Synopsis

The Assessment Outcomes Management API describes an API surface useful for the exchange of student assessment results.

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Overview

High-level Architecture

The Ed-Fi Assessment Outcomes Management API provides a blueprint for a source system (the provider) to manage a core set of assessment data on a target system (the consumer) using RESTful APIs. In this data exchange architecture, the provider implements an API client, which uses HTTP/S requests and RESTful patterns to manage API resources on the consumer system, which implements the API definition itself (see Figure 1).

![Figure 1. Overview of API and API client architecture](image)

While this architecture can be understood as the provider transferring data from itself to a consumer system, the API is described as “management.” In real-world use cases within the Ed-Fi community, field evidence suggests that calling such an API includes a broader set of responsibilities on behalf of the provider and consumer systems. [1]

The Ed-Fi Unifying Data Model (UDM)

Purpose of the UDM
The Ed-Fi UDM provides a logical model and data dictionary that define the semantics (entities, properties, and definitions) and the structure (relationships between entities including cardinality) of all data within all Ed-Fi published standards. They are "unifying" in the sense that they ensure the compatibility of the structure and meaning of data across all Ed-Fi standards.

The UDM is concerned principally with data directly related to student outcomes and results that can be used by teachers and others to make instructional decisions to improve student performance.

Consistent with that goal, the assessment data exchange models described in these standards are therefore focused on capture and delivery of results (see the outlined section of Figure 2).

Figure 2. Focus of the Ed-Fi Assessment Outcomes Management API Standards

Note that this does not mean the Ed-Fi UDM and the Ed-Fi data exchange standards do not capture information related to the assessment instruments themselves, the learning management system (LMS), or other context in which a student interacts with an assessment instrument. Elements related to those processes and artifacts do appear in the Ed-Fi UDM, but they are generally present because those elements are valuable in the interpretation of the student outcomes. [6]

Use Cases Out-of-Scope for the UDM

Given that focus of the Ed-Fi UDM and data exchange standards, the exchanges enabled in the model described here are not designed to deliver on the following functions and use cases:

- Portability of assessment instruments (e.g., test forms, question item banks, scoring algorithms) between LMS or similar systems
- Managing operations of assessments in real time (e.g., the amount of time the student has to perform an assessment)
- Derivative data to assist with the improvement of assessment instruments or to provide a microscopic view into student interactions (e.g., whether a question was skipped, amount of time spent on a question)

Version of the UDM for this Standard

This standard uses the Ed-Fi Unifying Data Model v2.0. All entities, properties and relationships are derived from that logical model and must observe those semantics and structure to be considered a faithful implementation of this standard.

Background on the Ed-Fi Assessment Domain

Hierarchical and Recursive Model

Many assessments are multi-tier in the sense that they provide multiple scores or result sets for each assessment. An example would be a single "reading" assessment that tested multiple skill areas, such as "Reading Comprehension," "Accuracy and Fluency," "Phonemic Awareness," and so on. In the Ed-Fi model, the top-level assessment is an Assessment and the skill areas are ObjectiveAssessments. This structure is recursive, so that there can be any number of levels of ObjectiveAssessments.

Once the student takes the assessment, the results are captured in the StudentAssessment and StudentObjectiveAssessment, each of which has references back to its parent entity. Finally, for assessments that report item level results, there are AssessmentItems and StudentAssessmentItems. (See Figure 3 for a partial UML representation of the Ed-Fi Assessment domain model.)
Learning Standards and Learning Objectives

Critical for use of student assessment results is defining for stakeholders what student knowledge, skills, and other competencies are being assessed. In the Ed-Fi assessment model, LearningStandards and LearningObjective play this role.

- **LearningStandard** represents governed sets of academic standards shared between organizations. These would include state-published or endorsed academic standards (such as the Common Core State Standards), or sets of academic standards published by other organizations designed to coordinate cross-sector activity (an example might be the Next Generation Science Standards).
- **LearningObjective** represents academic standards or similar guidelines on student competency development generally applicable to a single (and generally governed by a single) organization. They capture cases in which a school district may want to have a more elaborate or slightly different set of academic standards than the state, and it is for this reason that LearningObjectives can map to a LearningStandard.

Both LearningStandards and LearningObjectives are hierarchal as well; this matches the tiered pattern seen frequently in academic standards.

