearly distinguish the functions of the modules. Module 1 did not include detailed scenario

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creation or technical implementation in the classroom. Module 2 focused on scenario architecture, interaction, prototyping, testing and product creation rather than institutional implementation of the curriculum. Module 3, in turn, focuses on the educator's work in a real learning environment – curriculum integration, technical and logistical management, lesson facilitation and assessment of learners' performance.

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2. Organisation of the pilot

The developed online course was piloted by educators from Latvia and Croatia. A total of 12 educators were involved in the pilot, of whom 11 responded to the initial pilot survey questions, Ten educators piloted the online programme. The Moodle system allows us to track how many educators participated and which topics each of the participating educators explored. 8 submitted responses to the post-pilot questions, while two had prepared their comments on the pilot process. When analysing the submitted responses, it became clear that questions were also needed regarding the appropriateness of the online course duration. The questions were sent to all educators, but only five submitted responses.

The educators were divided into virtual groups. Each educator was given the opportunity to review at least eight of the 20 programme topics. Thus, during the pilot, all five common topics as well as three additional topics from different programme modules were tested. This approach made it possible to test the entire programme at the same time – the common programme sections that were particularly important to all partners, as well as specific topics from Modules 1, 2 and 3. However, two educators reviewed all programme topics.

The five common topics identified in the pilot feedback were: 1.1 XR Technology Fundamentals, 1.2 AR in Construction, 1.3 VR in Construction, 2.5 Storyboarding and Prototyping, and 3.1 XR Integration into the Curriculum. In addition, specific topics were reviewed, including 1.5 Sustainability and XR, 2.6 Digital Content Ethics, 2.7 Collaborative Development of XR Training Scenarios, and 3.2 XR Technical Management. One detailed response from a Latvian educator documents exactly these nine reviewed topics.

The aim of the pilot was not only to check whether the course content was understandable. The educators' responses made it possible to assess content clarity, navigation, the usefulness of learning materials and simulations, the course's relevance to vocational education in construction, technical difficulties, confidence gained in using XR, and readiness to use VR simulations in future work. A separate block of questions also assessed the overall workload and whether a duration of 30 hours was sufficient to cover the 20 topics.

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3. Educators' initial perceptions and needs

Prior to the piloting, 11 responses were received to the initial survey. In all 11 responses, participants indicated that they had not previously used VR technologies in the teaching and learning process. This indicates that the pilot group had very limited or no practical experience with VR in education. Therefore, the course was important not only for acquiring new knowledge but also for providing participants with their first structured introduction to the potential of XR technologies in education.

The average initial self-assessment of knowledge about using VR in education was 2.36 on a scale from 1 to 5. Responses ranged from 1 to 5, but the majority were in the 1–3 range. This indicates a relatively low initial level of knowledge. At the same time, confidence in the ability to integrate XR tasks into their lessons was higher, averaging 3.55 points. Thus, some educators were not yet familiar with the technology before the course, but were willing to learn and saw opportunities to use it in their work.

Several needs recurred in the initial responses. Educators wanted to gain practical skills in developing XR tasks, understand how to integrate the technology into their courses, obtain new ideas and examples, and better understand how the technology itself works. Several responses specifically mentioned the desire to learn practical methods and receive examples that could be used when working with learners. This is an important aspect when evaluating the pilot results, because the lack of practical experience later also emerged as the main area for improvement after the course.

Before the course, educators identified the availability of VR equipment, lack of computers and headsets, technical problems, the time required to learn the technology, and difficulties integrating VR into the existing curriculum as the main barriers. One response also mentioned the possibility that VR headsets could cause dizziness for students. Thus, the initial survey showed two main groups of needs: first, to understand and learn XR technology; second, to understand how to use it practically in a real learning environment with the available resources.

