FROM FIRST CONCEPTS TO INDEPENDENT PROJECTS: BUILDING THE AI-VET LEARNING JOURNEY

Artificial Intelligence is often introduced through isolated concepts, demonstrations or ready-made applications. When the AI-VET partnership began developing its training programme, however, the objective was more ambitious: to create a complete learning journey through which VET teachers and students could progress from understanding what AI is to designing and implementing their own intelligent solutions.

This required more than selecting a list of interesting topics. The partnership had to consider the complete process behind a real AI project: understanding the problem, working with hardware, collecting and preparing data, developing and evaluating a model, connecting devices, considering ethical implications and, finally, applying the resulting solution in a meaningful vocational or educational context. The programme was therefore developed as a structured pathway rather than a collection of independent modules. Each stage was designed to provide the knowledge and practical abilities required for the following one, allowing beginners to enter the course gradually while giving more experienced learners opportunities to explore the subjects in greater depth.

A PROGRAMME SHAPED BY COMPLEMENTARY EXPERTISE

The development process brought together eight organisations from seven European countries: Kaunas University of Technology, the European Vocational Training Association, Instituto Politécnico do Porto, Politeknika Ikastegia Txorierri, Sucessos Criativos, DDE B Athinas, Darica İlçe Millî Eğitim Müdürlüğü and Sredno Elektrotehnicko Uciliste na Grad Skopje Mihajlo Pupin.



This diversity was one of the programme's greatest strengths. University partners contributed scientific knowledge in Artificial Intelligence, Machine Learning, Computer Vision, model evaluation and responsible AI. Technology specialists transformed these concepts into practical activities involving microprocessors, cameras, sensors, actuators and online learning environments. VET schools and educational authorities contributed their direct understanding of learners, classrooms, curricula and the practical realities of vocational education. EVTA helped connect the programme with the broader European VET community and its emerging digital and green skills needs.

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The original division of responsibilities reflected this complementarity. Kaunas University of Technology contributed to the foundations of AI, introductory Computer Vision, image processing and real-world applications. Instituto Politécnico do Porto supported the Machine Learning, ethical and legal dimensions. Sucessos Criativos contributed its experience with microprocessors, sensors, environmental applications, the AI-VET Kit and the online platform. The VET institutions reviewed the work through the perspective of teachers and learners, while all partners contributed to validation, adaptation and translation.

LEARNING HOW REAL PROJECTS ARE DEVELOPED

Before moving into advanced AI, learners are introduced to project development and version control. Git, GitHub, collaborative workflows and Google Colab may initially appear secondary to Artificial Intelligence, but they represent an essential part of real technological work.

An AI solution rarely emerges from one uninterrupted piece of code. Projects evolve through experimentation, corrections, new datasets and contributions from different people. Version control helps learners document these changes, protect their work, collaborate with others and return to previous versions when something goes wrong. Introducing these skills early means that learners can apply professional working practices throughout the more advanced modules.

The course then enters Computer Vision, beginning with the representation and preparation of images. Learners explore classification, object detection and segmentation, while also studying preprocessing, augmentation, dataset organisation and model-evaluation metrics. This creates the bridge between understanding images as digital data and using them to train reliable AI systems.

Deep Learning follows naturally. Learners examine neural networks, convolutional architectures, activation functions, training methods and challenges such as overfitting or poor generalisation. Accuracy is not presented as the only measure of success. Precision, recall, F1-score, confusion matrices, IoU and other metrics help learners understand whether a model is genuinely useful and where it may be failing.

BUILDING RESPONSIBLE SOLUTIONS

Ethics, fairness and responsibility were not placed at the end of the programme as an optional discussion. They were integrated before learners began developing more advanced applications.

The dedicated module on bias and fairness examines how problems can enter an AI system through data, algorithms or human decisions. Learners consider transparency, accountability, the consequences of biased systems, the protection of fundamental rights and the principles behind European AI regulation.

This position within the learning journey is intentional. Before learners create systems that classify images, detect people or automate decisions, they should be able to ask whether those systems are fair, proportionate, explainable and appropriate for their intended context.

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FROM GUIDED EXERCISES TO INCREASINGLY INDEPENDENT WORK

The following modules allow learners to apply their knowledge at different levels of complexity.
Using **MobileNet**, they begin with a lightweight pre-trained image-classification model. Beginners can learn how to run an existing model and interpret its output. More advanced learners can prepare a custom dataset, use data augmentation, apply transfer learning, train a classifier and evaluate its performance before deploying it on a Raspberry Pi.

