QUANTUM
THE HEALTH DATA QUALITY LABEL

D4.3 Online training courses and workshops for different stakeholder groups

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QUANTUM summary	QUANTUM aims at developing and implementing a label mechanism that could be ideally adopted in the future HealthData@EU. QUANTUM builds on 5 technical work packages (WP). WP1 conceptualises and provides technical specifications for a data quality, utility, and maturity label. WP2 designs and tests, at small-scale, the label. WP3 implements the labelling mechanism in a number of data holders. WP4 engages the data quality users' community; and, WP5 outreaches other interested parties, including other initiatives building HealthData@EU.
Deliverable abstract	This deliverable provides a comprehensive overview of the development and structure of the QUANTUM Academy curriculum. It outlines the curriculum design, the validation process used to ensure the quality and relevance of the course content, and the practical steps for accessing and navigating the learning platform. In addition, the document describes the overall course composition.
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21	CESSDA ERIC	CESSDA ERIC	NO
21.1	KNAW	KONINKLIJKE NEDERLANDSE AKADEMIE VAN WETENSCHAPPEN - KNAW	NL
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QUANTUM
THE HEALTH DATA QUALITY LABEL

Developing a data quality and utility label for the European Health Data Space.

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List of Abbreviations and Acronyms	
CSA	Coordination and Support Action
EHDS	European Health Data Space
FFP	Fit-for-purpose
FFU	Fit-for-use
HADEA	European Health and Digital Executive Agency
HDAB	Health Data Access Bodies
MC	Multiple Choice

1. Introduction

1.1. Scope and objective of Deliverable 4.3

The scope of this deliverable includes integrating the feedback on user experience and pedagogical design gathered and reported in Milestones 4.3 and 4.4. During Milestone 4.3, feedback primarily addressed the content of Modules 1 and 2, while Module 3 was still under development. This input informed a thorough revision, with particular emphasis on enhancing the overall learning experience.

Between Milestones 4.3 and 4.4, the content for Module 3 was completed. In Milestone 4.4, the visual and pedagogical design of Modules 1 and 2 was reviewed, and the content of Module 3 was validated. The feedback collected at this stage has been incorporated into the revised versions of all three modules. In addition, Module 3 was further refined to ensure alignment with the enhanced learning experience established for Modules 1 and 2.

As a result of this iterative process, all three modules are now completed and fully aligned with the feedback received across Milestones 4.3 and 4.4, ensuring a coherent learning experience that combines strong pedagogical design with valuable, high-quality content.

