

Common
Education
Data
Standards

CEDS CONCEPTUAL MODEL

Version 8.0.0

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INTRODUCTION

The Common Education Data Standards (CEDS) initiative contains a broad scope of data element definitions spanning much of the P-20W (early learning through postsecondary and workforce) spectrum and provides context for understanding the standards' interrelationships and practical utility. CEDS focuses on data elements and modeling across early learning, K-12, postsecondary, career and technical education (CTE), adult education, and workforce sectors, and it has data domains for Assessments, Competencies, Credentials, Learning Resources, Authentication and Authorization, Facilities, and Implementation Variables.

CEDS includes data definitions at multiple levels:

- **Domains** organize data into the areas of Early Learning, K-12, Postsecondary, Career and Technical, Adult Education, Workforce, Assessments, Credentials, Competencies, Learning Resources, Facilities, Implementation Variables, and Authentication and Authorization.
- **Entities** represent a class of a Person, Organization, Role, Event, Resource, or Relationship.
- **Elements** are attributes of entities.
- **Option Sets** define acceptable values for elements.
- **Related Uses of the Elements** include references to the CEDS Connect Tool, which allows stakeholders across P-20W to define and share metrics and indicators such as graduation rates, program enrollment, employment outcomes, and academic outcomes that use CEDS-defined data elements.

CEDS includes data models that organize the common definitions to serve different purposes:

- **Conceptual Model.** The Conceptual Model is a canonical organization of entities based on a foundation of Person, Organization, Resource, and Relationship.
- **Domain Entity Schema (DES).** The DES is used as a web interface on the CEDS website and within the CEDS tools, Align and Connect, to organize and present data element definitions organized by domain.
- **Normalized Data Schema (NDS)/Integration Data Store (IDS).** A P-20W logical NDS and physical IDS relational data model are based on super classes/categories in the Conceptual Model.
- **Data Warehouse Reporting Data Store (DW RDS).** The P-20W DW RDS is a star-schema data model designed initially to support state reporting needs.

The latest version of the standards and related resources can be found at the CEDS website, <http://ceds.ed.gov>.

This document focuses on the Conceptual Model and represents a consensus of key stakeholders about the key entities and relationships that underlie CEDS.

1.0 THE CEDS CONCEPTUAL MODEL

This overview of the CEDS Conceptual Model contains general information that can be applied broadly across the four domains of P-20W education and training:

1. Early Childhood
2. K-12
3. Higher Education
4. Workforce (including military)

The CEDS Conceptual Data Model is built on four key concepts: Person, Organization, Resource, and Relationship. These key concepts are modeled as CEDS Entity super classes. They also serve as broad categories for understanding and organizing P-20W longitudinal data. The model supports longitudinal data, recognizing that data and relationships change over time:

- People have roles in Organizations for specific periods of time.
- The status of a Person, Organization, Resource, or Relationship may be different at different points in time.
- Events involving one or more Persons, Organizations, Resources, or Relationships occur at a point in time and over periods of time.

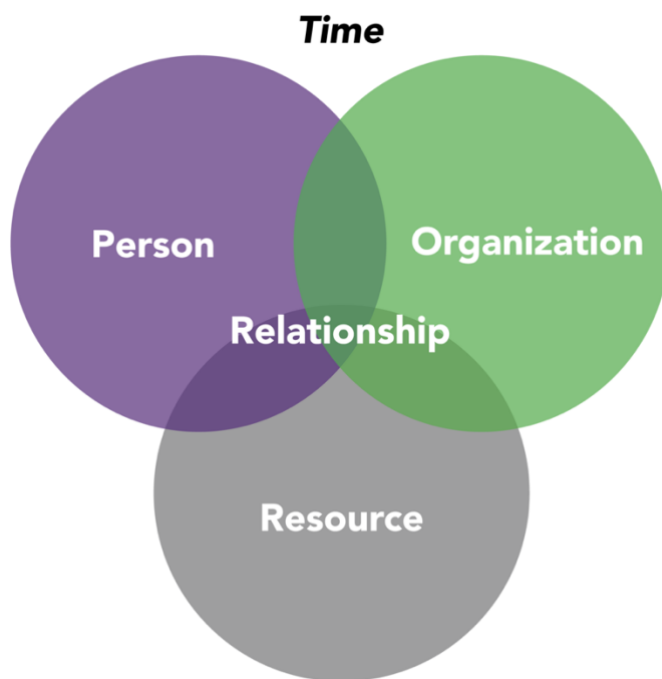


Figure 1. A diagram showing connections among the key concepts of the CEDS Conceptual Model

