Learning scenarios

WP D 2.2

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DALI4US DATA LITERACY FOR UPPER PRIMARY SCHOOLS

Work Package 2:

Conceptual design and

teaching/training resources

Deliverable D2.2

Learning scenarios

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ABSTRACT	
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Dissemination level		
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1. Introduction

Based on the framework on data literacy (D2.1) and the national upper primary curricula, learning scenarios are derived in each partner country. These scenarios outline the key topics or themes as well as the essential learning outcomes. They are shared and discussed between partners in order to build a broad repository for the development of corresponding teaching and learning materials.

This deliverable outlines the conceptualisation, development, and implementation of Learning Resources within the DALI4US project. These resources are designed to complement the Teaching and Learning Resources (Deliverable 2.4) and to operationalise the project vision as described in the Application Form. The Learning Scenarios are a central element of the project's ecosystem, offering teachers and students practical, flexible, and engaging pathways to develop data literacy. They reflect the project's guiding principles: co-creation between educators and data scientists, prioritisation of unplugged activities to ensure accessibility, and grounding in authentic, real-world contexts that connect directly to students' lived experiences.

2. Design priniciples

The design of the learning scenarios is grounded in a set of pedagogical and practical principles that ensure both coherence and flexibility. The aim is to make data literacy tangible, engaging, and accessible for upper primary students, while giving teachers the confidence and tools to adapt the activities to their own classroom contexts.

Each scenario follows a common template with well-defined components:

Context and Trigger

Every scenario begins with a short, relatable context. This could be a playful question, a story, or an everyday phenomenon such as favourite foods, sports, popular music, or the distribution of surnames. By anchoring the activity in students' lifeworlds, curiosity is sparked, and the abstract idea of "data" is immediately connected to something meaningful.

Learning Objectives and Outcomes

The scenarios explicitly outline their objectives, aligned both with the DALI4US Data Literacy Framework and national curricula. They are formulated not only in terms of technical knowledge (e.g. recognising clusters, interpreting graphs) but also transversal competences such as collaboration, communication, problem-solving, and ethical awareness. This dual focus ensures that students are developing both cognitive skills and responsible habits of mind.

Unplugged Activities

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As a first step, scenarios include playful, hands-on activities that introduce the core data concept without using digital devices. Examples include card-sorting to represent clustering, role-play to mimic classification, or creating timelines on paper to understand sequences. These activities reduce barriers to entry, prevent technical distractions, and allow children to grasp the essence of a concept in an intuitive and tactile way.

Digital Extension

After building understanding in an unplugged format, scenarios transition to OrangeEDU workflows. These extensions introduce students to simplified datasets and visual workflows, enabling them to experiment with clustering, classification, or recommender systems in a way that is accessible but still authentic. Teachers may choose from pre-prepared datasets or co-create new ones with their class, reinforcing student ownership and relevance.

Differentiation and Inclusion

The scenarios are designed to be adaptable for different learner profiles. For beginners or classes with limited resources, simplified unplugged versions are available. For more advanced groups, extensions with larger datasets or complex patterns are suggested. This scaffolding ensures that all students, regardless of prior knowledge or classroom context, can meaningfully engage with data literacy.

Reflection and Ethical Dimension

A central element of each scenario is the opportunity for reflection. Prompts guide students to consider not only what the data shows but also issues of fairness, bias, privacy, and responsible use. Activities such as group discussions move learning beyond technical application toward critical engagement with data as a social phenomenon.

Teacher Guidance

To support teachers, each scenario comes with extended information: background explanations of the concepts, anticipated challenges and common misconceptions, practical tips for classroom management, and options for adaptation. These notes help teachers feel confident when implementing the activities and support their own professional growth in data literacy.

Together, these principles ensure that every scenario is child-friendly, curriculum-relevant, and adaptable, forming a strong backbone for introducing data literacy in diverse upper primary classrooms.

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3. Structure of the Learning Resources

Beyond individual scenarios, the project provides a comprehensive package of Learning Resources. These are designed to build capacity among teachers, offer ready-to-use classroom activities, and ensure the sustainability of data literacy education beyond the project's lifetime.