2. The QUANTUM Academy

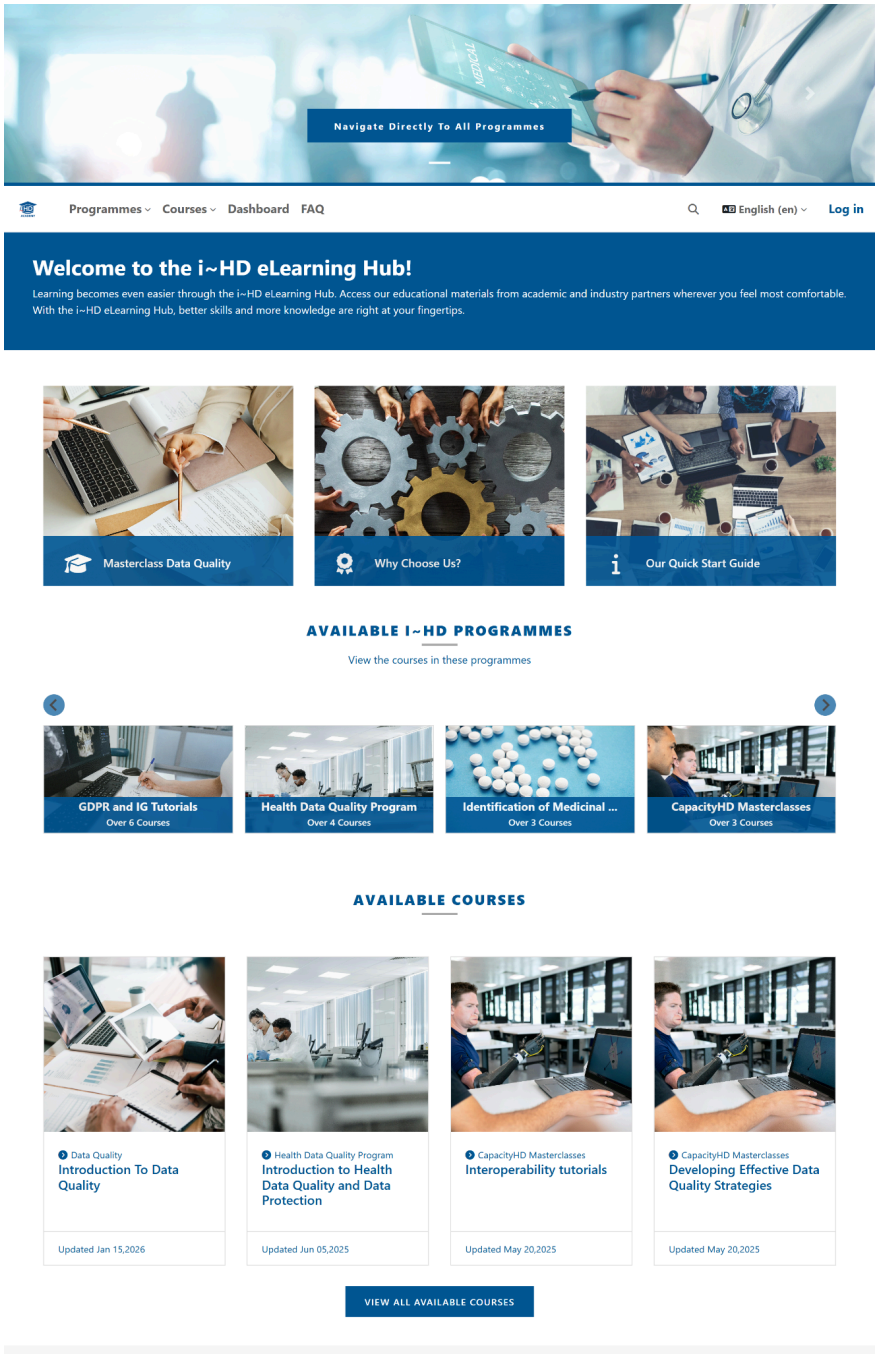
2.1. Accessing the QUANTUM Academy

The i~HD Academy's online learning environment (https://academy.i-hd.eu/) serves as the access point for QUANTUM Academy training materials, as described in Deliverables 4.1 and 4.2. Built on the Moodle learning management system, the platform enables a variety of interactive learning activities, including quizzes, discussion forums, and practical exercises.

Registration is open to all interested users. Once an account is created and activated, learners can self-enroll in the QUANTUM curriculum, and select the modules they wish to complete. The courses remain continuously accessible, allowing participants to engage with the material at any time and across devices, including laptops, desktop computers, and mobile phones.

This setup ensures that users can easily register, enrol, and interact with the QUANTUM Academy training resources directly through the platform.

Image 1. Screenshot of i~HD Academy's homepage



2.2. Curriculum overview

As defined in Deliverable 4.1, the QUANTUM Academy is structured into three core modules, comprising eight courses in total. Table 1 provides an overview of the current structure.

Table 1. Overview of the curriculum in QUANTUM Academy.

QUANTUM curriculum			
Module		**Course**	
1	Introduction	**1.1**	Introduction to Health Data Quality, Utility and Maturity
2	Data Quality Components in QUANTUM	**2.1**	Specifications of the Quality and Utility Label
		2.2	Data Holders' Maturity Model
		2.3	Fit for Purpose
3	Understanding of the label	**3.1**	Tools and Methodologies
		3.2	Design and Development of the Label
		3.3	Implement and Interpreting the Label
		3.4	Interaction with the QUANTUM Label

The curriculum targets 3 different groups of stakeholders: Data Users, Data Holders and HDABs. Although these groups have different responsibilities, the curriculum was designed to be broadly applicable. The aim was to support all stakeholders involved in data quality labelling, while recognising that not everyone needs the same depth of information. This inclusive approach is reflected in the stakeholder overview presented in Table 2. This table has been revised since it was last referenced in Deliverables 4.1 and 4.2. For Module 3, both 'Implementing and Interpreting the Label' and 'Interaction with the Label' have shifted focus from HDAB and Data Holder to Data User, a decision driven by the recognition that supporting data users in understanding and interpreting the label was needed.

