



# **RALEXILA** **System Model**

**Building an Interoperable  
Ecosystem for Adult Learning  
Registries and Individual Learning  
Accounts in Europe**



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## D3.1 - INFORMATION MODEL AND SYSTEM REQUIREMENTS

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# 1. Background

The ALEXILA System Model provides a structured approach to integrating a high-performing, flexible and robust Adult Learning and Education (ALE) registry with Individual Learning Accounts (ILAs), offering a comprehensive framework for managing learning opportunities, tracking entitlements, and ensuring interoperability.

The model defines key components, data structures, and technological principles, ensuring that ALE/ILA systems can operate efficiently, securely, and in compliance with EU standards.

The integration of ALE registries with ILAs is designed to improve access to learning opportunities, facilitate funding allocation, and support lifelong learning pathways. By providing a standardised yet adaptable framework, the system model enables national authorities, training providers, and adult learners to engage with trusted, quality-assured education and training systems.

A key challenge in developing an ALE/ILA system is ensuring that it remains flexible and scalable while accommodating diverse national regulations, policies, and technological infrastructures.

The System Model addresses this challenge by adopting a modular approach, allowing phased implementation based on national priorities. It also establishes a clear data structure for managing course information, entitlements, and user transactions, supporting greater transparency and efficiency in system operation. Additionally, the model provides guidance on security and compliance considerations, ensuring that personal data and financial transactions are protected in line with GDPR, cybersecurity regulations, and the EU Web Accessibility Directive.

The System Model is based on extensive multi-country research and consultation with experts, conducted as part of the RALEXILA project. This research examined existing national ALE and ILA implementations, identifying common challenges, good practices, and technical requirements. Furthermore, the model incorporates insights from the user needs assessment, which explored the perspectives of learners, training providers, policymakers, and funders. More details on this assessment can be found in Handbook – Part 2<sup>1</sup>.

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<sup>1</sup>Gołębiowska, A., Jahnke, S., Pinzi, V., Aristidou, X., Mršić, L., Pavić, E., Giannakopoulou, A., Poličnik, J., & Šilhár, K. (2026). RALEXILA - The Essential Guide to ALE National Registries: RALEXILA - National Registries of Adult Learning and Education to support the deployment of individual learning accounts. European Association for the Education of Adults. - <https://ralexila.eu/>

## **1.1 SCOPE OF THE DOCUMENT**

This document provides a technical and conceptual framework for the design and implementation of Adult Learning and Education (ALE) Registries integrated with Individual Learning Accounts (ILAs). It defines the system architecture, functional capabilities, security principles, and information models required to support scalable, interoperable, and compliant national implementations.

The System Model covers the core components of an ALE/ILA system, including registry management, ILA funding mechanisms, provider accreditation, and quality assurance. It adopts a modular and adaptable architecture to support phased implementation and alignment with national contexts and regulatory requirements.

Security, data protection, and accessibility are addressed as integral design considerations, including compliance with GDPR and the EU Web Accessibility Directive. The document also outlines interoperability mechanisms to support integration with national systems and alignment with European tools and frameworks such as Europass, ESCO, and the European Learning Model (ELM).

The information models presented in this document define the high-level data needs required for the operation, governance, and interoperability of an ALE/ILA system. They describe information objects, key attributes, and conceptual relationships, independent of any specific technical implementation. They are not intended to represent database schemas, table structures, or implementation-level specifications, which may be derived by implementing organisations according to their architectural and regulatory contexts.

# **2. High-Level Overview Of ALE And ILA Components**

## **2.1 THE ROLE OF THE ALE REGISTRY AND ILA COMPONENTS IN THE MODEL**

The Adult Learning and Education (ALE) registry forms the core foundation of the system, serving as a central database of learning opportunities (formal and non-formal). It provides structured, verified, and interoperable data on available courses, training providers, quality assurance mechanisms, and learner feedback.

The Individual Learning Account (ILA) component is an added instrument financial mechanism that enables learners to build their own learning paths, accessing information about learning opportunities and available funding, apply entitlements, and possibly manage enrolment and payment for selected learning opportunities.

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However, for ILAs to function effectively, they require well-structured and reliable ALE registries that ensure learners have access to quality-assured and recognised training opportunities.

## 2.1.1 Key relationships between ALE and ILA components

### ALE Registry as the Data Backbone

- Hosts and manages learning opportunities, providers, and eligibility details.
- Ensures searchability, comparability, and structured presentation of training options.
- Supports quality assurance processes to maintain credibility and trust.

### ILA as the Funding Layer

- Provides learners with information and functionalities to use their entitlements, subsidies, and financial credits for training.
- Enables automated validation of eligible courses based on predefined criteria.
- Ensures transparent tracking of fund usage and reporting for policymakers and funders.

### Integration and Interoperability

- The ILA component interacts with the ALE registry to verify course eligibility and process entitlements.
- Quality-assured providers and eligible training programmes are preconditioned for ILA funding.
- Data models align with European instruments and frameworks (Europass, ESCO, ELM) to ensure interoperability.

## 2.2 CAPABILITY MAP AND PRIORITISATION IN THE ALE/ILA SYSTEM

The capability framework for the ALE/ILA system was developed through an extensive multi-country research and consultation process, including user needs assessments, stakeholder interviews, and design thinking workshops (more information in the RALExILA Handbook – Part 2)<sup>2</sup>. These efforts helped to identify core functionalities, ensuring that the system meets the diverse needs of learners, training providers, administrators, policymakers, and funders.

The following capability map provides a structured breakdown of essential and advanced features, offering policymakers and system designers a clear roadmap for implementation.

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<sup>2</sup>Idem

The model is designed to be modular and scalable, enabling adaptation to national contexts while maintaining interoperability with European frameworks such as Europass, ESCO, and the European Learning Model (ELM).

## 2.2.1 Structure of the Capability Map

The capability map is categorised into four key layers:

- Foundational Capabilities – Core functions necessary for system operation, including course discovery, provider management, and user accounts.
- Operational Capabilities – Features that enhance system efficiency, such as user engagement tools, quality assurance mechanisms, and ILA tracking.
- Advanced Capabilities – Data-driven enhancements, including AI-powered recommendations, analytics for skills tracking, and job-matching functionalities.
- Non-Functional Capabilities – Ensuring security, accessibility, and compliance with EU regulations (e.g., GDPR, Web Accessibility Directive).

## 2.2.2 Prioritisation approach

Each capability is assigned a priority level (MUST, SHOULD, COULD) based on its importance to system functionality and stakeholder feedback. This prioritisation is not prescriptive but serves as a guiding framework for national implementation, allowing adjustments based on policy objectives, funding availability, and system maturity.

By defining capabilities within this structured framework, the system model ensures a flexible yet standardised approach to ALE and ILA implementation, supporting both national customisation and European interoperability.

## 2.2.3 Capability Map

### Foundational Capabilities

**Description:** Essential for all ALE/ILA systems, ensuring core functionality and system reliability.

| Feature/<br>Functionality     | Description   | Priority |
|-------------------------------|---|----------|
| <b>Discovery</b>              |   |          |
| <b>Search &amp; Filtering</b> | Enables users to find courses using specific criteria | MUST     |
| <b>Course Display</b>         | Provides detailed course information                  | MUST     |

|  |   |        |
|--|---|--------|
| <b>Course Comparison</b>                       | Allows users to compare similar courses side by side  | SHOULD |
| <b>Provider Directory</b>                      | Lists (accredited) providers with key information   | SHOULD |
| <b>Quality Assurance or Accreditation Info</b> | Displays provider accreditation status or (links to) information about Quality Assurance mechanisms                                 | SHOULD |
| <b>Provider Management</b>                     |   |        |
| <b>Provider Account Management</b>             | Manages provider profiles and corresponding information visible to learners   | MUST   |
| <b>Course Management</b>                       | Allows providers to add and manage courses  | MUST   |
| <b>Provider Registration</b>                   | Enables providers to register with the system   | MUST   |
| <b>Provider Eligibility and Compliance</b>     | Ensures providers meet quality assurance, eligibility, and compliance standards   | MUST   |
| <b>Provider Onboarding</b>                     | Supports providers during initial setup and onboarding  | SHOULD |
| <b>User Account &amp; ILA Essentials</b>       |   |        |
| <b>User Account Management</b>                 | Allows users to create and manage their accounts  | MUST   |
| <b>ILA Balance Tracking</b>                    | Displays available ILA balance, potential funding source(s) and previous use of funding   | MUST   |
| <b>Course Enrolment</b>                        | Enables users to enrol in courses or links to course enrolment and provides enrolment information (e.g. requirements)               | MUST   |
| <b>ILA Application &amp; Verification</b>      | Allows users to apply for and verify ILA funding eligibility  | SHOULD |
| <b>Payment Processing</b>                      | Handles payment transactions for (additional) course fees via the ILA platform (in case of personal and external funds integration) | COULD  |
| <b>User Onboarding</b>                         | Allows user to be guided through the platform for a better user experience and comprehension of other features/ functionalities     | COULD  |