Key Concepts (super classes)

Concept	Definition	Clarification/Examples
Person	A human being, alive or deceased, as recognized by each jurisdiction's legal definitions.	A person may have more than one Role (See Role).
Organization	An organized group of one or more people with a particular purpose.	Examples: <ul style="list-style-type: none"> • Course Section • K-12 School • Postsecondary Institution • Local Education Agency • State Education Agency • Program • Employer • Military Branch, Division, Squad, etc. • Professional Association
Resource	Anything could be a resource, depending on its context defined in metadata.	Broadly applicable to creative works and information resources. Examples: <ul style="list-style-type: none"> • Learning Resource • Competency Definition • Credential Definition • Assessment Item (Definition)
Relationship	People, Organizations, and Resources can all have standard association types within and across concepts.	Example association types: Enrolled In, Is Child Of, Precedes, Is Part Of, Is Equivalent To, Is Related To, Awards, Is Awarded, Created By. Example uses: <ul style="list-style-type: none"> • Relationship of a Person to an Organization • Relationship of a Person to a Resource • Relationship of an Organization to a Resource • Relationship between a Resource and a Resource (e.g., alignment between a Learning Resource and Competency Definition)

Relationship Concepts

The CEDS Conceptual Data Model includes additional concepts to support relationships for all aspects of P20-W education and training. Key types include Role and Event relationships.



Figure 2. A version of the conceptual model showing relationship types, Role and Event.

Concept	Definition	Clarification/Examples
Role	People have roles in Organizations for specific periods of time.	Examples: <ul style="list-style-type: none"> • K-12 Student • Postsecondary Student • Adult Education Student • Parent/Guardian • Employee • Educator • Credential Issuer
Event	People and Organizations have events with each other and with Resources on or over specific periods of time.	Event data may reflect changes in Relationships over time. Examples: <ul style="list-style-type: none"> • Enrollment Event • Employment Event • Credential Award/Assertion Event records may include actions, evidence, result/grade, verification, endorsement start date, end date, credits earned, term, license number, status, role, etc.

In addition, relationships between a Person and a Resource could signify, for example, that the person has been awarded a credential, mastered a competency, authored a resource, or owns a resource. Relationships between an Organization and a Resource could represent ownership, authorship, stewardship, etc.

1.1 EXAMPLE SUBCLASSES

CEDS Entities may be further defined as types of one of the four key concepts (super classes). For example, a “Postsecondary Institution” is a type of “Organization” (an organized group of one or more people with a particular purpose.) As a special type of Organization, the Postsecondary Institution has all of the attributes of the “Organization” along with additional postsecondary-specific attributes.

(This section is illustrative. Please see the data standard for complete list of CEDS entities.)

Organization

Subtypes of Organization:

- Employer
- K12 School
- Local Education Agency (LEA)
- Intermediate Educational Unit (IEU)
- State Education Agency (SEA)
- Recruiter
- Employee Benefit Carrier
- Employee Benefit Contributor
- Professional Membership Organization
- Education Institution
- Staff Development Provider
- Facility
- Course
- Course Section
- Program
- Postsecondary Institution
- Adult Education Provider
- Service Provider
- Affiliated Institution
- Governing Board
- Credentialing Organization
- Accrediting Organization
- Education Organization Network
- IDEA Part C Lead Agency

- Charter School Management Organization
- Charter School Authorizing Organization
- Emergency Response Agency

Resource

Resource is a broad category for CEDS Entities that includes information assets or metadata objects other than people and organizations. Resource entities defined in this document include:

- **Competency Definition.** A resource that includes a statement that describes a capability or behavior that a person may learn or be able to do within a given situation and environment, and may include definitions of the potential levels of mastery and metadata related to that statement.
- **Credential Definition.** A resource that defines a competency or qualification, achievement, personal or organizational quality, experience, attribute, or aspect of an identity typically used to indicate suitability (See: Credential Engine's [ceterms:Credential](#)).
- **System.** A collection of components organized to accomplish a specific function or set of functions. (In this context an information system that functions as an Actor in a use case.)
- **Learning Resource.** The content, materials, or informational resources that support learning.
- **Assessment Item.** A specific prompt that defines a question or protocol for a measurable activity that triggers a response from a person used to determine whether the person has mastered a learning objective.

Event

Event is a broad category for CEDS Entities that includes information that captures changes in Relationships or properties of other entities over time.

- **Competency Assertion.** An assertion by an issuer about a person regarding their competency as of a certain date.
- **Credential Award.** A record that includes an assertion by an agent/issuer that documents a person's or organization's qualification, achievement, personal or organizational quality, experience, attribute, or aspect of an identity as of a certain date or date range.

2.0 APPLYING THE MODEL (INFORMATIVE)

The following section offers examples of applications for the CEDS Conceptual Model using the following structure:

- **Context.** Each area focuses on the application of the six key concepts of the model to a particular context.
- **Key Concepts.** Any concepts used in the context are defined.
- **Use Cases.** Sets of use cases are defined first by a scenario. Specific use cases define actors (people, organizations, and systems) and events.

The following section is intended to illustrate cases in which the standard concepts may be applied. These use cases are not standards. This document is intended to be a living document that will grow with additional use cases over time. It is also intended to support coordination across standards. Feedback on these examples may help inform future development of CEDS and may be updated to reflect new or changed standards.

2.1. Enrollment and Rostering

2.1.1. Context

Education organizations often have relationships with each other, including a primary taxonomical relationship that is the source of legal authority and accountability. Any person can have one or more roles in one or more organizations for specific periods of time. The relationship between an organization and a person with a role with a start and end date can be considered “enrollment.”

2.1.2. Key Concepts

- A. Person
- B. Organization
- C. Role

2.1.3. Use Cases

2.1.3.1. U.S. K-12 Enrollment

Scenario: Each K-12 school (an **organization**) is part of one local education agency (LEA) (an **organization**). Each LEA is part of one state education agency (SEA) jurisdiction (an **organization**). A **person** may be enrolled with the **role** of “K-12 Student.” For purposes of U.S. Department of Education official ED*Facts* reporting, the **relationship** between K-12 organizations and a person enrolled as a K-12 Student can be accounted for in different ways:

- **Accountability.** The organization is responsible for student learning under federal Elementary and Secondary Education Act and state accountability plans.
- **Attendance.** The organization operates the physical or virtual site in which delivery of educational services take place.
- **Funding.** The organization is responsible for funding related to a student's enrollment.
- **Graduation.** The organization is responsible for issuing or awarding diplomas (e.g., for graduation rate reporting).
- **Individualized Education Program (IEP).** The organization is responsible for the enrolled student's IEP, a written instructional plan for students with disabilities designated as special education students under the Individuals with Disabilities Education Act (IDEA Part B).
- **Transportation.** The organization is responsible for transporting the student to the physical location of the school or facility in which educational services are delivered.

In this case, the **person** has a **role** (K-12 Student) and the **organization** has one or more specific responsibilities as a result of that **relationship**. The same **person** may hold **roles** in multiple organizations based on a single enrollment. If one of the **organizations** involved is a postsecondary institution, the **person** may be dual-enrolled as a K-12 Student and a Postsecondary Student.

	Actor	Action
A	Person	Enrolled in a school that is part of a school district (LEA)
B	Organization	Enrolls a person and takes on one or more responsibilities

2.1.3.2. Educator Working in One or More Colleges

Scenario: A professor (a **person** with the **role** of Postsecondary Staff) in a community college system (an **organization** with the type Postsecondary Institution) may work in one or more colleges. This case is of a **person** having the same **role** in multiple **organizations**. There is a need to uniquely identify the **person** independent of any one college.