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4. Pilot results

4.1. Clarity and structure of the course content

After the pilot, 8 responses were received in the available final survey block. In all eight responses, content clarity and comprehensibility were rated at 3 points on the scale used. This is a consistent result and indicates that no significant problems with content comprehensibility were identified in the pilot group.

Educators' comments were also generally positive. They noted that the course is well structured, easy to follow, and makes it possible to see which topics have already been covered. One Latvian educator specifically highlighted that the progress circle shown on the left side of the platform helps track how much of the content has already been completed. This is a small but practically significant navigation element that supports self-directed learning.

At the same time, several editorial and technical content issues were identified. During the detailed review by the Latvian educator, a sentence beginning with a lowercase letter was noticed, as well as repeated text in Module 1.1. It was also noted that some of the module final tests contain open-ended questions for which there is no clear and objectively correct answer. This issue was specifically mentioned in Module 1.2, with the observation that the same problem also occurs in Modules 1.3, 1.6, and other final tests.

Some technical text formatting issues were also identified, such as terms being joined together within words or tables. In another educator's response, no significant errors were found, but a few anglicisms were noted, such as "XR continuum."Thus, in terms of content quality, no major errors were identified in the course, but an editorial review of all five language versions is required before publication of the final version. Particular attention should be paid to test questions requiring free-text answers. If the learning platform uses automatic assessment, the question should be formulated so that the expected answer is clear. If automatic assessment is not required, the question can remain open, but clear assessment criteria should then be provided.

4.2. Navigation and Presentation of Learning Materials

Ease of navigation was rated at an average of 2.88 points in the final survey; seven of the eight respondents gave 3 points, while one gave 2 points. This shows that use of the platform did not generally create significant barriers. No major navigation problems were mentioned in the open responses either.

Educators positively assessed different ways of presenting content – text, tables, images and interactive elements. It was noted that topics containing less text and more images were easier to understand. At the same time, one educator noted that the learning material window in the learning environment sometimes reduces the visible workspace; however, the educator associated this issue with limitations of the learning environment itself rather than with the quality of the developed material.

It was also suggested that selected topics be supplemented with short video clips, particularly those demonstrating how an XR learning process actually takes

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place rather than merely describing it. This is a logical next step because the pilot showed that educators need not only to read about the technology but also to see it being used in practice.

4.3. Simulations and Practical Component

One of the clearest findings from the pilot was the value of simulations and practical examples. Several educators indicated that simulations in particular helped make abstract concepts understandable. 360° scenarios, interactive elements, hotspots and VR simulations were mentioned. Educators noted that such examples make it easier to understand spatial perception, interaction and the possibilities of using XR in education.

At the same time, the lack of a practical component was the most frequently repeated suggestion for improvement. Several responses indicated that the course is predominantly theoretical and that educators would need an opportunity to try XR tools themselves and create a simple learning material or simulation. It was suggested that short practical tasks also be included in the tests, such as writing part of an XR scenario, selecting appropriate recording equipment, or planning a simple interactive activity.

This conclusion is particularly important in light of the initial survey results. Before the course, all respondents indicated that they had not used VR technologies in the learning process. Therefore, theoretical explanation alone is not sufficient to build confidence in one's ability to use the technology independently. The pilot showed that educators need the next step – guided practical experience.

4.4. Relevance to Vocational Education and the Construction Sector

The course's relevance to vocational education in the construction sector was rated at an average of 2.88 points in the final survey; seven of the eight respondents gave it 3, while one gave it 2. In the open responses, educators emphasised the possibilities of XR in construction training, sustainable construction, green skills, and also career and occupation awareness.

One response from an educator whose work is related to career counselling was particularly significant. The educator noted that the learning content helped to better understand current developments in green and digital construction, while XR simulations made it easier to see practical work situations and the competencies required in different occupations. This broadens the programme's potential application – XR content can be used not only for teaching vocational skills but also for informing young people about occupations and career opportunities.