## Operational Capabilities

**Description:** Key for efficient system performance, supporting smooth interactions and data-driven decisions.

| Feature/<br>Functionality                             | Description  | Priority |
|---|--|----------|
| <b>User Engagement and Communication</b>              |  |          |
| <b>User Feedback and Support</b>                      | Collects user feedback and provides help options   | MUST     |
| <b>Notifications and Alerts</b>                       | Sends automated notifications about ILA and course updates e.g. new or remaining funding, updated courses, enrolment decisions | SHOULD   |
| <b>Personalised Learning Pathways</b>                 | Suggests tailored learning journeys based on user goals  | COULD    |
| <b>Provider Quality Assurance (QA) and Compliance</b> |  |          |
| <b>Course Ratings and Reviews</b>                     | Allows learners to rate and review completed courses   | SHOULD   |
| <b>Compliance Checks</b>                              | Ensures providers comply with quality assurance and eligibility  | COULD    |
| <b>Performance Metrics</b>                            | Tracks provider performance using key indicators   | COULD    |
| <b>ILA Management and Analytics</b>                   |  |          |
| <b>ILA Usage Tracking and Reporting</b>               | Provides insights on ILA usage and balances  | SHOULD   |
| <b>Fund Usage Analytics</b>                           | Tracks how ILA funds are allocated and spent   | SHOULD   |
| <b>Skills and Credentials Management</b>              |  |          |
| <b>Digital Credential Issuance and Management</b>     | Issues and stores digital credentials  | SHOULD   |
| <b>Skills and Competences Management</b>              | Tracks and categorises users' acquired skills and competences  | COULD    |
| <b>Skills Self-Assessment</b>                         | Allows users to assess their skills and competences through interactive tools  | COULD    |
| <b>Skills and competences Tracking</b>                | Provides dashboards to monitor skill and competences development progress  | COULD    |

|  |  |       |
|--|--|-------|
| <b>Recognition of Prior Learning (RPL)</b> | Supports the submission of certificates, work experience, micro-credentials etc. for the purpose of validation of previous learning achievements | COULD |
| <b>System Governance</b>                   |  |       |
| <b>Role-Based Access Controls</b>          | Restricts system access based on user roles  | MUST  |

## Advanced Capabilities

**Description:** Enhancing user experience and system effectiveness through advanced features and personalised support.

| <b>Feature/Functionality</b>               | <b>Description</b>   | <b>Priority</b> |
|--|--|-----------------|
| <b>System Insights and Analytics</b>       |  |                 |
| <b>User Engagement Analytics</b>           | Tracks and analyses user interactions within the system                                    | SHOULD          |
| <b>Learning Outcomes Benchmarking</b>      | Compares learning outcomes across different courses and users                              | COULD           |
| <b>Regulatory Compliance Analytics</b>     | Monitors system compliance with regulatory standards                                       | COULD           |
| <b>Policy and Decision-Making Insights</b> | Provides data-driven insights to support policymaking                                      | COULD           |
| <b>Career Support</b>                      |  |                 |
| <b>Skills and competences Gap Analysis</b> | Identifies skill and competences gaps based on users' profiles and career goals            | COULD           |
| <b>Personalised Career Guidance</b>        | Offers tailored career guidance, also linked to personalised/recommended learning pathways | SHOULD          |
| <b>Employment Information</b>              | Offers guidance on careers paths and job seeking resources                                 | COULD           |
| <b>Job Matching</b>                        | Connects users with job opportunities based on their skills                                | COULD           |
| <b>AI Features</b>                         |  |                 |
| <b>AI-Driven Course Recommendations</b>    | Suggests relevant courses using machine learning   | COULD           |

|                                  |   |       |
|----------------------------------|---|-------|
| <b>Automated Data Validation</b> | Ensures data accuracy and consistency using AI                | COULD |
| <b>Predictive Analytics</b>      | Uses data to predict learning outcomes and ILA usage patterns | COULD |

## Non-Functional Capabilities

**Description:** Ensuring system usability, security, and accessibility, critical for user trust and compliance.

| <b>Feature/Functionality</b>                          | <b>Short Description</b>  | <b>Priority</b> |
|---|---|-----------------|
| <b>User Experience &amp; Accessibility</b>            |   |                 |
| <b>Mobile-Friendly</b>                                | Optimised for mobile devices and tablets  | MUST            |
| <b>Consistent Layout</b>                              | Ensures a uniform interface across system modules   | SHOULD          |
| <b>Alternative Access Options (Offline)</b>           | Provides offline access for users with limited internet   | SHOULD          |
| <b>Unified Access for ALE/ILA</b>                     | Single sign-on for both ALE and ILA systems with a single point of entry, and, possibly integrated with national digital ID systems | SHOULD          |
| <b>Compliance with EU Web Accessibility Directive</b> | Meets accessibility standards for diverse users according to the EU's Web Accessibility Directive such as barrier-free access       | MUST            |
| <b>Multi-Language Support</b>                         | Offers multilingual options where necessary e.g. for multilingual countries, international users, or other such use-cases           | COULD           |
| <b>System Integrity &amp; Security</b>                |   |                 |
| <b>Privacy and Data Security Compliance (GDPR)</b>    | Ensures data protection in line with GDPR and compliance with applicable (national) data security regulations                       | MUST            |
| <b>Access Controls and User Authentication</b>        | Verifies user identity and restricts system access  | MUST            |
| <b>Data Integrity &amp; Interoperability</b>          | Ensures data accuracy e.g. through validation and compatibility with external systems   | SHOULD          |
| <b>Audit Logs</b>                                     | Maintains comprehensive logs of system access, data changes and feature usage   | MUST            |

# 3. Technological Considerations

This chapter presents the technological framework for an integrated Adult Learning and Education (ALE) Registry and Individual Learning Accounts (ILA) system. While it does not prescribe specific technologies, it outlines key technical principles that ensure the system remains modular, scalable, and secure while supporting seamless interoperability with existing national and European frameworks. By adopting a modular structure, the ALE/ILA system can be adapted to national contexts while ensuring long-term sustainability and integration with evolving digital learning ecosystems.

The technical considerations presented in this chapter are informed by two key sources: the RALExILA research and user needs assessment, which identified flexibility, accessibility, and interoperability as critical system requirements, and established technological standards and best practices in the EdTech industry. This dual approach ensures that the system design is both user-centred and aligned with industry developments, facilitating efficient integration, usability, and long-term adaptability.

## 3.1 ARCHITECTURAL CONSIDERATIONS

The ALE/ILA registry should operate as a comprehensive platform with several key components. A modular design is recommended, allowing independent deployment and scaling of core functionalities such as User Management, Learning Opportunity Discovery, ILA Management, Analytics, and Security. This modular approach ensures flexibility and scalability while a structured data layer should separate.

- Learning Opportunity Data - Course information, provider details, and quality assurance data, from
- ILA Data - User information, funding details, and usage data.

This separation enhances system performance, data security and allows for a more iterative and modular approach to implementation.

### 3.1.1 Interoperability

Interoperability should be a cornerstone of the ALE/ILA system's design. In line with the European Interoperability Framework<sup>3</sup>, interoperability is not limited to technical connectivity between systems, but encompasses the ability of organisations, processes, and digital solutions to work together effectively through shared principles, standards, and semantics.

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<sup>3</sup>European Commission - European Interoperability Framework (EIF) – Implementation Strategy. Available at: <https://digital-strategy.ec.europa.eu/en/policies/european-interoperability-framework>

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Designing an ALE/ILA system for interoperability supports the use of common data structures, reference models, and vocabularies, enabling information to be exchanged and interpreted consistently across national and European contexts. Beyond facilitating data exchange, such an approach contributes to the development of a shared understanding of concepts, terminology, and data meanings among stakeholders, including public authorities, providers, and system operators. This shared understanding is particularly important in the adult learning domain, where provision is diverse and spans formal, non-formal, and informal contexts.

Interoperability by design also supports the long-term sustainability of the system. By relying on open standards, well-defined interfaces, and reusable reference frameworks, an interoperable system is better able to adapt to policy evolution, integrate new services or platforms, and remain maintainable over time. This reduces dependency on bespoke solutions, facilitates future extensions, and strengthens the system's capacity to evolve within a broader European learning and qualifications ecosystem.

Together, the mechanisms described in this section (API-based exchange, controlled vocabularies, reference identifiers, and mappings) constitute an optional linked-data layer of the ALE/ILA System Model. This layer enables structured linking to external frameworks, registries, and reference systems, such as qualification frameworks, skills and competence frameworks, and regulated registers, without making such integration a prerequisite for core system operation.

## **Technical interoperability through API integration**

Technical interoperability enables the ALE/ILA system to exchange data with external systems in a secure, structured, and scalable manner. By exposing and consuming standardised APIs and supporting open data formats, the system can facilitate controlled data exchange with national platforms, sectoral systems, and European services, without requiring direct access to underlying databases.

API-based interoperability supports a range of use cases, including discovery of learning opportunities, synchronisation of provider or accreditation data, retrieval of entitlement or participation information, and referencing of externally managed credentials or quality evidence. While APIs are particularly suited for near real-time interaction, technical interoperability may also be complemented by other exchange patterns, such as periodic bulk data exchange or event-based notifications, depending on national infrastructure and system maturity.

To ensure compatibility across systems, technical interoperability should be underpinned by the use of machine-readable data formats such as JSON and, where semantic linking or cross-system interpretation is required, JSON-LD.

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Alignment with shared European data models (also with options for extensions and integrations, notably the European Learning Model (ELM)<sup>4</sup>, further supports consistent structuring of exchanged data related to learning opportunities, learning achievements, organisations, and associated metadata.

Secure access control, authentication, logging, and auditability are essential components of API-based interoperability and should be addressed in line with applicable data protection and security requirements.

## **Semantic interoperability through controlled vocabularies and thesauri**

Semantic interoperability ensures that data exchanged between systems is interpreted consistently and retains its intended meaning across organisational and national boundaries. In an ALE/ILA context, this is particularly important given the diversity of adult learning provision, credentials types, and governance arrangements.