Professors and educators can be identified in the following ways:

- **Social Security number (as a Staff Person).** Although Social Security numbers are universal identifiers (IDs) in the United States, they usually cannot be shared as a public identifier.
- **Local enterprise resource planning or learning management system ID.** This ID is common but only applies to a particular piece of software and is bounded by the single college that is hosting or using the software. If the software changes, the ID will change.
- **Organization ID.** This is the college's ID, usually managed by its human resources (HR) system. This ID also is confined by the organizational boundaries supported by the HR system. If the educator leaves the organization and returns, they might be given a different ID.
- **State ID.** The use of a state ID is rare but would be ideal for educators working in multiple colleges. Its usefulness as an identifier would start to break down if the educator worked across state borders.

	Actor	Action
A	Person	Employed by one or more colleges with the role of professor/educator using a consistent digital identifier
B	Organization (community colleges)	Employs professors/educators
C	Organization (state, region, or district)	Applies an identifier to the person being employed by the community colleges

2.1.3.3. Course-Section Rostering

Scenario: A **person** is enrolled in an instance of a course for a given period of time. The Course Section (a.k.a. Section) provides the organizational context for delivery of course content to a roster of students by one or more instructors, or via a different medium.

The Course Section is an **organization** in the CEDS Conceptual Model. It represents an instance of a Course. The Course (definition) falls within the **resource** category of the CEDS Conceptual Model. It defines “the sequence of one or more educational events and/or creative works

which aims to build knowledge, competence, or ability of learners.” The Course definition may link to other kinds of **resource** data such as competency definitions, learning resources, assessment forms, and credential definitions.

	Actor	Action
A	Person	Enrolled as a student in a Course Section
B	Person	Assigned as an instructor or other position related to Course Section
C	Organization	Course Section taught by one or more instructors with a roster of one or more students

2.2. Identity, Access, and Control

[This area is new and should be considered in draft form only and offered as an example with a request for feedback before final publication.]

Context

People and things have real-world identities and one or more digital identities. When the digital identity is tightly aligned with the real-world identity, it can be called a “digital twin.” When the digital identity is loosely or not at all connected to a real-world identity, it can be called an “alias” or, with people, a “persona.” Digital identities have unique information within a context, called identifiers. People have the rights to secure personally identifiable information (PII), access information about themselves, and control who else has access to education records about themselves. These rights may vary based on role and jurisdiction.

2.2.1. Key Concepts

- A. Person
- B. Organization
- C. Role
- D. **Identity:** The unique fact of being who or what a person or thing is.
- E. **Digital identity:** A unique fact of being who or what a person is in the digital world. Digital identity may be connected to a real-world Identity (digital twin) or not (alias/persona).
- F. **Digital identifier:** Unique information used to identify people, organizations, or things within a context. Examples include Social Security number, email address, State Assigned Student Identifier (SASID), and Local Assigned Student Identifier (LASID). A digital identity can have more than one digital identifier.

- G. **PII:** Personally Identifiable Information is any item, collection, or grouping of information about an individual that is maintained by an organization, including identifying information, education, financial transactions, medical history, Social Security number, and criminal or employment history. (See: [NIST Special Publication 800-122](#))
- H. **Personal information:** PII, demographics, and linked event information. Some information becomes personal in context, such as small group size aggregates.
- I. **Learner information:** Information about a learner.
- J. **Privacy rights:** Rights of a person to control access to and use of their personal information.
- K. **Authentication:** Actions and mechanisms that can authenticate the identity of a person, including information about an authentication provider, the login identifier used to authenticate a person's identity, and other information related to authentication of a person's identity.
- L. **Authorization:** The authority to grant access to data or services to authorized entities.
- M. **Access control:** The protocols in a system that limit access to data or services to authorized entities. Access controls also govern the information about a data system or application that an authenticated person or system may access.
- N. **Self-sovereign identity:** An identity system architecture based on the core principle that identity owners have the right to permanently control one or more identifiers together with the use of the associated identity data.
- O. **Information security:** Systems of controls designed to enforce privacy access controls and operational continuity.
- P. **Data stewardship/processor:** Responsibility for properly securing privacy access controls(<https://www.dama.org/content/body-knowledge>).
- Q. **Trust:** A person's or system's ability to rely on something from another. Fiduciary trust can be delegated from one entity to another.

