Achievement Standards Network (ASN)

An Application Profile for Mapping K-12 Educational Resources to Achievement Standards
ASN is a Project of the National Science Digital Library
Funded by

NATIONAL SCIENCE FOUNDATION (NSF)
THE PROBLEM...

- Large repositories of educational resources are being created in the form of lesson plans, learning objects, curriculum units, and activities for use in kindergarten through upper grades
- Jurisdictional controls of education include various forms of mandated achievements standards—e.g., national curricula and state content standards
- Metadata mapping educational resources to achievement standards supports teaching, learning and accountability
Machine-addressable form

ASN Repository

Semantic-web amenable

Achievement Standards

Tight Coupling

Instruction

Assessment

INSTRUCTIONAL GOAL
- Cut and paste standards text from documents to metadata describing educational resources
- Rekeying (interpreted) standards data to metadata records
- Proprietary, closed standards databases for closed systems

Confusion of Tongues

TOWER OF BABEL
ASN GOALS...

- Create a national (international?) repository of achievement standards in machine addressable form that
  - Are accurate digital representations of standards documents and their component statements (semantic units);
  - Are consistent in form; and
  - Are modeled in RDF and amenable to the Semantic Web
- Extensible framework to support evolving uses
- Open access with cost recovery model
Gathered all current and historical U.S. standards documents
761 standards documents have been decomposed (atomized) into “statements” derived from document structure and content
In excess of 350,000 standards statements
All documents and statements assigned URI and are dereferencable over the Web
Core Functions Supported

CORRELATION & ALIGNMENT
A correlation is

+ An assertion of a relationship between an educational resource and a standards statement

“Educational resource “A” is useful in meeting the requirements of standards statement “B”

An alignment is

+ An assertion of a relationship between two standards statements

“Standards statement “C” is the same as standards statement “D”
Alignment

- Direct Mappings
  1-to-many
- Inferred (indirect) mappings
  Many-to-1

Experimentation in the U.S. (1) Automatic (NLP/machine learning), (2) defined intermediary statements (uber/master statements); and (3) controlled vocabulary
RDF Modeling

MODELING DOCUMENTS AND STATEMENTS
ASN TAXON PATH
Contextualizing Statements

National Science Foundation

DC-2008, Berlin
## STATEMENT PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creator (DC)</td>
<td>A person or organization chiefly responsible for the intellectual content of the statement being described when different from the creator of the standards document (e.g., 3rd party derived statement).</td>
</tr>
<tr>
<td>Comment (ASN)</td>
<td>Supplemental text provided by the promulgating body that clarifies the nature, scope or use of the statement being described.</td>
</tr>
<tr>
<td>Concept Term (ASN)</td>
<td>A word or phrase used by the promulgating agency to refine and differentiate the statement being described contextually (e.g., a McREL concept term).</td>
</tr>
<tr>
<td>Created (DC)</td>
<td>Date of creation of the statement.</td>
</tr>
<tr>
<td>Description (DC)</td>
<td>The text of the statement being described.</td>
</tr>
<tr>
<td>Education Level (DC)</td>
<td>The grade or grade bands covered by the standards statement being described.</td>
</tr>
<tr>
<td>Identifier (DC)</td>
<td>An unambiguous reference to the resource within a given context. For the ASN standards statement, the value of the «identifier» is always a network-resolvable URI.</td>
</tr>
<tr>
<td>Is Child Of (GEM)</td>
<td>The statement being described is lower in some arbitrary hierarchy than the statement identified in the «isChildOf» property. The statement identified is a parent of the statement being described.</td>
</tr>
<tr>
<td>Is Part Of (DC)</td>
<td>The described statement is a physical or logical part of the referenced standards document.</td>
</tr>
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</table>
### STATEMENT PROPERTIES (CONT.)