The use of controlled vocabularies and thesauri supports semantic interoperability by reducing ambiguity and promoting consistent representation of key data elements, such as education and training fields, delivery modes, learning settings, languages, locations, accreditation types, and skills or competences. Where possible, data elements should reference identifiers from controlled vocabularies rather than relying solely on free-text values.

European reference vocabularies and frameworks provide important alignment points. For example, ESCO<sup>5</sup> and other EU competences frameworks support a shared representation of skills and competences, while the European Learning Model (ELM) provides a common semantic structure for learning-related data. National or sector-specific frameworks and vocabularies may also be required. In such cases, these should be clearly defined, governed, and, where relevant, mapped and or linked to broader European reference vocabularies to support comparability.

Semantic interoperability should also account for versioning and provenance. Systems should record the source and, where applicable, the version of vocabularies used, enabling traceability, and reducing the risk of misinterpretation over time. Where multiple vocabularies or frameworks are used in parallel (e.g. national skills frameworks alongside ESCO), equivalence or mapping relationships may be used to support alignment without forcing a single classification approach.

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<sup>4</sup>European Commission: European Learning Model (ELM) – semantic data model for learning and qualifications. Available at: <https://europa.eu/europass/elm>

<sup>5</sup>European Commission. ESCO – European multilingual classification of Skills, Competences, Qualifications and Occupations. Available at: <https://esco.ec.europa.eu>

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These relationships may take different forms, such as full one-to-one mappings between concepts, partial mappings where only certain elements correspond, or structured extensions where a national vocabulary builds upon a European reference framework while preserving local specificity.

Together with technical interoperability mechanisms, the consistent use of controlled vocabularies and semantic alignment principles enables ALE/ILA systems to support transparency, data quality, and meaningful reuse of information across interconnected education and training ecosystems.

### 3.1.2 Security

To enable secure and reliable data exchange, the system should adopt:

- Authentication and Authorisation Controls: Secure identity verification through e.g. OAuth2 or OpenID Connect.
- Data Anonymisation and Pseudonymisation: Ensuring that personal data is masked during transactions.
- Regular Security Audits: Independent assessments to maintain compliance with cybersecurity standards (ISO 27001, NIS2 Directive)<sup>6,7</sup>.

## 3.2 DATA PROTECTION, SECURITY, AND GDPR COMPLIANCE

Ensuring the security and privacy of user data is a fundamental requirement for any ALE/ILA system. Given that the system will handle sensitive personal information, including learner entitlements, financial transactions, and training records, it must comply with European data protection regulations, particularly the General Data Protection Regulation (GDPR).

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<sup>6</sup>ISO/IEC 27001:2022 – Information Security Management Systems (ISMS) ISO 27001 is an international standard for managing information security. It provides a framework for establishing, implementing, maintaining, and continuously improving an information security management system (ISMS). Source: International Organisation for Standardization (ISO). ISO/IEC 27001:2022 Information Security Management. Available at: <https://www.iso.org/standard/27001>

<sup>7</sup>NIS2 Directive (Directive (EU) 2022/2555 on Network and Information Security) The NIS2 Directive is the EU's updated legislation on cybersecurity, strengthening security requirements, incident reporting obligations, and cooperation mechanisms across Member States. Source: European Commission. Directive (EU) 2022/2555 of the European Parliament and of the Council on measures for a high common level of cybersecurity across the Union (NIS2). Available at: <https://eur-lex.europa.eu/eli/dir/2022/2555>

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### 3.2.1 Compliance with GDPR and data protection laws

To meet GDPR requirements, the system must process user data lawfully, fairly, and transparently.

Key compliance measures include:

- **Data Minimisation:** Only the necessary personal data required for account management, funding allocation, and reporting should be collected.
- **User Consent and Rights:** Learners must have full control over their data, including the right to access, modify, delete, or restrict processing of their personal information.
- **Data Portability:** Users should be able to download or transfer their training records and entitlement history in an interoperable format (e.g., JSON, XML, Europass Digital Credentials).
- **Automated Decision-Making and Transparency:** If the system uses AI-driven funding recommendations or eligibility validation, users must be informed about how decisions are made and be able to request human intervention if needed.

### 3.2.2 Security and system integrity

To safeguard data against unauthorised access, breaches, or fraud, the system should incorporate the following security best practices:

#### Access Control and Authentication

- **Role-Based Access Control (RBAC):** Access should be restricted based on user roles (learners, providers, administrators), ensuring that only authorised users can modify or access sensitive data.
- **Secure Authentication & Multi-Factor Authentication (MFA):** The system should implement strong authentication mechanisms, including single sign-on (SSO) and MFA for administrative users handling financial transactions.

#### Encryption Standards

- **In-Transit Encryption:** All data exchanges between users and system servers should be encrypted using TLS 1.2 or higher.
- **At-Rest Encryption:** Personal and financial data should be stored using AES-256 encryption to prevent unauthorised access.

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## Audit Logging and Monitoring

- Logging of all interactions with user data, providing a comprehensive audit trail for compliance and fraud prevention.
- Anomaly detection to flag suspicious activity, such as repeated failed login attempts or irregular fund disbursements.

### 3.2.3 System performance and sustainability

The back-end infrastructure should be highly scalable, secure, and optimised for performance, capable of handling large data volumes and complex operations efficiently. The platform should use open APIs to support seamless communication with external systems, ensuring compatibility with other national ALE/ILA systems while enabling potential cross-border data exchange.

The system's modular deployment approach ensures that each component can be scaled independently and developed iteratively, making it adaptable to diverse national infrastructures. By integrating performance optimisation measures, the system will remain efficient and responsive, even during peak usage.

By embedding privacy-by-design principles and ensuring compliance with EU regulations, the ALE/ILA system is well-positioned to evolve alongside the changing needs of adult learners, training providers, and policymakers.

Furthermore, compliance with the EU Web Accessibility Directive<sup>8</sup> ensures that the ALE/ILA platform remains inclusive, meeting the needs of all users, including individuals with disabilities, older adults, and those with low digital literacy. By embedding accessibility-by-design principles, the system will support wider adoption and usability, making learning opportunities equally accessible to all individuals, regardless of their abilities.

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<sup>8</sup>Directive (EU) 2016/2102 on the Accessibility of Public Sector Websites and Mobile Applications - The directive establishes accessibility requirements for public-sector digital services, ensuring compliance with WCAG 2.1 standards for inclusivity. Source: European Commission. Directive (EU) 2016/2102 of the European Parliament and of the Council on the accessibility of public sector websites and mobile applications. Available at: <https://eur-lex.europa.eu/eli/dir/2016/2102>

## 4. Data Model

### 4.1 A MULTI-LAYERED AND MODULAR APPROACH TO DATA MODELLING BASED ON ESTABLISHED EUROPEAN STANDARDS AND PRACTICES

This section takes a structured approach to designing a comprehensive and modular data model for Adult Learning and Education (ALE) and Individual Learning Accounts (ILAs).

This process is informed by Work Package 2 (WP2)<sup>9</sup>, which examined 10 reference countries through desk research, stakeholder interviews, surveys, and design thinking workshops. The findings of the research highlight fragmented data structures, limited interoperability, and inconsistencies in funding mechanisms, all of which must be addressed in a scalable and adaptable data model. Furthermore, it highlights the different approaches to Adult Learning and particularly the different ambitions and stages of implementing ILAs. Based on these findings, the proposed data model should ensure seamless integration, interoperability, and alignment with European frameworks, enabling efficient data exchange between learners, training providers, funders, and policymakers but also a common understanding of the data connected to Adult Learning. It must balance standardisation with flexibility, supporting national policy needs, allowing for a modular implementation of ALE/ILA systems, and additionally facilitating cross-border recognition of learning.

The RALExILA proposed data model aligns with European standards and principles, such as the European Learning model and the European model for developing micro-credentials. With this approach, the RALExILA data model enhances transparency, portability of credentials, and accessibility while relying on well-established standards and practices.

The proposed **data model** focuses on three distinct dimensions, mirroring the core components of the overall ALE/ILA system and the structure of the system capabilities as presented in the first chapter of this document.

- **Adult Learning and Education registry data model**, which focuses on Learning Opportunities and Achievements – it is a prerequisite for a common understanding for formal and non-formal Adult education and the base for an implementation of an ILA on top of the Adult Learning and Education (ALE) registry.

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<sup>9</sup>Gołębiowska, A., Mršić, L., Pavić, S., Pinzi, V., Pelucco, G., Steinkampf, L., Jahnke, S., Poličnik, J., Aristidou, X., & Šilhár, K. (2024). "Building ALE National Registries in Europe – Frameworks, insights and needs for supporting individual learning accounts. Algebra University. [http://ralexila.eu/wp-content/uploads/sites/91/2025/05/Ralexila\\_Del-2.1\\_FIN\\_EN.pdf](http://ralexila.eu/wp-content/uploads/sites/91/2025/05/Ralexila_Del-2.1_FIN_EN.pdf)

- **Individual Learning Account data model**, which focuses on the entitlement data as a prerequisite for the implementation of an ILA
- **Complementary data** – as there are a range of additional operational and advanced capabilities proposed in this System Model, this complementary data is not fully modelled and instead provides an overview of additional required data

## 4.2 ASSUMPTIONS AND DESIGN PRINCIPLES

The following is a set of assumptions and principles that the data models should follow.