Table 2. The relevance of each course to the specific stakeholder group. The amount of x's indicate the applicability or degree of benefit to each stakeholder group - the most x's representing the highest relevance. These relevance levels were defined based on the stakeholder needs assessment and analysis conducted in Deliverable 4.1.

QUANTUM curriculum				
	Chapter	**HDAB**	**Data holders**	**Data users**
Module 1	Introduction	xxx	xxx	xxx
Module 2	Specifications of the Quality and Utility Label	xxx	xxx	xxx
	Data Holders' Maturity Model	xx	xxx	x
	Fit-for-Purpose	x	xx	xxx
Module 3	Tools and Methodologies	xx	xxx	x
	Design and Development of the Label	xx	xxx	x
	Implementing and Interpreting the Label	xx	xxx	x
	Interaction with the QUANTUM Label	xx	x	xxx

2.3. User experience in the curriculum

The revisions following Milestones 4.3 and 4.4 focused on enhancing both the clarity and engagement of the learning materials. The original presentation-based videos were reworked into a more dynamic format, creating a more accessible and varied learning pathway. Feedback from Milestone 4.4 informed further refinements, including improving the readability of figures and slides and updating the AI-generated narration to ensure a smoother, more user-friendly experience.

Building on these improvements, significant attention was devoted to strengthening the overall learning experience and ensuring that the Academy delivers content in a clear, engaging, and pedagogically sound way. The platform has been designed to guide learners intuitively through the curriculum, with clearly structured sections, consistent navigation elements, and a layout that supports both linear progression and selective exploration. A table of contents remains

visible throughout the learning materials, enabling learners to move easily between chapters and revisit specific topics without losing their place.

To support different learning preferences, the curriculum incorporates a wide variety of content formats. Videos are complemented by explanatory text, visuals, diagrams, and interactive elements such as collapsible sections and embedded questions. This multimodal approach helps maintain engagement while also making complex information more digestible. Each chapter opens with a clear introduction and focus statement and concludes with a concise summary to reinforce key messages and support retention.

Learner readiness and self-reflection are supported through a pre-check quiz at the start of the curriculum, enabling learners to gauge their prior knowledge and identify areas requiring attention. Throughout the modules, short knowledge-check questions are integrated directly into the content to prompt active engagement and reinforce understanding in real time. At the end of the programme, a comprehensive quiz allows learners to consolidate what they have learned and verify their knowledge of the core concepts.

To support learners throughout this process, completion tracking is enabled across the curriculum, allowing learners to easily monitor their own progress and clearly see which activities they have completed and which still require attention. This provides learners with a transparent and self-directed learning experience, reducing the risk of accidentally skipping required content.

Taken together, these design choices reflect a deliberate effort to create a learning environment that is structured, engaging, and supportive. The Academy is not only a repository of information but a carefully crafted learning experience that accommodates diverse needs, encourages active participation, and provides learners with the tools and guidance necessary to navigate the curriculum with confidence.

2.4. Curriculum structure

The QUANTUM curriculum is organised into clearly defined sections, ensuring a structured progression through the modules and providing learners with a transparent overview of the full programme.

Section 1: Curriculum structure - Learning objectives - Pre-check quiz

The first section provides an overview of the curriculum structure and outlines the learning objectives for each chapter across all modules. This allows learners to develop a clear understanding of the purpose and expected outcomes of every part of the programme before engaging with the content. Furthermore, by presenting this information upfront, learners are better equipped to identify which modules are most relevant to their role, enabling them to prioritise accordingly and engage with the content most relevant to their needs. This targeted approach makes the learning experience more efficient, personalised, and learner-centred.

This section also includes a short quiz to assess prior knowledge before beginning the curriculum, allowing learners to start the programme with greater focus and awareness.