ObjectiveAssessments can map to LearningStandards or LearningObjectives. As noted above, a mapping to a LearningObjective may also signify a mapping to a LearningStandard, if the LearningObjective is so mapped. AssessmentItems can be mapped to LearningStandards.

Use Cases
The architecture covered by this model of data exchange is intended to serve the following example use cases. Note that these use cases are illustrative, not exhaustive: they outline a few high-value uses cases and do not cover all possible use cases.

- School X has a highly personalized learning process where student mastery is assessed against learning standards on an ongoing basis, sometimes even multiple times during the school day. These mastery levels for each student are recorded in an LMS, assessment, or gradebook system that teachers use to monitor progress to inform lesson planning and individual student “playlist” assignments. In addition to teacher delivered instruction and informal assessment, the school relies on external curriculum systems for content delivery. Those systems provide for “exit tickets” that describe the student’s mastery level against a learning standard. The information from the curriculum tools needs to travel to the LMS, assessment, or gradebook system as soon as possible after a student competes a learning unit.

- A school district uses an online diagnostic system to measure English-language learner capabilities as part of a larger system of identification and support for ELL students. Diagnostic sessions where the ELL screening assessment are administered are scheduled ad hoc as students enroll in the district or are otherwise identified. When a student completes a screening assessment, the resulting data needs to travel to a case-management system and to the district SIS system.

- A provider of interim benchmark assessments (typically given each grading period) needs to transfer results to school districts in machine readable format. The school districts typically aggregate this data alongside other data for the purposes of assessing progress towards overall yearly goals. The individual student level data is also included on quarterly report cards and put into parent portals. At an item or learning standard level, both in aggregate and at a student level, is, used by teachers for planning. The district wants this data to be available to produce the types of reports and visualizations outlined above and uses the Ed-Fi ODS to power the application and reporting tools.

Designations: Categories within the Standard

Even by limiting the scope of the data to be exchanged to student performance results and closely related data, there is considerable diversity of possible data that may be applicable to any given exchange. This diversity can be seen in the variety of data included in score reports that assessment providers send or publish to education agencies in K–12 today.

The Ed-Fi Assessment Outcomes Management Standard therefore includes a taxonomy to help define some common profiles for API usage; these are called “designations.” Each designation is meant to capture finer-grained understandings of a broad category, which describes the key features of the outcomes data critical to that class of assessment. The assessment designations are:

- Summative with Overall Outcomes
- Summative with Category-Level Outcomes
- Interim with Category-Level Outcomes
- Formative with Category-Level Outcomes
- Formative with Category-Level and Item Outcomes

Data Required for Each Designation

The data requirements for the five designations are listed in the table below. Beside each designation (in blue) along the left side, the table indicates which data is required and which data is optional for that designation.

There are also a few places where data is conditional: this data is considered required for fidelity to the standard if it is available (i.e., if that data included on a standard report the provider sends to school districts or otherwise provides as a normal part of its reporting).
Table 1. Data required by designation

### API Resources and Interactions

This API standard is designed to allow applications to read and write assessment data through a secure REST interface. API implementers and clients are expected to follow all guidelines in the Ed-Fi API Design and Implementation Guidelines. These include requirements relating to errors, authentication, security, and other aspects of API usage and implementation. Any MUSTs from that document should be considered required. If there are differences between the requirements included this document and that one, the information provided in this document should be assumed to have precedence.

An Open API definition of the REST interface is provided below. Consumer implementations wishing to conform to this standard are expected to implement all paths and resources described in that Open API specification. Providers wishing to conform to this standard are expected to be able to manage all API resources described, and accurately follow the semantics in the Ed-Fi UDM.

Please consult Table 1 above to see which data elements are required, optional, or conditionally required for each designation.

- **/assessments**
  - This entity represents a tool, instrument, process, or exhibition composed of a systematic sampling of behavior for measuring a student’s competence, knowledge, skills, or behavior. An assessment can be used to measure differences in individuals or groups and changes in performance from one occasion to the next.

- **/objectiveAssessments**
  - This entity represents subtests that assess specific learning objectives.

- **/assessmentItems**
  - This entity represents one of many single measures that make up an assessment.

- **/learningObjectives**
  - This entity represents identified learning objectives for specified objective assessments.

- **/studentAssessments**
  - This entity represents the analysis or scoring of a student’s response on an assessment. The analysis results in a value that represents a student’s performance on a set of items on a test.