- **Reuse of Existing Models:** Any ALE/ILA registry data model should maximise the reuse of components of existing learning models. This approach ensures that the registry is maintainable, meaning it can easily be kept operational, updated, and modified over time. It also helps to integrate smoothly with global standards while adapting to the country-specific contexts.
- **Centralised Management of identifiers:** Linked Data identifiers (IRIs) should be maintained centrally. This method facilitates organised and consistent data referencing across several ALE/ILA registries.
- **Data Exchange Format:** Data exchange formats for manual import/export or APIs should utilise JSON / JSON-LD. This format allows for the creation of ordinary JSON documents at the national level, which can be interpreted as RDF for Linked Data purposes at cross-country level (e.g. integration with Europass). Using JSON-LD enables any national ALE/ILA registry to benefit from the robustness of JSON while ensuring semantic richness and connectivity via RDF.
- **Linked Open Data:** It is recommended that any national ALE/ILA system utilise Linked Open Data<sup>10</sup> to enhance the semantic richness and connectivity of the data. This would also allow the integration of ALE data stemming from a range of regional, local, or sector-specific databases.

### 4.2.1 User roles in the information models

To clarify the purpose, responsibility, and primary use of the data elements described in this System Model, each information model indicates the primary user role served by a given data element.

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<sup>10</sup>Heath, T., & Bizer, C. (2011). Linked data: Evolving the web into a global data space. Springer.

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This role-based indication supports both:

- policy and governance analysis, by clarifying institutional responsibility and data stewardship; and
- technical system design, by informing access control, user interfaces, and interoperability priorities.

The assignment of a primary user role does not imply exclusive access or ownership. Data elements may be relevant to multiple actors within the system; the indicated role reflects the actor for which the data element is most directly relevant or for which responsibility typically lies.

## Core user roles

The following core user roles are used consistently across all information models in this document.

### **Learner**

Individuals using the system to explore learning opportunities, manage entitlements, enrol in learning, and evidence learning achievements.

### **Provider**

Organisations offering learning opportunities, courses, programmes, or credentials and responsible for their description, delivery, and quality.

### **Authority**

Public bodies responsible for regulation, funding, recognition, oversight, reporting, and quality assurance in relation to adult learning and qualifications.

### **System / Platform**

The ALE/ILA system itself, including automated processes, registries, interoperability services, and technical functions required to operate and link the system.

Additional roles (e.g. quality assurance agencies, employers, sector bodies) may be introduced in specific national or sectoral implementations, provided they can be logically mapped to or justified in relation to the core roles defined above.

## 4.3 ADULT LEARNING AND EDUCATION REGISTRY DATA MODEL

The Adult Learning and Education registry data model proposed in the following section focuses specifically on the exchange and management of Learning Opportunity and Learning Achievement data within the ALE system.

Note: This sub-model describes the information required for system operation and interoperability. It does not prescribe a database structure or technical implementation.

The diagram below provides a simplified overview of the key components/classes of the **Adult Learning and Education model**. At the centre of each instance of learning is a Learning Achievement (a credential, for example a certificate, a qualification, micro-credential etc). A Learning Achievement is obtained by participating in a Learning Opportunity e.g. an adult learning programme, training, or course. In cases where accreditation, licensing or other quality assurance mechanisms are in place for the Learning Achievement, they should be linked to an Organisation.

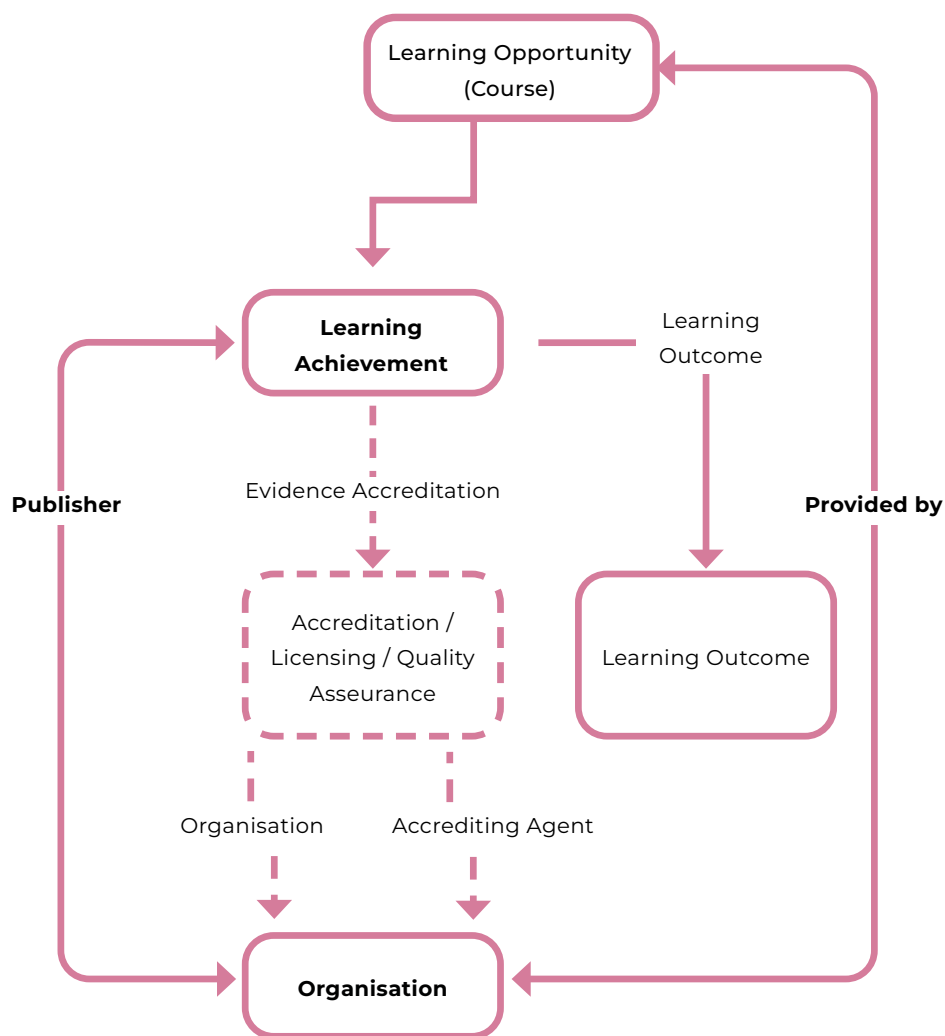


Figure 1 - Learning Achievements UML diagram

The following data model outlines the fundamental data fields that should be included in every Adult Learning and Education (ALE) registry.

As mentioned, this model is strongly influenced by the European model for Micro-credentials as outlined by the Council Recommendation on Micro-credentials<sup>11</sup> and it references the European Learning Model (ELM), to categorise each field according to the ELM respective class, thereby promoting interoperability, consistency, and structured data management across learning systems.

<sup>11</sup>Council of the European Union. (2022). COUNCIL RECOMMENDATION of 16 June 2022 on a European approach to micro-credentials for lifelong learning and employability. [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022H0627\(02\)](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022H0627(02))

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### 4.3.1 Alignment with the European model for micro-credentials

The approach to model Adult Learning and Education (ALE) registries in line with the principles of the Council Recommendation on Micro-credentials is driven by the need for alignment, interoperability, and flexibility in documenting learning achievements. The European approach for micro-credentials provides a structured and standardised approach that is in line with the needs emerged from the RALExILA research and the system modelling workshops. In this view, micro-credentials are specifically designed to support lifelong learning, offering modular and stackable learning opportunities and his flexibility is particularly relevant to adult learners, who, from recent studies and statistics, seems to engage more in non-formal and/or short learning and skills-based learning rather than formal pathways.<sup>12,13.</sup>

By embedding the core principles of the European micro-credentials approach, ALE registries can accommodate a wide range of learning formats, including formal, non-formal, and informal education, ensuring that diverse learning experiences are properly documented and valued.

This facilitates automated recognition, data portability, and integration across different institutions and labour markets. Additionally, the structured nature of the micro-credentials model, specifying learning outcomes, assessment methods, and workload estimates, brings greater transparency and quality assurance to ALE registries.

### 4.3.2 Alignment with external data models and ontologies


As mentioned in the previous chapters, the RALExILA proposed system model builds extensively on the European Learning Model (ELM) as a reference for describing learning opportunities, learning achievements, organisations, and related information objects. Where appropriate, the System Model also considers emerging European interoperability work that extends ELM for specific use cases.

The QualityLink<sup>14</sup> project provides relevant reference points for modelling and exchanging information about courses and micro-credentials and for representing quality information as structured, linkable evidence. QualityLink's primary focus is on formal education and, in particular, higher education, where comparable and cross-border information on courses and credentials is increasingly required.

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<sup>12</sup>OECD. (2025). Trends in adult learning: Insights from the Survey of Adult Skills (PIAAC). OECD Publishing.

<sup>13</sup>Eurostat. (2024). Adult education survey (AES): Participation in education and training. Publications Office of the European Union.



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Despite this focus, several of the conceptual challenges addressed by QualityLink are equally relevant for adult learning and non-formal education, especially in systems that make extensive use of micro-credentials. These include:

- the need to describe learning opportunities in interoperable ways;
- the challenge of representing quality information beyond simple accreditation status;
- the use of identifiers and references to enable aggregation of information from multiple sources; and
- the importance of transparency and provenance when publishing quality-related data.

QualityLink's technical specifications emphasise semantic interoperability through an ontology that extends ELM and an application profile that extends the ELM Learning Opportunity and Qualification profile through optional properties. This approach is particularly relevant for ALE/ILA systems, where quality information may be introduced progressively and must accommodate diverse learning contexts and governance arrangements.

