BISG
BOOK INDUSTRY STUDY GROUP

Recommendations for Citing Educational Standards & Objectives in Metadata

Guidelines for the North American Book Industry

June 30, 2015

INCLUDING

- *Options for citing learning objectives in ONIX , with examples for ONIX 2.1 and 3.0*
- *The complete BISG Educational Taxonomy*
- *Guidelines for text complexity & reading levels*
- *Resources for learning more about educational standards*

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BISG Recommendations for Citing Educational Standards and Objectives in Metadata was written and compiled for the Book Industry Study Group, Inc. (BISG) by the Educational Standards Taxonomy Working Group of the BISG Subject Codes and Metadata Committees. It is an update to the 2014 *BISG Recommendations for Citing Common Core State Standards in ONIX*, compiled by the Metadata Committee's Common Core Working Group. Copyright © 2015 Book Industry Study Group, Inc. All rights reserved.

This document should be read alongside the BISG/BookNet Canada publication Best Practices for Product Metadata: Guide for North American Data Senders and Receivers.

All references to ONIX data elements are drawn from:
ONIX for Books Product Information Format Specification Release 3.0.2, © 2014;
ONIX for Books Implementation and Best Practice Guide © 2011–2014;
and ONIX Code Lists, Issue 29, © June 2015.

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Copyedited by Patricia Fogarty.

Contributors

A special thanks to BISG Common Core and Educational Standards Taxonomy Working Group members for assisting with the market research around this issue and the writing of this document:

Connie Harbison (Co-Chair & Editor; Baker & Taylor)
Patricia Payton (Co-Chair & Editor; Bowker)
Kelly Berglund (Amazon.com)
Sam Dempsey (Baker & Taylor)
Diane Mangan (Baker & Taylor)
Michele Ogletree (Baker & Taylor)
Julie Morris (Editor; BISG)
Gillian Engberg (Booklist Publications)
Cheryl Dickemper (Booksource)
Matthew Zoni (BookWeb)
Tom Richardson (BookNet Canada)
Amy Cox (Capstone Publishing)
Gillia Olson (Capstone Publishing)
Martha Heyman (Cengage)
Jaimie Cona (DK Publishers)
Pat Elko (Elsevier)
Graham Bell (EDItEUR)
George Ricciardi (F.A. Davis)
Maureen Whelan (Government Printing Office)
Victoria Stapleton (Hachette Book Group USA)
Diane Burrows (HarperCollins Publishers)

Sarah Merritt (HarperCollins Publishers)
Josh Weiss (HarperCollins Publishers)
Lisa Bemis (Houghton Mifflin Harcourt)
Josh Harwood (Houghton Mifflin Harcourt)
Becky Saikia-Wilson (Houghton Mifflin Harcourt)
Kendall Haynes (Ingram Content Group)
Wendell Lotz (Ingram Content Group)
March Natividad (Ingram Content Group/VitalSource Technologies)
Jonathan Perry (Jared & Perry Metadata)
Alexandra Noya (Kaplan)
Devon Keefe (Kaplan Test Prep)
Pam Gruber (Little Brown Publishers)
Wendy Brooks (McGraw Hill Education)
Tom Adamich (Mitinet)
Amie Wright (New York Public Library)
Mary McAveney (Open Road Integrated Media)
Carol Kornfeind (Pearson)
Yonah Hirschman (Pearson)
Kimberly Bayley (Penguin Random House)
Michael Gentile (Penguin Random House)
Lani Kaneta (Penguin Random House)
Shelley Miller (Penguin Random House)
Laurel Stokes (Penguin Random House)
Adrienne Waintraub (Penguin Random House)
Holly Cefrey (Rosen Publishing)
Lauren Davis (Routledge/ Taylor & Francis)
Aimee Boyer (Simon & Schuster)
Michelle Leo (Simon & Schuster)
Lori Kelly (Taylor & Francis)
Dimi Berkner (Wiley)
Frank McDermott (Wiley)
Sara Merritt (Zondervan)

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New York Public Libraries
Todd Young (Perma-Bound)
Krista Monyhan (Coughlan Companies)
Stephen Cox (Salem-Keizer Public Schools)
K. Elizabeth Beazizo (West Salem High School)
Lisa Hardey (Sprague High School)
Jennifer Boudrye (District of Columbia Public Schools)

Contents

Introduction

This document provides recommendations for communicating educational standards and objectives including Common Core State Standards (CCSS), in book product metadata. These recommendations were developed with the North American market in mind, but some guidelines are also applicable to other markets. The objective of this document is to outline clear recommendations for the creation and distribution of metadata for print and digital educational content in order to maximize the visibility and understanding of how a product is aligned with relevant educational standards and objectives. (See Appendix 1 for more background on relevant educational standards.) In doing this, we hope to reduce confusion in the marketplace arising from incomplete or inaccurate information about educational content, and to provide a path for greater discoverability by consumers.

The education and library communities have a clear set of needs that can be met through the inclusion of credible educational standards, such as CCSS alignment, and learning-objective metadata within books. Therefore, it is advantageous for publishers, distributors, retailers, and others throughout the book supply chain to work from a set of common guidelines for the consistent placement and formatting of this information. However, allowances must be made for the diverse levels of understanding of educational standards and learning objectives within the target user communities as well as within publishing supply chain organizations. Generating rich, highly detailed metadata that require deep knowledge of the standards will not be beneficial to a large portion of the target users, but using vague terms such as "Common Core aligned" will undermine both the credibility and the utility of the standard. This document seeks to strike the appropriate balance between educational standards data that would be either too granular or too broad.