The structure of the resources includes:

Introductory Modules

These modules act as entry points for teachers. They explain the importance of data literacy in the digital age, introduce the DALI4US framework, and give a clear overview of how the different concepts (clustering, classification, recommender systems) can be approached in age-appropriate ways. They also situate the project within broader European digital education initiatives, helping teachers see the bigger picture.

Scenario Repository

A central component of the resources is a growing collection of unplugged-first scenarios co-created by teachers and data scientists. Each scenario follows the design principles above and is presented in a consistent template for easy classroom adoption. The repository functions as a living library where teachers can access, adapt, and share resources across partner countries.

Digital Assets

To complement unplugged learning, the resources include downloadable OrangeEDU workflows and curated datasets. Teachers can immediately use these in class or modify them to suit local contexts. Guidance is provided on how to collect class-specific data, enabling students to see their own experiences reflected in the analysis.

Cross-curricular Pathways

The resources explicitly point out how data literacy can be embedded across subjects. For example:

- Mathematics: visualising distributions, interpreting graphs, or calculating probabilities.
- Language: analysing word frequencies or storytelling with data.
- Geography: clustering regions based on local data (e.g., surnames, weather).
- Science: classifying plants, animals, or environmental observations.
- Arts: exploring patterns in artworks or music.

This cross-curricular design underscores that data literacy is not an isolated subject but a transversal competence.

Extended Teacher Resources

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Beyond classroom materials, the package provides professional development tools: detailed teacher notes, reflective questions, examples of classroom adaptations, and links to further reading. These resources are designed to support teachers' long-term confidence and to foster a professional community of practice.

By combining these layers—introductory orientation, scenario-based activities, digital extensions, cross-curricular pathways, and extended teacher support—the Learning Resources form a complete ecosystem. They allow for flexible entry points, cater to different teaching styles and school contexts, and ensure that data literacy can be sustainably integrated into upper primary education across Europe.

a. Examples of Learning Scenarios

The DALI4US Teachers' Workshops took place at each of the three partner locations (Slovenia, Luxemburg, Dublin) between 31st January and February,

- Slovenia - 31st January 2025
- Luxembourg - 4th February 2025
- Ireland - 5th February 2025

Each workshop was a full day, facilitated by Blaz Zupan and Janez Demsar (University of Ljubljana). Evaluative data was collected (pre and post workshop survey / focus group interviews after the workshop) at each location.

In Črnomelj (Slovenia), the topic of the workshop was Recommender systems (favourite musicians). Recommender systems was also the focus in Luxembourg using sitcoms rather than favourite musicians, while in Dublin, the topic was Prediction models (gnomes and quadrilaterals) as the teachers had already worked on recommender systems with sitcoms in the previous workshop.

Outlined below is an overview of the content and concepts focused on during each of the workshops.

- **Recommender systems**

We encounter recommender systems everywhere. Adults may experience them while using online stores, for example, while students might first come across them on video platforms like YouTube and TikTok. In this activity, participants learn how such systems work as they have to choose their favourite cartoons, TV series or musicians. Discussions also focus on how these systems – not just those for recommending videos but also the ones that recommend news and social media posts – trap us in filter bubbles, showing us only what we already know and like. While many will associate this type of activity primarily with computer science and informatics, it connects with mathematics as students are essentially looking for intersections of sets. Further mathematical connections can be explored such as unions and even division with decimals. In addition, graphs are drawn which are similar to sociograms; while these may not

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be a part of the elementary school curriculum, they essentially represent relationships and are foundational to many mathematical topics.

This activity can also be linked to other subjects such as literacy if, instead of cartoons or musicians, students choose other items, such as their favourite books.

Link to the scenario: https://pumice.si/en/cartoons/ - in the workshop, only the unplugged part was completed (Recommendation System in the Classroom)

- **Prediction models (Gnomes):**

The lesson introduces the workings of a simple machine learning algorithm and model – a classification tree. This activity is probably most closely associated with Mathematics, Science, Computer Science and Informatics curricula.