QualityLink also highlights the role of identifiers, data source discovery, and exchange mechanisms across standards (e.g. ELM, OOAPI<sup>15</sup>, Edu-API<sup>16</sup>, OCCAPI<sup>17</sup>). These considerations inform the System Model's approach to interoperability and alignment with external systems.

Finally, for credential description and issuance, additional alignment may be considered with established credential formats such as Open Badges, as reflected for example in the SURF eduBadges metadata model<sup>18</sup>, which extends Open Badges v2.1<sup>19</sup>, also in view of supporting future global (not only European) interoperability of credentials and LERs (learning and employment records).

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<sup>14</sup>QualityLink project. Technical specifications and project outputs on course data exchange, quality indicators and ontology mapping. Available at: <https://quality-link.eu/project-outputs/>

<sup>15</sup>SURF. Open Onderwijs API (OOAPI) specification for exchanging educational data. Available at: <https://openonderwijsapi.github.io/>

<sup>16</sup>SURF. Edu-API: standardised APIs for exchanging education-related data. Available at: <https://edu-api.surf.nl/>

<sup>17</sup>Open Education initiatives. Open Course Catalogue API (OCCAPI) for course metadata exchange. Available at: <https://open-catalogue.org/occapi/>

<sup>18</sup>SURF. eduBadges metadata model and technical documentation. Available at: <https://edubadges.nl/technical-information>

<sup>19</sup>IMS Global Learning Consortium. Open Badges Specification (version 2.1). Available at: <https://www.imsglobal.org/activity/digital-credentials>

### 4.3.3 Adult Learning and Education registry data model table

| Element                              | Class                | Description   | ELM Reference            | Requirement | Primary user role |
|--------------------------------------|----------------------|---|--------------------------|-------------|-------------------|
| <b>Identification of the learner</b> | Person Identity      | Details that uniquely identify the Adult Learner  | ELM Person Identity      | Obligatory  | System / Platform |
| <b>Title of Learning Achievement</b> | Learning Achievement | The official designation of the Learning Achievement, awarded upon successful completion of the Learning Opportunity  | ELM Learning Achievement | Obligatory  | Provider          |
| <b>Country/ Region of the issuer</b> | Organisation         | Geographical location indicating where the issuing body is based.   | ELM Organisation         | Obligatory  | Authority         |
| <b>Awarding body</b>                 | Organisation         | The organisation responsible for awarding the Learning Achievement  | ELM Organisation         | Obligatory  | Authority         |
| <b>Issuing organisation</b>          | Organisation         | The organisation that issues a credential - often same as Awarding body but with digital credentials often has the particular role of certifying and sealing a credential | ELM Organisation         | Optional    | Authority         |
| <b>Date of issuing</b>               | Learning Achievement | The specific date when the Learning Achievement was awarded to the Adult Learner.   | ELM Learning Achievement | Obligatory  | System / Platform |
| <b>Learning outcomes</b>             | Learning Outcome     | Statements of what a learner knows, understands and is able to do on completion of a learning process (Knowledge, Skills, and Competences).                               | ELM Learning Outcome     | Obligatory  | Learner           |
| <b>Related skill(s)</b>              | Learning Outcome     | A link to a related skill. It should be provided using a controlled vocabulary of any existing framework (e.g. EU, national, sectorial etc.)                              | ELM Learning Outcome     | Optional    | Learner           |

|   |                      |  |                          |            |                   |
|---|----------------------|--|--------------------------|------------|-------------------|
| <b>Related skill(s)</b>   | Learning Outcome     | A link to a related skill. It should be provided using a controlled vocabulary of any existing framework (e.g. EU, national, sectorial etc.) | ELM Learning Outcome     | Optional   | Learner           |
| <b>Notional workload needed to achieve the learning outcomes</b>            | Learning Opportunity | The estimated amount of time required to achieve the specified learning outcomes.  | ELM Learning Opportunity | Obligatory | Learner           |
| <b>Level of the learning experience leading to the Learning Achievement</b> | Learning Opportunity | The qualification framework level (e.g., EQF or National Qualification Framework level) if applicable  | ELM Learning Opportunity | Optional   | System / Platform |
| <b>Type of assessment</b>   | Learning Opportunity | The method or approach used to evaluate the learner's achievement of the learning outcomes (e.g., exam, project, continuous assessment).     | ELM Learning Opportunity | Obligatory | Learner           |
| <b>Form of participation in the learning activity</b>                       | Learning Opportunity | The mode of delivery for the learning activity, such as online, in-person, or blended formats.   | ELM Learning Opportunity | Obligatory | Learner           |
| <b>Type of quality assurance applied</b>                                    | Accreditation        | The quality assurance processes or standards applied to ensure the credibility and recognition of the Learning Achievement.                  | ELM Accreditation        | Obligatory | Authority         |
| <b>Prerequisites needed to enrol in the learning activity</b>               | Learning Opportunity | Any required prior knowledge, skills, or qualifications necessary for enrolment in the learning activity.                                    | ELM Learning Opportunity | Optional   | Learner           |
| <b>Supervision and identity verification during assessment</b>              | Learning Opportunity | Measures in place to supervise assessments and verify the identity of adult learners to ensure integrity and authenticity.                   | ELM Learning Opportunity | Optional   | Authority         |
| <b>Grade achieved</b>   | Learning Achievement | The result or grade obtained by the adult learner upon completion of the assessment, reflecting their level of performance.                  | ELM Learning Achievement | Optional   | Learner           |

|   |                      |  |                          |          |           |
|---|----------------------|--|--------------------------|----------|-----------|
| <b>Integration/stackability options</b> | Learning Opportunity | Information on how Learning Achievement can be combined with other achievements to form or contribute to a larger achievement      | ELM Learning Opportunity | Optional | Authority |
| <b>Further information</b>              | Learning Opportunity | Additional details or context about the Learning Opportunity, such as links to supplementary resources or institution information. | ELM Learning Opportunity | Optional | Learner   |

## 4.4 INDIVIDUAL LEARNING ACCOUNT DATA MODEL

Note: This sub-model describes the information required for system operation and interoperability. It does not prescribe a database structure or technical implementation

The diagram below describes key components/classes relevant for the **Individual Learning Account model**, focusing on the interaction between the Adult Learner, the entitlement, and the Training Provider.

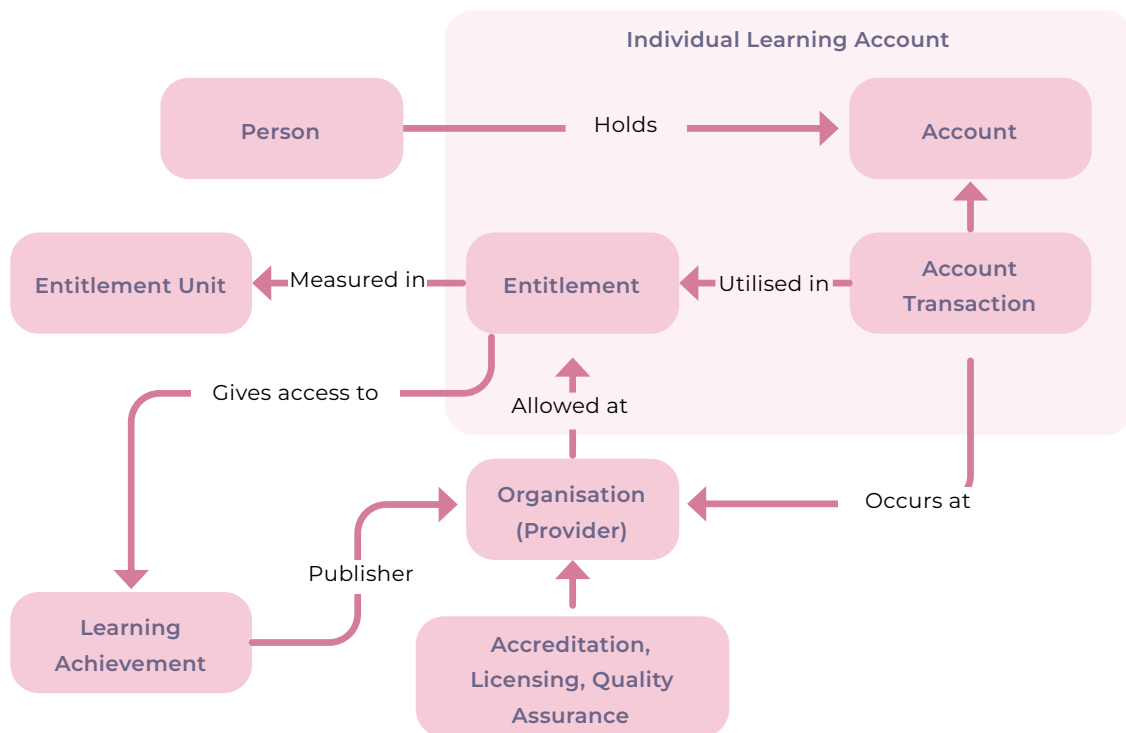


Figure 2 - Individual Learning Account UML diagram

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**The Person (Account Holder)** is the individual who holds an Individual Learning Account (ILA). This person is registered within the system and receives entitlements that can be used to access learning opportunities. The account holder has full control over selecting learning options from (accredited) providers, using their entitlement units to pay for courses, training, or other approved education services. Their engagement with the system includes account registration, entitlement allocation, course selection, and tracking their learning history.