Section 2: Learning materials - Checklist learning objectives

Section 2 contains all learning materials, organised by module and chapter. Each chapter is presented in a book-style format, with a table of contents on the right-hand side to allow easy navigation between segments. The chapters include a combination of reading materials, videos, practical examples, quiz questions, and a clear end-of-chapter summary.

Section 2 concludes with the same list of learning objectives introduced in Section 1. Learners can check off the objectives they have mastered and identify those that still need attention, helping them focus on the areas of the course where further understanding is required.

Section 3: Assessment

The third section contains the assessments for each chapter, with the exception of Chapter 2 in Module 3, which features a demo video of the tool and therefore has no quiz. The quizzes include a mix of question types, such as multiple choice, true/false, and ordering tasks, to support different forms of knowledge checking and to reflect the variety of skills addressed in the learning outcomes. Learners can choose to complete each quiz immediately after its corresponding chapter or take all assessments together once they have finished the full set of learning materials. Each quiz provides instant feedback, enabling learners to see right away when an answer is incorrect, strengthening both short-term comprehension and long-term retention. Learners may retake each quiz as needed, but must achieve a passing score on every

assessment and complete all required activities to finish the curriculum. These activities include reviewing the course structure and learning objectives, working through all learning materials, and filling in the learning objective checklist. Once all activities have been viewed and the quiz is passed, the curriculum is considered finished.

Section 4: Library

The fourth section serves as a library, providing additional resources such as articles, background reading, and extended examples. Learners who wish to explore specific topics in greater depth can easily find all supplementary materials in this section.

Module 1: Introduction to Health Data Quality, Utility and Maturity

Module overview

This module introduces the essential concepts of data quality, including its key dimensions and the different stakeholders who benefit from high-quality data. It highlights the importance of data quality, utility and maturity and explains how these elements connect to the QUANTUM project's objectives within the EHDS. Through clear concepts and real-world examples, the module provides a broad foundation for understanding why data quality is crucial in the health data secondary use.

Why this matters

A clear grasp of what data quality means, and who depends on it creates a shared foundation for responsible health data use. By linking core concepts like quality, utility, and maturity to the goals of QUANTUM and the EHDS, this module helps learners understand how these principles support a more trustworthy and interoperable European health data ecosystem.

Prerequisites

This module does not require any prerequisites.

Module learning outcomes

By the end of this module, learners will be able to:

- Define data quality and explain its importance in healthcare and research contexts.
- Differentiate between primary and secondary use of health data and identify their implications for data quality.
- Analyse challenges affecting the current state of health data quality.
- Identify key stakeholders in the health data quality ecosystem and explain their roles and interactions.
- Explain how data quality, utility and maturity relate to the objectives of QUANTUM and the EHDS.

Module structure overview

Chapter	Title	Description	Duration
1.1	Introduction to Health Data Quality, Utility and Maturity	Explores the different concepts, the dimensions, stakeholders benefitting from data quality and the project QUANTUM and its connection to data quality.	45 -60 minutes

Learning path guidance

- Data holders: complete all chapters in sequence
- Data users: complete all chapters in sequence
- HDAB's: complete all chapters in sequence

Assessment strategy

Assessment is designed to evaluate both conceptual understanding and basic application of key ideas within the constraints of an online, self-paced environment.

The module assessment is aligned with the learning outcomes.

Learning outcome	Assessment approach
Define data quality	Conceptual Multiple Choice (MC) questions with applied examples
Differentiate primary vs secondary use	Scenario-based MC questions
Analyse current challenges	Scenario-based questions

Identify stakeholders and roles	Matching and drag-and-drop
Explain QUANTUM and EHDS relevance	Mixed-format questions (MC questions + ordering + short answer)

Transition

Building a shared understanding of what data quality is and why it matters naturally leads to the next module: examining the foundational structure and components of the QUANTUM label itself.

Module 2: Data Quality Components in QUANTUM

Module overview

This module provides a structured and practical understanding of the core components underpinning the QUANTUM data quality and utility label. It focuses on how data quality is defined, measured, operationalised, and contextualised within real-world health data environments.