Additional sources for concept definitions include the [Sovrin Foundation Glossary](#) and the [W3C Verifiable Credentials](#) Recommendation.

2.2.2. Use Cases

2.2.2.1. Someone Requesting Access to Student Data

Scenario: A **person** enrolled with the **role** of student in an **organization** has a digital identity in the organization's systems, which use a unique identifier to link personal information. As the steward of those data, the organization is responsible for ensuring security, including controlled access to agents of the organization with legitimate educational purposes and/or permission from the person or their guardian to access the data.

	Actor	Action
A	Person	Data steward responsible for granting access or not to the student's data
B	Person	Student about whom data are being requested
C	Person	The student's guardian who is responsible for making decisions about that student's data
D	Person	The requestor: The person requesting the data
E	Organization	Educational organization(s) that has enrolled and registered the student

2.3. Competencies, Credentials, and Employment

2.3.1. Context

Competencies and credentials are closely related terms that have evolved broad and overlapping common uses and should be clearly delineated when modeling. Both competencies and credentials are described by **resource** data—including a definition that applies to any instance of the competency or credential—and **event** data pertaining to a specific instance of a competency or credential being issued to a learner.

Concept	Resource Data	Event Data
Competency	Competency Definition	Competency Assertion
Credential	Credential Definition	Credential Award

2.3.2. Key Concepts

- A. Person
- B. Organization
- C. Role
- D. Competency Definition
- E. **Competency Assertion**
- F. Credential Definition
- G. **Credential Award**
- H. **System**

2.3.3. Use Cases

2.3.3.1. Competency-Based Achievement

Scenario: A **person** enrolled with the **role** of Instructor in a Course Section (**organization**) asserts that a **person** enrolled with the **role** of Student in that **organization** has achieved a specific competency defined by that organization as a learning target. This transaction includes an **event** (the Competency Assertion) and a **resource** (the Competency Definition).

A **person** with the **role** of an employee of an **organization** participates in a performance assessment within a simulated environment. The simulator collects data about the person's actions on the job task in response to the simulation. A software algorithm analyzes the data as evidence and records an assertion (on behalf of the organization) that the person has achieved a competency defined for the job within a professional competency framework.

	Actor	Action
A	Person	Makes a Competency Assertion about a learner based on a Competency Definition applicable to the Course
B	Organization	Issues a micro-credential with linked data for a Competency Definition and evidence supporting the assertion

[The following use case is in draft form only and offered as one example of a talent marketplace use scenario with a request for feedback before final publication. The intent is to update this example based on use cases being developed by T3 Innovation Network pilot projects.]

2.3.3.2. Talent Marketplace

Scenario: An **organization** posts a machine-readable, skill-based, job posting (**resource**). A **person** in the **role** of Applicant shares a verifiable skill record (**resource**) that matches competency definitions (**resource**) with linked data in the job posting. The following processes are supported:

- **Signal, search, and discover.** This process includes the ability to identify the opportunities meeting user requirements. Examples include finding relevant jobs and education, training and credentialing opportunities, and potential job applicants.
- **Apply, screen, and verify.** This process includes the ability to manage the application, screening, and verification process for employment, military, and education training and credentialing opportunities.
- **Manage participation, completion, and transition.** This process includes the ability to manage participation and completion of employment, military, and education training and credentialing opportunities, including monitoring, assessing, and documenting performance and updating learner records.
- **Conduct talent analytics.** This process includes the ability to analyze large numbers of de-identified learner/worker records to improve and support other applications and get better results.

	Actor	Action
A	Organization	Posts job descriptions with explicit, linked data competencies that can be matched with shared learner records
B	Person	Shares a verifiable skill record that matches competency descriptions with linked data in the job posting
C	System	Matches job descriptions and shared skills profiles to support screening and verification
D	System	Allows for analyzing de-identified learner/worker records to improve and support other applications and get better results