### Changes to Ed-Fi Unifying Data Model
This standard includes two non-breaking changes to the Ed-Fi Unifying Data Model. If finalized, the Ed-Fi Unifying Data model will be updated (i.e., given a new version via incrementing the 3rd version digit, also called the revision number).

Those changes are captured in these Data Standard tickets:

- **DATASTD-1075** - Getting issue details... | STATUS
  Per this ticket, the ScoreResult common type will be added to ObjectiveAssessment with a cardinality of 0..n.
- **DATASTD-1068** - Getting issue details... | STATUS
  Per this ticket, school years will be extended to the 2060 school year.

The second if these is only indirectly related to this draft; this draft is simply regarded as the most convenient release vehicle for the change. If the change is already made prior to this release (i.e., via another standard reaching a final approval), please consult the Tracker or the other RFC standards for the exact release vehicle that carried the change.

### Designation Requirements and Sample Data

Below appear descriptions of the requirements for each of the five designations. Each description shows the API resources/endpoints the client must be able to manage, as well as the JSON structure.

**Designation 1: Summative with Overall Outcomes**

This designation covers data exchanges focused on communication of overall scores for an assessment, that is, scores that represent a summation of the student performance across an entire assessment. Such assessments typically do not provide sub-assessment (or "category" scores).

#### Requirements

- **Assessment metadata**
  - Overall scores per reporting method with minimum and maximum scores
  - Overall performance level per reporting method
- **Student Assessment**
  - Overall score results per reporting method
  - Overall performance level met per reporting method

#### JSON with Sample Data

/assessments
Designation 2: Summative with Category-Level Outcomes

In this designation, the data exchange includes category scores in addition to overall scores. Score reports of this kind will typically break down larger outcomes into finer-grained taxonomies of student skills and capabilities. Those finer-grained outcomes optionally may be indexed to learning objectives.
Requirements

- Assessment metadata
  - Overall scores per reporting method with minimum and maximum scores
  - Overall performance level per reporting method
- Objective Assessment metadata
  - Objective scores per reporting method with minimum and maximum scores
  - Objective performance level per reporting method
- Student Assessment
  - Overall score results per reporting method
  - Overall performance level met per reporting method
  - Student objective assessment
    - Objective scores per reporting method with minimum and maximum scores
    - Objective performance level per reporting method

JSON with Sample Data

```
/assessments
{
    "academicSubjectDescriptor": "English Language Arts",
    "assessedGradeLevelDescriptor": "Fifth grade",
    "title": "State Assessment",
    "version": 2017,
    "categoryDescriptor": "State summative assessment 3-8 general",
    "maxRawScore": 1750,
    "namespace": "http://ed-fi.org/Assessment/Assessment.xml",
    "identificationCodes": [
        {
            "assessmentIdentificationSystemDescriptor": "State",
            "identificationCode": "ELA 2017 State Assessment"
        }
    ],
    "performanceLevels": [],
    "scores": [
        {
            "assessmentReportingMethodType": "Raw score",
            "resultDatatypeType": "Integer",
            "maximumScore": "1750",
            "minimumScore": "0"
        }
    ]
}

/objectiveAssessments
```
Designation 3: Interim with Category-Level Outcomes

In this designation, the system is required to write learning objective metadata (learningObjectives) in addition to assessment and student results.

Requirements

- Assessment metadata
  - Overall scores per reporting method with minimum and maximum scores
  - Overall performance level per reporting method
- Objective Assessment metadata
  - Objective scores per reporting method with minimum and maximum scores
  - Objective performance level per reporting method
- Defined Learning Objectives
- Student Assessment
  - Overall score results per reporting method
  - Overall performance level met per reporting method
  - Student objective assessment
    - Objective scores per reporting method with minimum and maximum scores
    - Objective performance level per reporting method

JSON with Sample Data

```
/assessments
```
Designation 4: Formative with Category-Level Outcomes
In this designation, the system generally writes category-level outcomes only (objectiveAssessments and studentObjectiveAssessments). However, a key requirement is that these category-level outcomes are indexed to some set of industry-standard learning standards (e.g., state-specific or common core learning standards).