Learners will explore the technical foundations of the label, including its specifications, the maturity model for data holders, and the concept of fit-for-purpose in data use. The module bridges conceptual frameworks with implementation logic, preparing learners to interpret and apply the label in practice.

Why this matters

Reliable health data is essential for research, policy-making, and clinical decision-making. Understanding how data quality is assessed and contextualised within QUANTUM enables stakeholders to make informed, risk-aware decisions.

Prerequisites

Basic understanding of data quality concepts (module 1).

Module learning outcomes

By the end of this module, learners will be able to:

- Explain the structure and methodology of the QUANTUM data quality and utility label.
- Analyse key data quality dimensions and their contribution to label scoring.
- Interpret the data holders' maturity model and its implications for data quality management.
- Differentiate between "fit-for-purpose" and "fit-for-use" in data evaluation.
- Evaluate data quality and maturity information to determine dataset suitability for specific use cases.
- Apply QUANTUM concepts to assess data quality challenges in realistic scenarios.

Module structure overview

Chapter	Title	Description	Duration
2.1	Specifications of the quality and utility label	Explains how the label is constructed, including dimensions, weighting, and scoring	25 - 30 minutes
2.2	Data holders' maturity model	Introduces the maturity model and its role in assessing organisational capability	15-20 minutes
2.3	Fit-for-purpose	Explores how data quality is evaluated relative to intended use	15-20 minutes

Learning path guidance

- Data holders: complete all chapters in sequence
- Data users: focus on chapters 2.1 and 2.3
- HDABs: prioritise chapters 2.1 and 2.2

Chapter 2.1: Specifications of the Quality and Utility Label

Overview

This chapter explains how the QUANTUM label is constructed, including the data foundation required to interpret label outputs. quality dimensions, scoring methodology, and aggregation logic. It provides the conceptual and technical

Learning objectives

By the end of this chapter, learners will be able to:

- Explain the structure of the QUANTUM label, including its key components.
- Analyse how data quality dimensions contribute to overall scoring.
- Interpret the weighting and aggregation process used in label construction

Assessment strategy

The assessment is designed to evaluate both conceptual understanding and basic application of key ideas within the constraints of an online, self-paced environment.

The module assessment is aligned with the learning outcomes.

Learning outcome	Assessment approach
Explain QUANTUM label structure	Conceptual MC questions
Analyse data quality dimensions	Mixed format questions (matching + conceptual MC questions + drag-and-drop + scenario-based MC questions)
Interpret weighting and aggregation process	Conceptual MC question and scenario-based questions

Transition

Understanding how scores are generated leads to the next chapter: assessing organisational capability through maturity models.

Chapter 2.2: Data Holders' Maturity Model

Overview

This chapter introduces the maturity model used to evaluate how well organisations manage and improve data quality over time.

Learning objectives

- Define a data maturity model and its purpose.
- Describe the levels of the QUANTUM maturity model.
- Analyse how maturity impacts data quality outcomes.
- Interpret maturity assessments in organisational contexts.

Assessment strategy

Assessment is designed to evaluate both conceptual understanding and basic application of key ideas within the constraints of an online, self-paced environment.
The module assessment is aligned with the learning outcomes.

Learning outcome	Assessment approach
Define a data maturity model	Conceptual MC questions
Describe the levels of the QUANTUM maturity model	Mixed format questions (matching + drag-and-drop + scenario-based questions + ordering)
Analyse maturity impact	Conceptual MC questions and scenario-based MC questions
Interpret maturity assessment	Matching and scenario-based MC questions

Transition

Once maturity is understood, the next step is evaluating whether data is fit for a specific purpose.

Chapter 2.3: Fit-for-purpose

Overview

This chapter explores how data quality must be evaluated relative to intended use, introducing the concept of fit-for-purpose.

Learning objectives

- Differentiate between fit-for-purpose (FFP) and fit-for-use (FFU).
- Analyse how context affects data quality requirements.
- Evaluate dataset suitability for specific use cases.
- Apply fit-for-purpose reasoning to real-world scenarios.

Assessment strategy

Assessment is designed to evaluate both conceptual understanding and basic application of key ideas within the constraints of an online, self-paced environment.

The module assessment is aligned with the learning outcomes.