The **Entitlement and Entitlement Units** represent the financial or non-financial credits allocated to an individual for learning purposes. These units can take various forms, such as money, vouchers, tokens, or learning hours, depending on the funding model. Each entitlement is governed by a set of rules that define eligibility, validity period, and the types of learning opportunities it can be used for. The system ensures that entitlements are allocated fairly and transparently, allowing individuals to access learning in alignment with national or employer-driven policies.

The **Training Provider** is an organisation that delivers education and training services within the ILA framework. For the purpose of accessing ILA funded training, providers are assumed to be accredited, licensed or quality assured and eligible (eligibility criteria established by each system/mechanism). While an ALE registry might include Learning Opportunities by all types of providers, entitlements through ILAs typically require some form of QA process (formal accreditation, proof of QA system in place, minimum eligibility criteria e.g. related to capacity etc.). Providers offer courses that individuals can access using their entitlement units as a form of payment. Once a person selects a course and redeems their entitlements, the provider confirms the registration and facilitates the learning process. Upon completion, the provider is responsible for reporting outcomes, such as attendance, assessment results, and credentials acquired, ensuring that the system maintains accurate records of an individual's learning achievements.

The following table provides an overview of data elements considered relevant for the Individual Learning Account data model based on the ALE/ILA capabilities, as described in Chapter 1, and the key components, as described in the simplified diagram at the beginning of this section.

As the implementation of ILAs can be complex and highly mutable, no provision of Required fields is made here.

Note also that while the ELM provides a comprehensive framework that aligns with many of the proposed data elements, particularly those related to personal identity and entitlements, certain elements, especially those pertaining to financial transactions and application statuses, are not explicitly covered within the current ELM structure. Incorporating these elements may necessitate extending the ELM.

## Individual Learning Account data model table

| Element                              | Class            | Description   | ELM Reference   |
|--------------------------------------|------------------|---|---|
| <b>User Account ID</b>               | Person Identity  | Unique identifier for the user within the system.   | ELM Person Identifier   |
| <b>User Role</b>                     | Person           | Defines whether the user is a learner, provider, administrator, policymaker, or funder.           | ELM Role  |
| <b>User Profile Information</b>      | Person           | Basic personal data (e.g., name, contact details, preferred language).                            | ELM Person (Given Name, Family Name, Contact Information, Preferred Language) |
| <b>Entitlement Type</b>              | Entitlement      | Specifies the funding type (e.g. public, private, co-funded) of the ILA entitlement               | ELM Entitlement Type  |
| <b>Eligibility Criteria (person)</b> | Entitlement      | Rules determining who qualifies for entitlements (e.g., employment status, sector, income level). | ELM Entitlement Eligibility Criteria  |
| <b>Entitlement Allocation Amount</b> | Entitlement      | The financial value or learning credits assigned to the user.                                     | ELM Entitlement Value   |
| <b>Entitlement Balance</b>           | Entitlement      | Remaining funding or credits available for the user.  |   |
| <b>Entitlement Unit Type</b>         | Entitlement Unit | Specifies whether the funding is a grant, voucher, tax credit, or subsidy.                        |   |
| <b>Entitlement Unit Amount</b>       | Entitlement Unit | The value assigned to a single unit.  |   |
| <b>Entitlement Unit Expiry Date</b>  | Entitlement Unit | When the unit must be used before it expires.   |   |
| <b>ILA Application Status</b>        | Application      | Status of the user's ILA application (e.g., pending, approved, rejected).                         |   |
| <b>ILA Approval Date</b>             | Application      | When the ILA was approved.  |   |
| <b>Payment Processing Status</b>     | Transaction      | Whether a payment for a course has been completed, pending, or refunded.                          |   |
| <b>Transaction History</b>           | Transaction      | A record of all financial transactions, including course payments, refunds, and top-ups.          |   |

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## 4.5 COMPLEMENTARY DATA FOR AN INTEGRATED ALE/ILA SYSTEM

In addition to core registry and Individual Learning Account (ILA) data, an integrated ALE/ILA system may rely on a range of complementary data domains to support user-centred services, effective governance, and evidence-informed policy-making. These complementary data elements do not define the existence of learning opportunities or entitlements, but enhance the system's analytical, decision-support, and personalisation capabilities.

Such data supports key system objectives, including improving learner engagement and navigation, enabling meaningful skills and credential management, and generating insights for monitoring, evaluation, and policy development. Complementary data may be sourced from providers, authorities, learners, system processes, or external datasets, and is typically introduced progressively, depending on national priorities, feasibility, and governance arrangements.

The following sections describe key categories of complementary data that can be integrated into an ALE/ILA system, including user engagement and personalisation data, skills and credentials-related data, system insights and policy-support data, and quality indicators and quality evidence. Together, these data domains strengthen transparency, trust, and the overall value of the system for all stakeholders.

### 4.5.1 Quality indicators and quality evidence

In addition to describing learning opportunities, credentials, and entitlements, an ALE/ILA system may integrate quality-related data to support transparency, trust, and informed decision-making. Quality indicators and quality evidence complement formal quality assurance processes by providing contextual, comparable, and user-relevant information about learning opportunities, providers, and credentials.

Quality-related data is particularly relevant in adult learning and non-formal education contexts, where learning provision is diverse and where traditional accreditation alone may not fully capture aspects such as relevance, accessibility, learner experience, or recognition potential. Rather than relying on single composite scores, quality information is best represented as individual, interpretable indicators, accompanied by clear information on their source and status.

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## Conceptual approach

This System Model adopts a quality evidence approach, based on the RALExILA research, and further inspired by emerging European interoperability work (e.g. QualityLink and the Higher Education Interoperability Framework), leading to an approach to quality that is represented through structured observations that:

- are linked to a specific subject (e.g. provider, learning opportunity, credential);
- refer to a defined quality domain;
- include provenance and verification information; and
- may evolve over time.

Quality indicators are treated as complementary data and as an optional extension of the core ALE/ILA data model. This allows systems to introduce quality-related data progressively, starting with feasible, self-declared or authority-verified indicators, and expanding to additional sources as governance and data availability mature.

## Quality domains

A holistic view of quality may consider multiple domains, including for example:

- relevance and accuracy of learning content;
- teaching and assessment approaches;
- accessibility and inclusivity;
- learner-centred experience and outcomes; and
- institutional or organisational reputation.

Not all of these domains need to be implemented from the outset of an ALE/ILA system. The selection and prioritisation of domains and indicators should reflect national policy objectives, the characteristics of adult learning provision and data feasibility.

## Link and integration with other complementary data domains

Quality indicators and quality evidence reinforce and complement other data domains within an integrated ALE/ILA system. They do that by strengthening the system's capacity to support users, manage learning outcomes, and inform governance. Quality-related information, such as delivery modes, accessibility information, and learner feedback contribute directly to user engagement and personalisation, enabling learners to make informed choices and receive more tailored guidance.

At the same time, indicators linked to recognition, assessment practices, and stackability enhance skills and credentials management by improving the interpretability, comparability, and portability of learning achievements and micro-credentials across contexts.

When aggregated at system level, quality-related data also supports system insights and policy development, providing evidence for monitoring provision, identifying gaps or imbalances, and informing funding decisions and continuous system improvement.

## Governance and feasibility considerations of quality information

Given the diversity of adult learning provision, quality indicators may originate from different sources, including:

- provider self-declarations and self-assessment approaches,
- authority or quality assurance registers,
- learner feedback mechanisms, or
- system-derived data.

The System Model therefore emphasises the importance of recording source type, verification status, and reference period for quality-related data. This ensures transparency and allows users and decision-makers to interpret quality information appropriately.

The table below describes the core elements of a Quality Indicator Observation, which captures a single, interpretable observation of quality-related information, together with its provenance and status.

The table is illustrative and defines information needs rather than implementation structures.

## Conceptual Model – Quality-related information

| Element            | Class                       | Description   | Requirement |
|--------------------|-----------------------------|---|-------------|
| <b>indicatorID</b> | QualityIndicatorObservation | Identifier of the indicator from a controlled vocabulary                              | Obligatory  |
| <b>domain</b>      | QualityIndicatorObservation | Quality domain to which the indicator belongs   | Obligatory  |
| <b>subject</b>     | QualityIndicatorObservation | The entity described (Provider / Learning Opportunity / Credential / optional System) | Obligatory  |
| <b>value</b>       | QualityIndicatorObservation | Observed indicator value (numeric, categorical, text)                                 | Obligatory  |

|                                  |                             |  |            |
|----------------------------------|-----------------------------|--|------------|
| <b>sourceType</b>                | QualityIndicatorObservation | Source type (self-declared, authority-verified, third-party, system-derived) | Obligatory |
| <b>verificationStatus</b>        | QualityIndicatorObservation | Status of verification (self-declared, verified, contested, expired)         | Obligatory |
| <b>referencePeriod</b>           | QualityIndicatorObservation | Time window or date the observation refers to                                | Optional   |
| <b>evidenceURI</b>               | QualityIndicatorObservation | Link to supporting evidence or reference                                     | Optional   |
| <b>lastUpdated</b>               | QualityIndicatorObservation | Timestamp of last update   | Optional   |
| <b>licenceOrReuse-Constraint</b> | QualityIndicatorObservation | Licensing or reuse conditions where relevant                                 | Optional   |

## 4.5.2 User engagement & personalisation

A comprehensive and integrated ALE/ILA system must go beyond structured entitlements and learning records by incorporating user engagement data that enhances accessibility, usability, and personalisation, as well as the provision of Skills management.