**Requirements**

- **Assessment metadata**
- **Objective assessment metadata**
  - Objective scores per reporting method with minimum and maximum scores
  - Objective performance level per reporting method
  - Learning Standards for each objective assessment
- **Student Assessment**
  - Overall score results per reporting method
  - Overall performance level met per reporting method
  - Student objective assessment
    - Objective scores per reporting method with minimum and maximum scores
    - Objective performance level per reporting method

**JSON with Sample Data**

```json
/assessments
{

  "academicSubjectDescriptor": "Science",
  "assessedGradeLevelDescriptor": "Ninth grade",
  "title": "Physics I – CBA #1",
  "version": 2017,
  "categoryDescriptor": "Formative",
  "maxRawScore": 0,
  "namespace": "http://ed-fi.org/Assessment/Assessment.xml",
  "identificationCodes": [

    {
      "assessmentIdentificationSystemDescriptor": "District",
      "identificationCode": "Ninth Physics I - CBA #1"
    }

  ],
  "performanceLevels": [],
  "scores": [

  ]
}

/learningStandards
{

  "learningStandardId": "112.39.1.0",
  "academicSubjectDescriptor": "Science",
  "courseTitle": "Physics I – CBA #1 Ninth grade",
  "description": "Safety, Measurement, Graphing 1D Motion.",
  "contentStandard": {
    "title": "State Standard",
    "authors": []
  },
  "gradeLevels": [

    {
      "gradeLevelDescriptor": "Ninth grade"
    }

  ]
}

/objectiveAssessments
```
Designation 5: Formative with Category-Level and Item Outcomes

In this designation, the system writes category-level outcomes (objective Assessments and studentObjectiveAssessments) and item-level outcomes (assessmentItems and studentAssessmentItems).

In addition, a key requirement is that these category and item-level outcomes are indexed to a set of industry-standard learning standards (e.g., state-specific or Common Core Learning Standards).

Requirements

- **Assessment metadata**
  - Overall scores per reporting method with minimum and maximum scores
  - Overall performance level per reporting method

- **Objective Assessment metadata**
  - Objective scores per reporting method with minimum and maximum scores
  - Objective performance level per reporting method
  - Learning Standards for each objective assessment

- **Assessment Item metadata**
  - Learning Standards for each assessment item

- **Student Assessment**
  - Overall score results per reporting method
  - Overall performance level met per reporting method
  - Student objective assessment
    - Objective scores per reporting method with minimum and maximum scores
    - Objective performance level per reporting method
  - Student assessment item results

**JSON with Sample Data**

```json
/assessments

{
  "academicSubjectDescriptor": "Mathematics",
  "assessedGradeLevelDescriptor": "Tenth grade",
  "title": "Math Quizzler Unit 1",
  "version": 12,
  "categoryDescriptor": "Class quiz",
  "namespace": "http://ed-fi.org/Assessment/Assessment.xml",
  "identificationCodes": [
    {
      "assessmentIdentificationSystemDescriptor": "District",
      "identificationCode": "Math Quizzler Unit 1 Advanced Math for students v4.4"
    }
  ],
  "performanceLevels": [],
  "scores": []
}

/learningStandards
```
"description": "Unit 1 Advanced Math for students v4.4."
"gradeLevels": [
  {
    "gradeLevelDescriptor": "Tenth grade"
  }
]
}

"parentLearningStandardReference": {
  "learningStandardId": "1.4.4HSG-GPE.1"
},
"learningStandardId": "4.HSG-GPE/B/4.1",
"academicSubjectDescriptor": "Mathematics",
"courseTitle": "Advanced Math for students v4.4",
"description": "High School: Geometry » Expressing Geometric Properties with Equations » Use coordinates to prove simple geometric theorems algebraically » 4."
"gradeLevels": [
  {
    "gradeLevelDescriptor": "Tenth grade"
  }
]
}

"parentLearningStandardReference": {
  "learningStandardId": "1.4.4HSG-GPE.1"
},
"learningStandardId": "5.HSG-GPE/B/5.1",
"academicSubjectDescriptor": "Mathematics",
"courseTitle": "Advanced Math for students v4.4",
"description": "High School: Geometry » Expressing Geometric Properties with Equations » Use coordinates to prove simple geometric theorems algebraically » 4."
"gradeLevels": [
  {
    "gradeLevelDescriptor": "Tenth grade"
  }
]
null
For example, it can be helpful for teachers looking at the results of a test to be able to see the test questions, or to understand if a student was provided one or more accommodations for the test itself.

For example, the provider is also required to be able to reconcile records following errors or other transport problems, implement data quality checks, and log and surface errors to users.