Learning outcome	Assessment approach
Differentiate between FFP and FFU	Scenario-based MC questions
Analyse impact of context on data quality requirements	Mixed format questions (conceptual MC questions + matching + scenario-based MC questions)
Evaluate dataset suitability	Conceptual MC questions and scenario-based MC questions
Apply FFP reasoning	Scenario-based MC questions

Transition

Having established the foundational structure and components of the label, the next step is to examine the assessment phase of the label.

Module 3: Understanding of the Label

Module overview

This module focuses on the assessment phase of the quality and utility label, offering insight into the tools and methods that guide its creation, refinement, and practical application. Across four chapters, learners will gain a clear understanding of how the label is developed, assessed, and put into use.

Why this matters

A clear understanding of how the label is developed and assessed is essential for ensuring its credibility and usefulness. By knowing the methods, tools, and standards behind the label, stakeholders can trust its outcomes, interpret its meaning accurately, and apply it responsibly in real-world decision-making.

Prerequisites

- Basic understanding of data quality concepts (module 1)
- Basic understanding of how the label is constructed (module 2 chapter 1)
- Basic understanding of the data holder's maturity model (module 2 chapter 2)
- Basic understanding of the fit-for-purpose concept (module 2 chapter 3)

Module learning outcomes

By the end of this module, learners will be able to:

- Understand how data quality is assessed and communicated within the European health data secondary use ecosystem.
- Explain the purpose and methodological foundations of the QUANTUM self-assessment approach.
- Recognise the role of European interoperability standards in enabling consistent exchange of data quality information.
- Apply the data quality and utility label tool within organisational data management workflows.
- Use fit-for-purpose reasoning to interpret data quality information in realistic data-use scenarios.
- Evaluate data quality scores, and organisational maturity results to inform dataset selection.

Module structure overview

Chapter	Title	Description	Duration
3.1	Tools and methodologies	Explains how data quality is assessed today, and outlines the structure of the quality label and the metadata that underpins its scoring and practical use	15 - 20 minutes
3.2	Design and development of the label	Demonstrates effective navigation of the QUANTUM tool's interface and functions	20-25 minutes
3.3	Implementing and interpreting the label	Examines the QUANTUM assessment workflow, highlighting associated best practices and common challenges	25-35 minutes
3.4	Interaction with the QUANTUM label	Demonstrates how to interpret data quality and utility scores alongside the maturity results, gaining a clearer understanding of what they represent in practice	15-20 minutes

Learning path guidance

- Data holders: focus on chapters 3.1, 3.2 and 3.3
- Data users: focus on chapter 3.4
- HDABs: complete all chapters in sequence

Chapter 3.1: Tools and Methodologies

Overview

This chapter examines how data quality is assessed today and explores why the QUANTUM project adopts a self-assessment approach. It outlines the specific methodological foundation of the quality and utility label and the metadata standards that support its structure and application.

Learning objectives

- Describe how data quality is currently assessed by data holders in Europe.
- Explain the rationale behind QUANTUM's self-assessment approach.
- Summarise the methodological foundations of the data quality and utility label.
- Recognise how European interoperability standards enable the creation and exchange of data quality information.

Assessment strategy

Assessment is designed to evaluate both conceptual understanding and basic application of key ideas within the constraints of an online, self-paced environment.

The module assessment is aligned with the learning outcomes.

Learning outcome	Assessment approach
Current assessment of data quality	Scenario-based MC questions
Rationale behind QUANTUM's self-assessment approach	Conceptual MC questions
Methodological foundations of the label	Conceptual MC questions and ordering
European interoperability standards	Conceptual MC questions

Transition

Having established the methodological foundations and metadata standards underpinning the label, it is time to turn to its practical application within the tool.

Chapter 3.2: Design and Development of the Label

Overview

This chapter provides a navigation of the QUANTUM tool's interface, offering a structured walkthrough of its main sections including the dashboard homepage, the assessment page, the label page, and the maturity page.

Learning objectives

- Identify the structure, features, and functionalities of the completed data quality and utility label tool.