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jurisdiction</td>
<td>A legal, quasi-legal, organizational or institutional domain of the entity mandating the use of the achievement standard—e.g., California.</td>
</tr>
<tr>
<td>Local Subject (ASN)</td>
<td>The text string denoting the subject of the statement as designated by the promulgating agency.</td>
</tr>
<tr>
<td>Relation (DC)</td>
<td>A related resource.</td>
</tr>
<tr>
<td>Statement Label (ASN)</td>
<td>The textual label identifying the class of the statement as designated by the promulgating body—e.g., &quot;Standard,&quot; &quot;Benchmark,&quot; &quot;Strand,&quot; or &quot;Topic.&quot;</td>
</tr>
<tr>
<td>Statement Notation (ASN)</td>
<td>An alphanumeric notation or ID code as defined by the promulgating body to identify the statement.</td>
</tr>
<tr>
<td>Status (ASN)</td>
<td>The publication status of the statement taken from the ASN Status controlled vocabulary.</td>
</tr>
<tr>
<td>Subject (DC)</td>
<td>An ASN topic of the content of the statement being described.</td>
</tr>
</tbody>
</table>

†For document properties, see paper appendix.
AUGMENTING THE ASN...

Refining Statements & Adding New Relationships
“Analyze and solve multi-step problems involving addition, subtraction, multiplication and division using an organized approach, and verify and interpret results with respect to the original problem.”

<table>
<thead>
<tr>
<th></th>
<th>involving addition</th>
<th>involving subtraction</th>
<th>involving multiplication</th>
<th>involving division</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze multistep problems ...</td>
<td>analyze addition</td>
<td>analyze subtraction</td>
<td>analyze multiplication</td>
<td>analyze division</td>
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<tr>
<td>Solve multistep problems ...</td>
<td>solve addition</td>
<td>solve subtraction</td>
<td>solve multiplication</td>
<td>solve division</td>
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<tr>
<td>Verify multistep problems ...</td>
<td>verify addition</td>
<td>verify subtraction</td>
<td>verify multiplication</td>
<td>verify division</td>
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<tr>
<td>Interpret multistep problems ...</td>
<td>interpret addition</td>
<td>interpret subtraction</td>
<td>interpret multiplication</td>
<td>interpret division</td>
</tr>
</tbody>
</table>

"Analyze and solve multi-step problems involving addition, subtraction, multiplication and division using an organized approach, and verify and interpret results with respect to the original problem."
3rd Party Augmentation (Derived Statements)
NEW RELATIONSHIPS—STRAND MAPS

1. Plants and animals both need to take in water, and animals need to take in food. In addition, plants need light. [SC1]
2. Most living things need water, food, and air. [SC2]
3. Air is a substance that surrounds us and takes up space. [SC4]
4. Carbon and hydrogen are common elements of living matter. [SC4]
5. Atoms may stick together in well-defined molecules, or may be packed together in large groups. Different arrangements of atoms into groups compose all substances. [SC4]
6. The idea of atoms explains the conservation of matter: if the number of atoms stays the same, no matter how different the same atoms are rearranged, then their total mass stays the same. [SC4]
7. Heat provides molecules that serve as fuel and building material for all organisms. [SC4]
8. Organisms that eat plants break down the plant structures to produce the materials and energy they need to survive. Then they are consumed by other organisms. [SC4]
9. Insects and various other organisms depend on dead plant and animal material for food. [SC4]
10. Almost all kinds of animals’ food can be traced back to plants. [SC4]
11. Over the whole earth, organisms are growing, dying, decaying, and new organisms are being produced by the old ones. [SC4]
12. As an organism begins to decompose, the materials it contains are returned to the environment. [SC4]
TOOLS & SERVICES

- Batch downloads of standards
- Mechanism to dereference an ASN URI
- Web Services for interactions with the ASN by metadata generation tools
- Searching & browsing interfaces to the ASN
ASN-XML Export v1.4.1

Existing Documents (Check Documents for Text File Export)

- Achievement Standards Network
- Alabama
- Alaska
- American Assoc Advancement of Science Proj 2061 (AAASP)
- Arizona
- Arkansas
  - Geography-2000: 3/13/2008 5:10:02 PM View
  - Historical Understanding-2000: 3/13/2008 5:10:02 PM View
  - Economics-2000: 3/13/2008 5:10:02 PM View
  - Bernie-2000-3/13/2008 5:10:00 PM View
  - Behavioral Studies-2000: 3/13/2008 5:10:00 PM View
  - Social Studies-2000: 3/13/2008 5:10:04 PM View
  - K-4 History and State History-2000: 3/13/2008 5:10:04 PM View
  - The Arts-2001: 3/13/2008 5:10:06 PM View
  - Science-2005: 3/13/2008 5:09:20 PM View
  - Social Studies-2006: 6/26/2008 2:36:34 PM View
- California
- Colorado
- Connecticut