Firstly, participants discuss and decide on rules to determine the professions of gnomes based on their appearance. Then, they formally write up the rules. Next, participants through discussion are guided toward the idea of a classification tree. This is done by selecting one of the images without showing it to the participants. Their task is to determine the gnome's profession by asking questions about its characteristics. Once their questioning process becomes "consolidated" and follows a clear pattern, participants are asked if they could create a "recipe" for determining a profession — essentially, a set of instructions for asking questions. The final result of this process will be the drawing of a classification tree – i.e. from the set of gnome images, they have extracted a general pattern, a rule. The algorithm can be demonstrated physically by observing and sorting cards with gnomes into subgroups.

Such procedures have been used in the past, for example in medicine, to predict the success of operations, to determine diseases, the effectiveness of drugs etc. Today, we use similar models, but they can do even more, and are therefore much more complex, requiring more data and better computers.

Link to the scenario: https://pumice.si/en/gnomes/ - in the workshop, just the unplugged part was completed (Recommendation System in the Classroom). This activity can also serve as preparation for another activity on prediction models – Identifying Quadrilaterals.

- **Prediction models (Quadrilaterals):**

This activity is directly linked to mathematics as participants review how to recognise different types of quadrilaterals and their properties. From the perspective of AI, the focus is on data collection and representing it in a table. Students are introduced to machine learning, including how to build and use a classification tree – either on paper and/or with a computer. Along the way, they discover that a model built from (partially) incorrect data is usually (partially) inaccurate. There are different ways to organise and manage this lesson.

- Participants can review the properties and names of quadrilaterals by identifying and recording them on cards. Depending on the objectives of the lesson this identification and recording step

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can be skipped, and participants are given cards where the properties are already filled out [this was the process adopted at the Dublin workshop].
- Participants manually construct a classification tree for identifying quadrilaterals by arranging cards on the table and drawing the tree using masking tape, adding decision criteria at its nodes.
- Participants then use the tree to identify new quadrilaterals.

Before manually constructing a classification tree, participants should of course first understand what classification trees look like. The easiest way to do this is by first conducting a lesson about classification of gnomes or the animal tree.

To wrap up the activity, participants engaged in a discussion focused on the use of prediction models in everyday life. In medicine, for instance, the computer is shown many people with different symptoms and told which diseases these people have; in this way, it learns to identify diseases based on symptoms, just like it learned to identify different types of quadrilaterals based on their properties.

Participants were then shown how this activity could be extended by exploring whether a computer could also construct such a tree - and how it would do so. Students can collect the data themselves, or we can use pre-prepared datasets.

- Students enter data about quadrilaterals using tablets or computers. The website collects all students' responses.
- The data is imported into Orange and the tree constructed
- The tree the computer constructed is then check by manually verifying whether it aligns with the known properties of quadrilaterals and by testing whether it correctly classifies test quadrilaterals.
- With the right widgets in the Orange environment, the mistakes made by students can be analysed.
- Finally, how the computer uses the model to identify new quadrilaterals is tested.

Link to the scenario: https://pumice.si/en/quadrilaterals/

4. Added Value

By blending the expertise of data scientists and pedagogues, the Learning Scenarios provide a distinctive added value. They move beyond abstract concepts and make data literacy tangible for upper primary students. The unplugged-first approach ensures equity of access, while digital extensions offer authentic practice with modern tools. The focus on real-life contexts ensures that students see data literacy not as an isolated skill, but as part of their everyday decision-making and inquiry.

5. Implications for the Project

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The Learning Scenarios reinforce the project's ambition to deliver a comprehensive data literacy package. They support:

- Teacher professionalisation by providing concrete examples and ready-to-use classroom material.
- Student engagement through age-appropriate, relevant, and motivating tasks.
- Sustainability by aligning resources with curriculum requirements and embedding them in the GAIRDÍN platform.
- Scalability and transferability as the resources are open, adaptable, and usable across different countries and educational contexts.

6. Next Steps

In the upcoming large-scale experimentation phase, these resources will be extensively tested with teachers across partner countries. Feedback will focus on:

- Effectiveness of unplugged-first strategies.
- Integration of real-life datasets into the curriculum.
- Usability of digital extensions and OrangeEDU workflows.
- Teacher confidence in adapting and expanding resources.

The outcomes of this testing will inform refinements and ensure that the Learning Resources are robust, engaging, and sustainable beyond the project's lifetime.

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