CEDS Addresses Learner Experiences

CEDS Version 3 introduced a common data vocabulary for defining data elements related to learner experiences (the **Learner Action** entity). Initially, the use cases were limited to online assessment systems to (1) to inform a teacher's prescriptive feedback to a student, or (2) in the case of intelligent tutoring systems using data, to provide scaffolding within the context of "assessment as learning" experiences.

Version 5 of CEDS expanded this Learner Action category based on advances in technology and practice. These data element definitions, defined for the context of online assessment, will accommodate future developments in CEDS for data standards that support all kinds of learning experiences that take place online.

Learner experience data collected in online systems provide diagnostic clues that otherwise might only be observed by a tutor in a one-on-one situation. Details—such as the time it takes to respond to a question, when and how the learner interacted with materials (e.g., a video or interactive lesson), when the learner asked for help, whether the learner gave up on an exercise, and whether the learner liked one learning experience over another—can be used by educators to diagnose problems and prescribe next steps for learner growth. Educators can't observe every student at every moment, but the learning experience data collected during online experiences can be condensed into a form that supports some of the same kinds of instructional decision making.

Scope

CEDS has adopted the approach of and some of the vocabulary developed by the Experience Application Programming Interface (xAPI) project. The approach uses a statement such as "The Learner answered question #1" to describe a single event in a learning experience. The statement has three parts: (1) an actor (The learner), (2) a verb (answered), and (3) an object (question #1). Each statement has a timestamp.

Sometimes the diagnostic value is based on the interval of time between one action and another. For example, if a teacher reviewing the experience of a student taking a multiple-choice quiz can see that the student answered four questions in about four seconds and got two of the questions wrong, the teacher might conclude that the student was guessing and didn't take the time to read the questions. Or, in a system that offers hints that lead successively closer to the correct answer, a student who repeatedly asked for hints may have been trying to "game the system" rather than trying to solve the problem. Other learning experience data could include the time that students spend on a page of a reading assignment, and the path taken through an interactive exercise.

> **Experience API (xAPI)**
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> A specification defining standards for storing and providing access to information about learning experiences. The xAPI enables the tracking of learning experiences, including traditional records, such as scores or completion. It also stores records of learners' actions, like reading an article or watching a training video. The xAPI is designed to support existing SCORM® use cases as well as enable the use cases that were difficult to meet with SCORM, such as mobile training and content that is accessed outside of a Web browser.

Learner experience statements are in the form of (1) Actor, (2) Verb, (3) Object, (4) Result, and include the Time of the Action (5).

CEDS represents these parts as follows:

(1) Learner Action Actor Identifier
(2) Learner Action Type
(3) Learner Action Object Description, Learner Action Object Identifier, Learner Action Object Type
(4) Learner Action Value
(5) Learner Action Date Time

For example, (a student) (attempted) (an assessment problem) (value entered) at (date/time). The example might be followed by another statement with the outcome of the attempt, such as (a student) (passed/failed/scored) (an assessment problem) (score value) at (date/time).

CEDS defines the data elements to capture these experiences, including a standardized list of verbs and their definitions, as follows:

answered	The person gave a correct answer or solution.
asked	The person inquired about something, or sought an answer to a question or problem.
attempted	The person made an effort or attempt.
attended	The person was present.
commented	The person made or wrote a comment.
completed	The person finished or ended the specified activity or object.
exited	The person moved out of or departed from interaction with the specified activity or object.
experienced	The person participated in or underwent.
failed	The person was unsuccessful with the specified activity or object.
imported	The person transferred the specified information object into a data store.
initialized	The person assigned an initial value to the specified activity or object.
interacted	The person acted with or towards the object of the statement.
launched	The person gave impetus to the object of the statement.
mastered	The person became completely proficient or skilled in a competency.
passed	The person achieved a successful result from an evaluation or a selection process.
preferred	The person selected the object as an alternative over another.
progressed	The person moved forward.
registered	The person enrolled in or was recorded as a candidate for.
responded	The person showed a response or a reaction to.
resumed	The person returned to a previous location or condition within an activity.
scored	The person recorded the result of—assigned a grade or rank to—an evaluation of the specified object or activity.
shared	The person made the specified object available for use by others.
suspended	The person made the specified object or activity come to an end or stop.
terminated	The person brought the object or activity to a final end.
voided	The person declared the object or activity invalid.

The Actor in an xAPI statement must be a specific learner, or some person/entity acting on behalf of a learner, so users of the data can determine who took the action. In CEDS, the actor is defined by the element "Learner Action Actor Identifier."

The Object must also be specific, as represented by the CEDS element "Learner Action Object Identifier," but for some interpretations of this kind of data, it is helpful to have the type of object, e.g., "assessment item" or "video." Along with the identifier, CEDS defines an element classifying the type of object and a human-readable description of the object.

Future Directions

Future steps for CEDS include building the learner action elements into the context of various instructional delivery models. CEDS includes the building blocks to comprehensively address learner experiences, including elements for learner experiences, learning assignments, learner goals, competency-based assessment, rubrics for evaluating learner experiences, and data about learner achievements. The xAPI community has only begun to explore the range of possible objects and actions. It may be within the scope of future CEDS activity to standardize a vocabulary for Learner Action Object Type, and expand the Learner Action Type vocabulary. Yet to be developed are the data models to support the learner experiences across the breadth of instructional delivery models; the context of learning experience data within a course section; the links between formative assessment and grading (including competency-based grading); and the application of rubrics to digital, physical, and project-based learning experiences.

Connections

The following CEDS Connections are available:

Connection	URL
Learning Experience Elements in CEDS	https://ceds.ed.gov/connectManageCase.aspx?UseCaseId=654

(Other Connections may be developed from time to time. Please visit http://ceds.ed.gov for more information.)