Generate a Document

Organization: --Select an Organization--
Academic Standards: Social Studies

File Created: Mar 13 2008
Export Version: 1.4.1
Subject: http://purl.org/ASN/scheme/ASNTopic/usHistory

Selected Statement Details

Statement: S10210AF
FOCUS: American History from Discovery through the U.S. Constitution
1SS-E5. Describe the causes, course, and consequences of early European exploration of North America, with emphasis on:

Child Statement: S1004ACE
PO 1. the reasons for European exploration of the Americas.
Children:

Child Statement: S1023DE7
PO 2. the characteristics and results of various European expeditions, including those of Christopher Columbus, John Cabot, Hernando Cortes, and Hernando de Soto
Children:

Child Statement: S101EB54
PO 3. the political, economic, and social impact on the indigenous peoples
Children:

No errors found in the document
Welcome to the ASN Editor!

The ASN provides tools and content groups. Organizations that pose challenges. Without an application development, application builders to.
The ASN exposes both current technical standards.

--- Select a State/Organization ---
- Alabama
- Alaska
- American Assoc Advancement of Science Proj 2
- Arizona
- Arkansas
- California
- Canada
- Colorado
- Connecticut
- Delaware
- District of Columbia
- Florida
- Georgia
- Hawaii
- Idaho
- Illinois
- Indiana
- Iowa
- Ireland
- Japan
- Kansas
- Kentucky
- Louisiana
- Maine
- Maryland
- Massachusetts
- Michigan
- Minnesota
- Mississippi

--- Select a State/Organization ---
- Select a State/Organization ---
- Select a State/Organization ---