4.5. Technical Difficulties

In the eight final survey responses to the question about technical or other difficulties, no significant technical problems were reported. This is a positive result, as the course was completed independently in an online environment. At the same time, several comments distinguished problems with using the platform from difficulties in learning the XR technology itself.

Educators who reported difficulties focused more on the technical side of XR development, choosing the right tools, and creating interaction. Thus, after the course, the main barrier was no longer the course platform but the next level of practical competence – how to create and implement XR learning material independently.

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4.6. Confidence in Using XR After the Course

In the final survey, self-assessed confidence in using VR tools in teaching subjects was at the level of 2 or 3 points: four educators gave 2 points and four gave 3 points. The average result was 2.5. This indicator cannot be directly compared with the initial survey average of 3.55 because the initial survey used a 1–5 scale, whereas the available post-pilot responses use a 1–3 scale. Therefore, no conclusion can be drawn about a statistical increase or decrease in confidence.

However, the qualitative responses allow a practical conclusion to be drawn. After the course, educators were more often able to describe how XR can be used, how an XR scenario is developed, and how the technology can be linked to learning objectives. Several indicated that they now understand the process of creating XR simulations, but that practical experience is still needed. Thus, the course has provided a foundation and orientation, but it does not yet give all educators the readiness to create XR material independently.

4.7. Readiness to Use VR in the Future

When asked whether they would use VR simulations in their teaching in the future, six of the eight respondents answered “Yes”, while two answered “Maybe”. No one answered “No”. This is a significant result: despite the lack of practical experience, all respondents remained open to using VR in the future after the course.

In the open responses, readiness to use the technology was linked to practical examples, scenarios, and the possibility of connecting XR with existing learning content. This indicates that the main outcome of the course is not only providing knowledge about XR, but also building educators’ interest and readiness to continue working with the technology.

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5. Evaluation of course workload and duration

In the separate question block on course workload, 5 responses were received. Two educators considered the 30-hour workload too small, two considered it appropriate, and one considered it too large. When asked whether 30 hours were sufficient to understand the 20 topics, two answered “Insufficient”, one “Mostly insufficient”, one “Mostly sufficient”, and one “Yes, completely sufficient”. Thus, the majority of this group of five respondents considered 30 hours to be borderline or insufficient.

Four of the five respondents recommended more than 30 hours for the course in the future, while one recommended approximately 30 hours. Educators specifically indicated that more time was needed for content creation topics, including 2.5 – writing XR module scenarios, shot planning and prototyping. One respondent explained that more time would be needed for almost all topics because they read the learning material slowly and sometimes answered the questions repeatedly.

Taking into account the teachers’ recommendations, the required learning time for the topic was increased from the initially planned 30 hours to 60 hours, which is equivalent to 2 ECVET points.

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6. Main improvements identified

The pilot results show that the basic structure of the course is functional and the content is understandable, but several specific improvements are needed before the final version is used.

Improvement	Recommended action
1. Editorial review	Carry out a final proofreading of all 20 topics and all five language versions. Check for typographical errors, capitalisation, repeated text, terminology consistency and individual Anglicisms.
2. Review of final tests	Rephrase open questions that do not have an unambiguous correct answer. If a question requires a free-text answer, clear assessment criteria should be provided.
3. More practical tasks	Add short practical tasks after the theoretical section. This is particularly important for scenario design, prototyping and technical XR creation topics.
4. Practical XR trial	If project resources allow, provide at least one guided practical activity in which the educator tries an XR tool or creates a simple XR learning element.
5. More visual content	In topics where the text is dense, increase the use of images, diagrams and short videos. Pilot responses show that visual materials help with understanding the content.
6. Video demonstrations	Include short, high-quality videos showing XR use in a real learning process, rather than merely explaining the technology.
7. Scenario examples	Supplement the theory with ready-made examples showing how to move from a learning objective to an XR scenario, interaction and assessment.
8. Clarification of time allocation	Review the time allocated to topics requiring a greater individual workload, especially scenario writing, shot planning and prototyping.
9. Documentation of course duration	Align the course duration stated in the curriculum document and the pilot survey, and clearly distinguish learning-content hours from independent-work hours if such a division is intended.
10. Terminology harmonisation	Before final publication, check terminology in all five languages to eliminate unnecessary Anglicisms and inconsistent translations of the same concepts.