Assessment strategy

This chapter focuses on familiarising learners with the navigation, structure, and key features of the QUANTUM data quality and utility label tool. Because the objective is to identify and understand the tool's interface rather than apply analytical skills, this section does not include a quiz. Its purpose is to provide orientation and confidence in using the platform before moving on to more complex assessment-related tasks in later chapters.

Transition

Once the structure and navigation of the tool are understood, attention shifts to the step-by-step assessment workflow that reinforces effective implementation.

Chapter 3.3: Implementing and Interpreting the Label

Overview

This chapter outlines how to prepare an organisation for the assessment and how to follow the assessment workflow step by step. It also addresses common implementation challenges and presents practical strategies for resolving them, while offering guidance on establishing a smooth, efficient, and repeatable assessment process.

Learning objectives

- Describe the overall process for implementing the tool, from initial setup to integration within an organisation's data management workflow.
- Examine common challenges encountered during the implementation of the label.
- Assess recommended best practices and apply appropriate solutions to address implementation obstacles.

Assessment strategy

Assessment is designed to evaluate both conceptual understanding and basic application of key ideas within the constraints of an online, self-paced environment.

The module assessment is aligned with the learning outcomes.

Learning outcome	Assessment approach
Implementing process of the tool	Conceptual MC questions, scenario-based questions and ordering
Challenges	Conceptual and scenario-based MC questions
Best practices	Conceptual MC questions

Transition

Once the assessment process and its practical implementation are understood, attention turns to the role of the label for data users and the insights that can be drawn from its results.

Chapter 3.4: Interaction with the QUANTUM Label

Overview

This chapter examines the importance of the label from a data-user perspective and clarifies what the label can and cannot communicate. It explains how to interpret the data quality and utility scores alongside the maturity results, providing a clearer understanding of their practical meaning. The chapter then explores how the label can be applied effectively and illustrates its use through a series of case studies.

Learning objectives

- Distinguish what the label can and cannot communicate to data users.
- Interpret data quality and utility scores and explain their significance.
- Evaluate the implications of scoring thresholds for data usability.
- Analyse organisational maturity results and determine what they indicate for data reuse.
- Apply the label effectively to inform dataset selection.
- Use fit-for-purpose reasoning in realistic data-use scenarios to justify selection decisions.

Assessment strategy

Assessment is designed to evaluate both conceptual understanding and basic application of key ideas within the constraints of an online, self-paced environment.

The module assessment is aligned with the learning outcomes.

Learning outcome	Assessment approach
What the label can and cannot do	Conceptual questions
Data quality and utility scores	Conceptual questions and ordering
Organisational maturity results	Conceptual questions, ordering, scenario-based questions
Apply the label for dataset selection	Scenario-based questions and matching
Fit-for-purpose selection	Scenario-based questions and matching

2.5. Support and contact

QUANTUM academy materials are freely accessible to EHDS Stakeholders at https://academy.i-hd.eu/ and improvements over them are to be licensed to interested parties under a Attribution-ShareAlike 4.0 International .

For any questions or issues related to the use of the Academy platform, including technical difficulties, access problems, or other operational matters, as well as content-related inquiries such as clarification of module material or requests for additional information, users may contact academy@i-hd.eu .

Support is available on working days between 08:00 and 17:00. Users who encounter issues outside support hours are encouraged to submit their request by email, all inquiries will be addressed as soon as possible on the next working day.

3. Conclusions

This deliverable presents an integrated overview of the QUANTUM Academy, detailing its layout, access mechanisms, core learning components, and the key features that shape the overall user experience.

Throughout its development, substantial efforts have been made to ensure that the course structure, content, and learning environment jointly support a high-quality, user-centred educational experience. The curriculum has undergone multiple rounds of validation, drawing on feedback from internal workshops and early testers. These insights have been instrumental in refining Modules 1 and 2 and in shaping the development of Module 3.

The curriculum's structured composition, ranging from learning objectives and quizzes to chapter-based materials, assessments, and a dedicated resource library, supports a coherent and intuitive learner journey.

Taken together, these efforts demonstrate the successful delivery of a robust, effective training programme. The QUANTUM Academy now stands on a strong foundation, with validated content, an improved learning experience, and a clear structure that will continue to evolve through future iterations and learner feedback.