Collections, or who conduct research involving learning standards face their own set of policies and agreement on the best way to represent them in metadata, basic research and extendible. The ASN provides the tools and services for researchers, service providers and access through platform independent, interoperable and extendible services that support GEM, IMS, IEEE-LOM, OAI-PMH and SIF (Schools Interoperability Framework).
<table>
<thead>
<tr>
<th>Document ID</th>
<th>Title</th>
<th>Subject</th>
<th>Adoption</th>
<th>Status</th>
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<tr>
<td><a href="http://purl.org/ASN/resources/D1000287">http://purl.org/ASN/resources/D1000287</a></td>
<td>Social Studies Strand 3 - Civics/Government</td>
<td>Civics</td>
<td>2006</td>
<td>Active</td>
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<td><a href="http://purl.org/ASN/resources/D1000285">http://purl.org/ASN/resources/D1000285</a></td>
<td>Social Studies Strand 5 - Economics</td>
<td>Economics</td>
<td>2006</td>
<td>Active</td>
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<td><a href="http://purl.org/ASN/resources/D1000295">http://purl.org/ASN/resources/D1000295</a></td>
<td>Social Studies Strand 4 - Geography</td>
<td>Geography</td>
<td>2006</td>
<td>Active</td>
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<td>RefID</td>
<td>Order</td>
<td>Statement</td>
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<td>Subject</td>
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<td><a href="http://purl.org/ASN/resources/S1134CD0">http://purl.org/ASN/resources/S1134CD0</a></td>
<td>1</td>
<td>Strand 1: Number and Operations</td>
<td>K,1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
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<tr>
<td><a href="http://purl.org/ASN/resources/S1134D99">http://purl.org/ASN/resources/S1134D99</a></td>
<td>2</td>
<td>Strand 2: Data Analysis, Probability, and Discrete Mathematics</td>
<td>K,1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
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<tr>
<td><a href="http://purl.org/ASN/resources/S1134DCA">http://purl.org/ASN/resources/S1134DCA</a></td>
<td>3</td>
<td>Strand 3: Patterns, Algebra, and Functions</td>
<td>K,1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
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<tr>
<td><a href="http://purl.org/ASN/resources/S113501B">http://purl.org/ASN/resources/S113501B</a></td>
<td>4</td>
<td>Strand 4: Geometry and Measurement</td>
<td>K,1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
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<td><a href="http://purl.org/ASN/resources/S11350A3">http://purl.org/ASN/resources/S11350A3</a></td>
<td>5</td>
<td>Strand 5: Structure and Logic</td>
<td>K,1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
</tr>
<tr>
<td>RefID</td>
<td>Order</td>
<td>Statement</td>
<td>Grade</td>
<td>Subject</td>
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<td><a href="http://purl.org/ASN/resources/S1024934">http://purl.org/ASN/resources/S1024934</a></td>
<td>1</td>
<td>Number, Number Sense and Operations Standard</td>
<td>K1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
</tr>
<tr>
<td><a href="http://purl.org/ASN/resources/S10210AA">http://purl.org/ASN/resources/S10210AA</a></td>
<td>2</td>
<td>Measurement Standard</td>
<td>K1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
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<tr>
<td><a href="http://purl.org/ASN/resources/S101E4D1">http://purl.org/ASN/resources/S101E4D1</a></td>
<td>3</td>
<td>Geometry and Spatial Sense Standard</td>
<td>K1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
</tr>
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<td><a href="http://purl.org/ASN/resources/S100IE3S">http://purl.org/ASN/resources/S100IE3S</a></td>
<td>4</td>
<td>Patterns, Functions and Algebraic Standard</td>
<td>K1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
</tr>
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<td><a href="http://purl.org/ASN/resources/S100C490">http://purl.org/ASN/resources/S100C490</a></td>
<td>5</td>
<td>Data Analysis and Probability Standard</td>
<td>K1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
</tr>
<tr>
<td><a href="http://purl.org/ASN/resources/S10111EF">http://purl.org/ASN/resources/S10111EF</a></td>
<td>1</td>
<td>Number and Number Systems</td>
<td>K1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
</tr>
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<td><a href="http://purl.org/ASN/resources/S1000034">http://purl.org/ASN/resources/S1000034</a></td>
<td>2</td>
<td>Meaning of Operations</td>
<td>K1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
</tr>
<tr>
<td><a href="http://purl.org/ASN/resources/S10052F">http://purl.org/ASN/resources/S10052F</a></td>
<td>3</td>
<td>Computation and Estimation</td>
<td>K1,2,3,4,5,6,7,8,9,10,11,12</td>
<td>Math</td>
</tr>
<tr>
<td><a href="http://purl.org/ASN/resources/S102487C">http://purl.org/ASN/resources/S102487C</a></td>
<td>12</td>
<td>12. Analyze and solve multi-step problems involving addition, subtraction, multiplication and division using an organized approach, and verify and interpret results with respect to the original problem.</td>
<td>4</td>
<td>Math</td>
</tr>
</tbody>
</table>

**STATEMENT URI**

http://purl.org/ASN/resources/S102487C

**TAXON PATH**

Hierarchy Level 3 (42)
FUTURE WORK
- Statement versioning
  + Deviation from current document-centric focus to evolving statements
- Vocabulary extensions
  + Strand map (Navigable paths) extensions & authoring environment
- Enhanced array of properties
  + Continuous discovery of new assertions to be made
Who’s using it?

ADOPTION OF THE ASN...
COST RECOVERY BUSINESS MODEL...

- All ASN URI are freely dereferencable
- Repository and web services are accessible free of charge to non-profits (registration required)
- Modest annual fees for commercial access
FOR-PROFIT APPLICATIONS
- Cambridge University Press
- Thinkfinity—Verizon Foundation (formerly Marco Polo)

NON-PROFIT APPLICATIONS (Select)
- American Association for the Advancement of Science (AAAS)
- International Reading Association
- National Center for Family Literacy
- Council on Economic Education
- National Council of Teachers of English
- National Council of Teachers of Mathematics

UNDER CONSIDERATION
- IMS Global Consortium

ASN ADOPTERS...

ProLiteracy Worldwide
- Smithsonian National Museum of American History
- John F. Kennedy Center for the Performing Arts
- WGBH (Teacher’s Domain)
- Center for Natural Language Processing (CNLP—Syracuse University)
- TeachEngineering (University of Oregon)
- Michigan State Libraries
- Gateway to 21st Century Skills

Harcourt
- McGraw Hill

National Science Foundation
THANK YOU!

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