This includes:

- Alter and Notification data – Allows for prompting platform or email notifications and alerts.
- User feedback and support data – provision of feedback for the platform, bug reports and possible ticketing for user support.
- Learner Feedback & Satisfaction Ratings – Collecting learner input on courses, providers, and funding experiences to generate provider/course ratings and inform system improvements.

## 4.5.3 Skills and credentials management

An integrated ALE/ILA system should support learners in understanding, documenting, and using their skills and learning achievements, while facilitating recognition and progression across education, training, and employment contexts. Rather than positioning the system as a central repository for skills or credentials, this complementary data domain focuses on enabling structured references, linkages, and interoperability that support learner mobility, career development, and lifelong learning pathways.

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Skills and credentials management may draw on structured learning opportunity data and, where available, on optional representations of learning achievements and credentials. Where credential issuance, storage, or skills portfolios are handled by external platforms (e.g. national credential services, Europass, provider systems, or digital credential wallets), the ALE/ILA system may maintain references, identifiers, and verification links to support transparency, recognition, and policy analysis.

While skills and competences may appear secondary from the perspective of a registry primarily focused on learning opportunities and entitlements, they are of central importance for learners. For adult learners, skills and competences represent the meaningful outcomes of learning, connecting individual learning activities to employability, career progression, and personal development. Reflecting skills and competences in the data model therefore allows learning opportunities and credentials to be interpreted not only as courses completed, but as contributions to a learner's evolving skills profile.

By enabling structured references to skills and competences, aligned where appropriate with recognised frameworks (e.g. ESCO, LifeComp<sup>20</sup>, DigComp<sup>21</sup>), the ALE/ILA system supports learner self-understanding, recognition of prior learning, and informed decision-making, while creating the foundation for guidance, progression pathways, and future interoperability with labour-market and career services.

Key capabilities supported through Skills and Credentials management include the following.

- User skills assessment and management: enabling learners to assess and describe their skills, align them with recognised skills or competence frameworks (e.g. ESCO), and reference externally managed skills profiles or portfolios where applicable.
- Recognition of Prior Learning (RPL): supporting the submission and management of evidence related to prior learning and learning achievements, including references to certifications or digital credentials, to facilitate validation and recognition processes by providers or competent authorities.
- Learning achievement and credential referencing: enabling the association of learning achievements with learning opportunities and, where relevant, with credential definitions and issued credentials, without requiring the system to store full credential payloads.

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<sup>20</sup>European Commission, Joint Research Centre (2020). LifeComp: The European Framework for Personal, Social and Learning to Learn Key Competence. Luxembourg: Publications Office of the European Union. <https://data.europa.eu/doi/10.2760/302967>

<sup>21</sup>European Commission, Joint Research Centre (2022). The Digital Competence Framework for Citizens (DigComp 2.2). Luxembourg: Publications Office of the European Union. <https://data.europa.eu/doi/10.2760/115376>

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- Learner preferences and learning goals: allowing users to express personal learning objectives, preferred fields of learning, or career aspirations, which can inform guidance, recommendations, and progression pathways.
  - Learner progress tracking: capturing participation in learning activities and progression through formal and non-formal learning, supporting both individual learner awareness and aggregated system-level analysis.

## **Credentials: credential types and issued credentials**

While the ALE/ILA system is primarily conceived as a register of learning opportunities and entitlements, it should be designed in a way that enables the issuance, referencing, and reuse of credentials derived from those learning opportunities. Credential issuance and storage are therefore not core system requirements, but the System Model is credential-ready by design.

This section introduces an optional credential data layer that allows learning opportunity data, structured in line with European micro-credential recommendations, to be reused for credentialing, verification, and recognition purposes. Credentials may be issued, stored, and managed externally (e.g. by providers, sectoral platforms, or national and European credential services), while the ALE/ILA system maintains structured references where needed.

### **Conceptual distinction: Credential Type and Credential**

To support interoperability and avoid conflating definition with issuance, the System Model distinguishes between:

1. Credential Type – the definition of a credential that may be issued, describing its intended learning outcomes, assessment approach, and recognition characteristics; and
2. Credential (Issued Credential) – an instance of a credential awarded to a specific learner at a specific point in time.

A Credential Type describes the characteristics of a credential that may be awarded upon successful completion of a learning opportunity. It is typically stable over time and may be reused across multiple learning offerings or cohorts.

Credential Types may be defined and maintained by providers, authorities, or recognised sectoral bodies, and may reference learning opportunity data already captured in the ALE/ILA registry.

## Credential Type (definition-level, optional)

| Element                                 | Class   | ELM Reference                             |
|---|---|---|
| <b>Credential Type identifier</b>       | Unique identifier of the credential type                      | ELM Learning Achievement                  |
| <b>Title</b>                            | Official name of the credential type                          | ELM Learning Achievement                  |
| <b>Description</b>                      | Description of the purpose and scope of the credential        | ELM Learning Achievement                  |
| <b>Learning outcomes reference</b>      | Reference to learning outcomes associated with the credential | ELM Learning Outcome                      |
| <b>Assessment approach</b>              | Method used to assess achievement of learning outcomes        | ELM Learning Assessment                   |
| <b>Workload</b>                         | Notional workload required to achieve the credential          | ELM Learning Opportunity                  |
| <b>Awarding body</b>                    | Organisation formally responsible for recognition or award    | ELM Awarding                              |
| <b>Eligible issuer(s)</b>               | Organisation(s) authorised to issue the credential            | ELM Awarding                              |
| <b>Quality assurance underpinning</b>   | Reference to QA processes or quality evidence                 | ELM Accreditation and Quality Assurance   |
| <b>Stackability / integration rules</b> | Conditions for combining with other credentials               | ELM Qualification (extensions)            |
| <b>Level alignment</b>                  | Reference to EQF/NQF level where applicable                   | ELM Qualification                         |
| <b>Alignment references</b>             | References to external frameworks or standards                | ELM Alignment and controlled vocabularies |

Notes: Minimum metadata expectations are defined at Credential Type level, allowing different types of credentials (e.g. micro-credentials, modules, certificates) to express appropriate levels of structure without imposing a single mandatory template, despite the registry model being modelled in line with the European micro-credential model

ELM does not use “Credential type” as a class; the Concept is realised through “Qualification” or “Learning Achievement Specification”

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## Credential (issued instance, reference-oriented)

A Credential represents the awarding of a credential to a specific learner. In line with the overall system scope, the ALE/ILA system does not require full storage of credential payloads. Instead, credentials may be referenced, with identifiers and verification links pointing to external credentialing systems.

This enables traceability, verification, and policy analysis without requiring the ALE/ILA system to act as a credential repository or wallet.

| Element                             | Class  | ELM Reference                        |
|-------------------------------------|--|--------------------------------------|
| <b>Credential identifier</b>        | Unique identifier of the issued credential   | ELM Learning Achievement             |
| <b>Credential Type reference</b>    | Reference to the corresponding Credential Type   | ELM Learning Achievement             |
| <b>Credential holder</b>            | Reference to the learner to whom the credential was awarded  | ELM Person                           |
| <b>Issuer</b>                       | Organisation that issued the credential  | ELM Awarding                         |
| <b>Awarding body</b>                | Organisation responsible for issuing learning achievements   | ELM Awarding                         |
| <b>Issue date</b>                   | Date the credential was issued   | ELM Awarding                         |
| <b>Status</b>                       | Current status (e.g. valid, revoked, expired)  | ELM Learning Achievement (extension) |
| <b>Verification / evidence link</b> | URI or service endpoint for verification   | ELM Evidence                         |
| <b>Learning outcomes reference</b>  | Reference to the learning outcomes associated with the credential (inherited from Credential Type; may optionally include instance-specific refinements) | ELM Learning Outcome                 |
| <b>Credential payload reference</b> | Reference to an external credential representation   | ELM Evidence / Web Resource          |

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#### 4.5.4 System insights and policy support

A data-driven ALE/ILA system should include analytics and policy-relevant data to improve decision-making, system governance, and regulatory compliance.

- User Engagement analytics data – Monitoring engagement patterns, such as course searches, skills and learning achievement data to improve learner support services.
- System Analytics – Aggregates user activity data, as well as system interactions (e.g. login frequency) to inform continuous platform improvements.
- Learning Outcomes Benchmarking Data – Compares skill acquisition and achievement across courses and user demographics to assess effectiveness.
- Skills Gap & Labour Market Data – Compares in-demand skills with learner profiles to identify gaps, inform training needs and help with funding decisions for governments.
- Regulatory Compliance & Audit Logs – Captures data to ensure compliance with GDPR, quality assurance regulations, and system integrity requirements.

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## 4.6 CONTROLLED VOCABULARIES REFERENCE LIST

The following non-exhaustive list provides illustrative examples of controlled vocabularies that may be referenced in an ALE/ILA system to support semantic interoperability, data consistency, and alignment with European reference frameworks. The selection and use of vocabularies remain a national implementation choice.

Accreditation

- suggested reuse of [EDC Controlled List of Accreditation Types](#)

Learning Entitlement

- suggested reuse of [ESCO Occupations](#)

Learning Outcomes – Skills and competences

- suggested reuse of [ESCO Skill Pillar concept types](#)

Occupations / target roles

- suggested reuse of [ESCO Occupations](#)

Locations

- suggested reuse of [Countries and Territories Authority List](#)

Language of instruction

- suggested reuse of Language Named Authority List

Education level

- should be defined and maintained on national level – suggested digitisation of [ISCED \(2011\)](#)
- European Qualifications Framework reference where applicable – [reuse of EQF overview](#)

Learning opportunity - Thematic area

- suggested reuse of the [ISCED-F 2013 Classification](#)

Mode of delivery (for Learning opportunities)

- suggested reuse of [EDC Controlled List of Mode of Delivery](#)

Credential type (where credentials are referenced)

- Controlled list for credential categories (e.g. micro-credential, certificate, module), defined nationally and aligned with EU micro-credential terminology where appropriate

# 5. Glossary

## **ALE Registry**

An ALE registry is a system or platform that collects, organises, and makes accessible information about learning opportunities for adults. It is designed to help adults find relevant courses, programmes, and resources to improve their skills, knowledge, and qualifications.