The **YOLO object-detection module** goes one step further. Instead of identifying only what an image contains, learners develop systems capable of locating objects within it. They can begin by using existing classes and later annotate their own datasets, train custom models, adjust confidence thresholds and deploy real-time detection systems.

Finally, the AI-IoT integration module connects these capabilities with the physical world. Through MQTT, a Raspberry Pi and an ESP32 can exchange information locally or through cloud services. A camera may detect a person, object or environmental condition and send a message that activates an LED, motor, display or another connected device.

At this stage, the separate subjects become one complete system:

- Obseve
- Interpret
- Communicate
- Respond

This is where the progression of the course becomes particularly valuable for VET learners. A student may start with a simple LED and finish by building a camera-based monitoring system, an intelligent environmental solution, an automated industrial prototype or a connected device that responds to real-time data.

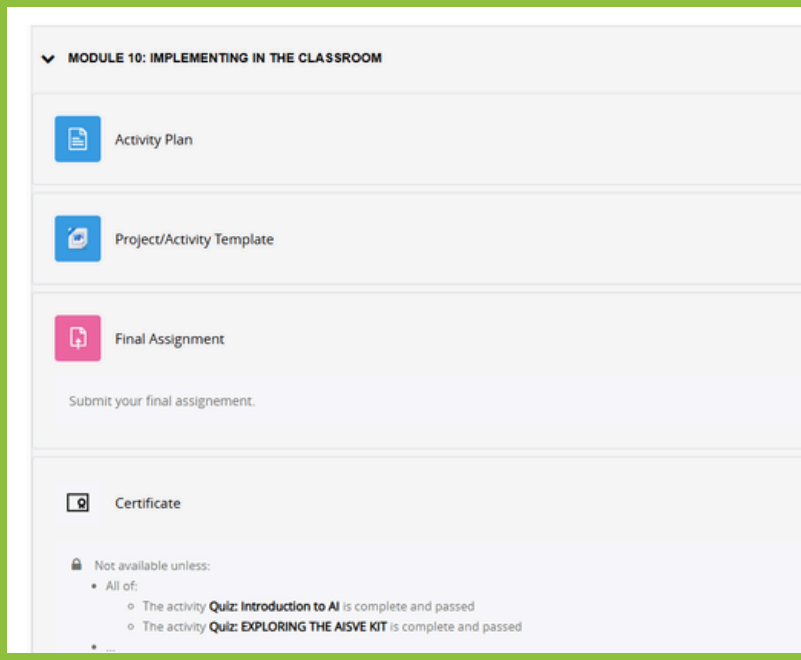
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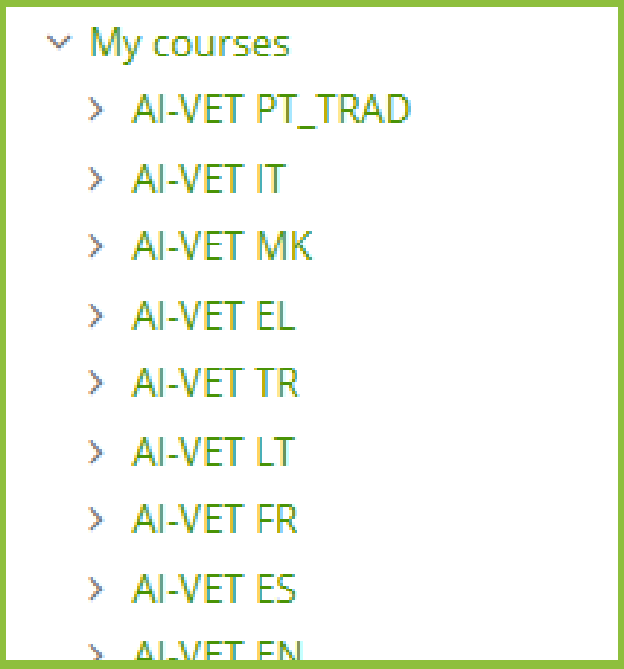
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ACCESSIBLE ACROSS THE PARTNERSHIP

To ensure that language would not become a barrier, the course was prepared in English and translated into the languages represented across the partnership. This multilingual approach allows teachers and learners to engage with complex technological subjects in a language that is more familiar to them, while maintaining a shared European programme structure. The project had planned the MOOC precisely as a flexible and interactive learning experience available in English and across the partner languages.









With the structure, practical resources, quizzes, translated versions, final assignment and certification pathway in place, the programme was ready to move from development to validation.

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