Overall, the pilot confirmed that the developed online programme can be used for educators' professional development in the field of XR technologies. The programme structure is clear, the topics are arranged in a logical sequence, and the course content is linked to vocational education in construction, sustainability and

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green skills. Educators positively assessed the simulations, practical examples, visual materials, and the opportunity to explore XR applications in different educational contexts.

At the same time, the pilot showed that the quality of theoretical content alone is not sufficient for educators to feel ready to independently develop XR learning material. The main next direction for development is the practical component. Educators want not only to understand what XR is and how it can be used, but also to try the tools themselves, create a simple scenario, test interaction, and see how an XR lesson takes place in a real learning situation.

An important achievement is that after the course none of the eight final survey respondents answered that they would not use VR simulations in the future. Six educators clearly indicated “Yes”, while two selected “Maybe”. This demonstrates a positive attitude towards future use of the technology. At the same time, confidence in independent use is not yet consistently high, so the next stage should focus on strengthening practical skills.

The content errors identified during the pilot are minor and can mostly be corrected during editorial review. The most important improvements concern clarifying test questions, increasing practical activities, using more visual content, and reviewing the allocation of time. These improvements do not change the basic structure of the programme but make it more suitable for educators who are new to XR technology.

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7. Note on the data basis

1. The online course content was developed jointly by five partners – Finland, Spain, Latvia, Croatia and Austria – and after the English version was created, it was prepared in the five partner languages. The Spanish partner had a leading role in coordinating the content.

2. The programme consists of 20 learning units in three modules. The modules are divided by function: understanding XR technologies and their significance, creating XR learning scenarios, and implementing and evaluating XR in a real educational environment.

3. Ten educators from Latvia and Croatia were involved in the course pilot. Each educator reviewed at least eight of the 20 topics, covering five common topics and three topics from different modules.

4. In the initial survey, 11 respondents indicated that they had not previously used VR technologies in the learning process. This confirms that the target audience needed an introductory course combining an explanation of the technology with examples of practical use.

5. After the pilot, the course content was generally assessed as clear and understandable. In the eight final survey responses, content clarity was rated at 3 points on the scale used. Navigation and use of the materials were rated highly, and no significant technical problems were identified.

6. The most valuable parts of the course for educators were the simulations, practical examples, and the opportunity to see XR used in education. At the same time, the most frequently mentioned improvement was to increase practical activities.

7. Six of the eight final survey respondents indicated that they would use VR simulations in the learning process in the future, while two selected “Maybe”. No respondent gave a negative answer.

8. The pilot showed that the next version of the programme needs more practical tasks, videos and visual examples, as well as more precise final tests. Particular attention should be paid to scenario writing, prototyping and the technical creation of XR materials.

9. Overall, the pilot results confirm that the programme achieves its initial objective – to provide educators with a structured understanding of XR technologies and their use in vocational education. To move from understanding to independent use, the practical component needs to be strengthened.

10. Before using the final version within the project, it is recommended to carry out a final editorial and terminology review of all five language versions, review the test questions, and reconcile the total number of course hours stated in the documentation.

In this analysis, the quantitative results were calculated from the available survey responses: 11 initial survey responses, 10 post-pilot course evaluation responses, and 5 responses concerning course workload and duration. The total

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number of educators involved in the pilot was 10; in addition to the 8 electronic survey responses, the analysis used two separately submitted detailed educator feedback responses. Therefore, the participation of 10 educators and the 8 quantitatively processed final survey responses are not conflated.

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