## **API (Application Programming Interface)**

An API defines protocols for software applications to communicate, enabling interoperability, data exchange, and integration of new features across platforms.

## **Authentication & Authorisation**

- Authentication: Verifies a user's identity via passwords, biometrics, or tokens.
- Authorisation: Determines access rights and permissions for authenticated users.

## **Awarding Body**

The organisation that issues qualifications (certificates, diplomas, or titles) formally recognising the learning outcomes, typically following an assessment procedure.

## **Controlled Vocabulary**

A controlled vocabulary defines a set of concepts, possibly hierarchically organised. Sub-types include code lists, taxonomies, thesauri. Such semantic assets are usually defined by using SKOS. Examples are language, regional and country codes.

## **Credential**

A credential is a formal or non-formal attestation of learning achievement awarded to a learner by an issuing organisation. In the context of the ALE/ILA system, credentials may be referenced without being stored or issued directly by the system.

## **Credential Type**

A Credential Type describes the definition and characteristics of a credential that may be issued, including learning outcomes, assessment approach, workload, and quality assurance expectations. Credential Types provide a stable reference for issued credentials and support comparability and stackability.

## **Data Governance**

Data Governance refers to the development and enforcement of policies related to the management of data.

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## **Data Management**

Data Management (DM) is the development, execution, and supervision of plans, policies, programs, and practices that deliver, control, protect, and enhance the value of data and information assets throughout their lifecycles. It is the implementation of architectures, tools, and processes to achieve stated data governance objectives.

## **Data Model**

A data model is an abstract model that organises elements of data and standardises how they relate to one another and to the properties of real-world entities.

## **Data Policy**

A set of broad, high-level principles which form the guiding framework in which data management can operate. More specifically, data policies govern data management, data interoperability and standards, data quality, data protection and information security.

## **Dataset**

A Dataset is a collection of data, published or curated by a single source, and available for access or download in one or more formats.

## **ESCO (European Skills, Competences, Qualifications, and Occupations)**

ESCO is the EU classification system for skills, competences, qualifications, and occupations, supporting job matching, career guidance, and education planning.

## **Europass**

Europass is an EU toolset for documenting skills, qualifications, and experiences. It includes a CV builder, cover letter editor, and digital credentials for mobility across Europe

## **European Learning Model (ELM)**

ELM is a data model by the European Commission that standardises learning opportunities, qualifications, and credentials for interoperability across Europe.

## **General Data Protection Regulation (GDPR)**

GDPR is the EU's data protection law ensuring individuals' control over personal data. It applies to any organisation processing EU residents' data.

## **Individual Learning Account (ILA) platform**

Online platform with features to manage funding or credit (allocate and use) and personal accounts with information on programmes and achievements, through public, private or hybrid funding

## **Issuer**

The organisation that technically issues a credential to a learner, for example by generating a digital credential or certificate.

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## **Linked Open Data**

Linked Open Data (LOD) is a set of design principles developed to share machine-understandable data on the web employing the Resource Description Framework (RDF) and the Hypertext Transfer Protocol (HTTP). Linked Data is intended for access by both humans and machines.

## **Machine-readable Format**

Machine-readable format means a file format structured so that software applications can easily identify, recognise, and extract specific data, including individual statements of fact, and their internal structure.

## **Metadata**

Structured information about a resource that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage that resource. It ensures that the context for how data was created, analysed, or stored is clear, detailed, and therefore, reproducible. Metadata is often referred to as data about data.

## **Micro-credentials**

Micro-credentials certify small volumes of learning, assessed against clear standards. They are flexible, stackable, and quality assured, supporting lifelong learning and labour market needs.

## **Ontology**

A formal model that allows knowledge to be represented for a specific domain. An ontology describes the types of things that exist (classes), the relationships between them (properties) and the logical ways those classes and properties can be used together (axioms).

## **Semantics**

In the humanities, the term “semantics” relates to meaning, such as the meaning of a word. When used in the context of the Semantic Web, however, the term refers to the formally defined meaning that can be used in the computation

## **Semantic Interoperability**

The ability of organisations to interact towards mutually beneficial goals, involving the sharing of information and knowledge between these organisations, through the business processes they support, by means of the exchange of data between their ICT systems. In the European Interoperability Framework (EIF), semantic interoperability covers both semantic and syntactic aspects.

## **Taxonomy**

Taxonomy is a classification which distinguishes categories and allows employment of hierarchy forming relations in order to allow organisation of knowledge.

## Technical specifications

The technical specifications use the internationally accepted definitions and concept of “learning achievement,” “qualifications”, “credentials”, “micro-credentials”, “National Qualifications Frameworks”, “National qualifications systems”, “Registers of qualifications”, “Quality assurance”, “Accreditation”, as endorsed or published by UNESCO-UNEVOC, European Commission, European Qualifications Framework, Europass and Cedefop.

## UML

Unified Modelling Language (UML) is standardised visual modelling for specifying, visualising, constructing, and documenting the artefacts of software systems.

## URI

A Uniform Resource Identifier (URI) is a string of characters that unambiguously identifies a particular resource or concepts on the web. URIs can be used to uniquely identify virtually anything including a physical building or more abstract concepts such as colours.

## Vocabulary

A collection of “terms” for a particular purpose. Vocabularies can range from simple such as the widely used RDF Schema, FOAF and Dublin Core Metadata Element Set to complex vocabularies with thousands of terms, such as those used in healthcare to describe symptoms, diseases, and treatments. Vocabularies play a significant role in Linked Data, specifically to help with data integration.

## Web Accessibility Directive

This EU directive mandates accessibility for public sector websites and apps, ensuring content is perceivable, operable, and inclusive, especially for people with disabilities.

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# 7. Annexes

## 7.1 ANNEX 1 - OVERVIEW OF COMPETENCE AND SKILLS FRAMEWORKS

The following overview provides a non-exhaustive list of European and international competence and skills frameworks that may be relevant for future alignment of ALE/ILA systems. The frameworks listed are not mandatory for implementation. They are presented as reference points for inspiration, interoperability planning, and progressive enhancement of skills-related data.

### 7.1.1 Cross-sector European skills and competence frameworks

**ESCO (European Skills, Competences, Qualifications and Occupations)** provides a multilingual taxonomy of skills, competences, qualifications, and occupations.

*Relevance for ALE/ILA: ESCO can be used to tag learning outcomes, describe skills targeted by learning opportunities, support guidance and matching services, and enable interoperability with labour-market and employment systems.*

**European Qualifications Framework (EQF)** define learning outcomes across eight levels in terms of knowledge, skills, and responsibility/autonomy.

*Relevance for ALE/ILA: EQF descriptors can support level alignment of learning opportunities, credential types, and learning achievements, where such alignment is appropriate.*

### 7.1.2 Thematic European competence frameworks

**DigComp (Digital Competence Framework for Citizens)** defines digital competences across proficiency levels.

*Relevance for ALE/ILA: Useful for structuring digital skills-related learning opportunities, tagging learning outcomes, and supporting digital upskilling pathways.*

**EntreComp (Entrepreneurship Competence Framework)** describes entrepreneurial competences relevant across education and work contexts.

*Relevance for ALE/ILA: Supports learning opportunities related to entrepreneurship, self-employment, and innovation-oriented adult learning.*

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**LifeComp (Personal, Social and Learning-to-Learn Competences)** focuses on transversal competences such as self-regulation, collaboration, and learning to learn.

*Relevance for ALE/ILA: Particularly relevant for non-formal adult learning, employability pathways, and lifelong learning orientation.*

### **7.1.3 National and sectoral competence frameworks**

#### **National competence and skills frameworks (linked to NQFs)**

Many countries maintain national competence frameworks aligned with their National Qualifications Frameworks.

*Relevance for ALE/ILA: National frameworks can be used to describe learning outcomes and skills in a way that reflects domestic policy priorities, while being mapped to European reference frameworks where needed.*

#### **Sectoral and professional competence frameworks**

Sectoral frameworks developed by professional bodies or social partners (e.g. health, education, engineering, ICT).

*Relevance for ALE/ILA: These frameworks are particularly relevant for regulated professions, continuing professional development (CPD), and sector-specific upskilling initiatives.*

### **7.1.4 International and global reference frameworks**

#### **OECD skills frameworks (e.g. PIAAC-related constructs)**

OECD frameworks describe skills relevant to adult competencies and labour-market participation.

*Relevance for ALE/ILA: Useful for policy analysis, benchmarking, and system-level insights into skills supply and demand.*

**UNESCO competence and TVET-related frameworks** address competences linked to lifelong learning, adult education, and vocational training.

*Relevance for ALE/ILA: Relevant for international comparability and for systems engaging in global cooperation or development-oriented initiatives.*

**O\*NET** (illustrative example) is a comprehensive occupational and skills database used primarily in the United States.

*Relevance for ALE/ILA: Illustrative example of a large-scale skills and occupations system; may inform interoperability approaches in international contexts but is not intended as a European reference.*



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