Two specific BISG working groups were involved in the research and creation of this document. In 2014, the Common Core Working Group completed research on the state of the marketplace at that time and provided suggestions for enhancements to ONIX specifically for expressing Common Core State Standards metadata; those suggestions were later incorporated into ONIX. This work was published and made freely available by BISG as the BISG *Recommendations for Citing Common Core State Standards in ONIX.*

In the spring of 2015, the Educational Taxonomy Working Group followed up on this work by developing the Educational Taxonomy, a list of key terms and phrases used to express common learning objectives found in various educational standards, including CCSS, Next Generation Science Standards (NGSS), and other state-specific standards as well as proprietary classification systems. In order to create this revised version, the group also updated and expanded the Common Core recommendations document to include broader guidelines for expressing educational standards and learning outcome metadata.

The Educational Taxonomy provides a suggested list of controlled key terms and phrases that can be used in metadata for print and digital products in order to facilitate easy communication of key learning objectives (see

complete taxonomy in Appendix 5). As we will describe in more detail throughout this guide, the taxonomy can be used alongside other metadata to make information about an educational resource as robust as possible.

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Citation Options

ONIX now has specific fields for communicating CCSS and educational objective information. Specially designed fields are described below, along with additional information that will allow publishers to fully describe titles applicable to the educational marketplace.

1. Educational Taxonomy

Definition

The objective of the Educational Taxonomy is to provide a controlled vocabulary for describing a publication's intended learning outcomes, regardless of the educational standard (or lack thereof) with which the publication is aligned. A taxonomy is a classification system based on an organizational scheme. In this instance, it is a single-level list of carefully chosen phrases (descriptors) and corresponding seven-character alphanumeric codes. The descriptor consists of a phrase that describes the desired learning outcome. The code is to be used by data senders and recipients to ensure consistency and to avoid typos and misspellings. The four-character alpha code EDTX represents the taxonomy, followed by a three-digit numeric code (e.g., EDTX010). Please see Appendix 5 for the full list of codes and descriptors.

The hope is that, with the introduction of a controlled taxonomy based on common key terms and phrases, consumers will more easily discover titles meeting their needs, because searching will result in fewer false hits and a higher match to relevant titles.

Extent of References

For the purposes of classifying and communicating the Educational Taxonomy terms, it is recommended that no more than five learning objectives be noted. Prioritization of the standards related to a given title will allow the audience to understand the most relevant learning goals for that work without becoming overwhelmed by the metadata. It also will decrease the likelihood that audiences will overlook a title as being too general for their needs.

2. CCSS Dot Notation

Definition

Once it has been established that a given book or other content can be used in the educational process, teachers, librarians, and others involved with the content/book need to have methods and a syntax with which to connect the content to the relevant standard. Specific standards can be identified by alphanumeric identifiers and XML representations that are known as the dot notation.

For example, the standard for Mathematical Content includes three skills that should be mastered in Geometry for the fourth grade. The learning goal is the ability to "draw and identify lines and angles, and classify shapes by properties of their lines and angles." This standard is expressed in the dot notation **CCSS.MATH.CONTENT.4.G.A.1**.

Similarly, the standard for English Language Arts Standards for Reading: Literature for Grade 1, which calls for the learning goal "ask and answer questions about key details in a text," is expressed as **CCSS.ELA-LITERACY.RL.1.1**.

A complete listing of the dot notations can be found at http://www.corestandards.org.

The CCSS guidelines recommend that the full dot notation be used in most metadata exchanges.

With the use of the full CCSS dot notation (**CCSS.ELA-Literacy.RI.K.1**), rather than the shorter dot notation some publishers have adopted to date (**RI.K.1**), references remain as uniform as possible, while resolving any ambiguity as to the learning goals, or standards, that apply to a given title.

Extent of References

For the purposes of classifying and communicating information about CCSS related titles, it is recommended that *no more than five standards be noted*. Prioritization of the standards related to a given title will allow the audience to understand the most relevant learning goals for that work without becoming overwhelmed by the metadata. It also will decrease the likelihood that audiences will overlook a title as being too general for their needs. Judicious use of the dot notation will allow several standards to be covered by the notation cited. For example, it might be possible to use **CCSS.ELA-LITERACY.RL.1** to convey that the content is appropriate in teaching all nine standards in that domain.

Dot Notation vs. Educational Taxonomy

Whether learning objective language (as highlighted in the Educational Taxonomy) and dot notation are preferred will often depend on the user's awareness of the standards and the goals of the receiving party. Therefore, citing only the CCSS dot notation might not be enough. Other data fields for communicating learning goals are also noted below.

3. BISAC Subject Headings

Definition

The BISAC Subject Headings list is an industry-approved list of subject descriptors, each represented by a nine-character alphanumeric code. The descriptor itself consists of two, three, or four levels, in the manner described below.

For example, the code for the descriptor representing general travel in the southern United States is TRV025070 and the related descriptor is "TRAVEL / United States / South / General."

There are 52 major sections, such as COMPUTERS, FICTION, HISTORY, and TRUE CRIME. Each major section contains a number of detailed descriptors that represent subtopics the BISG Subject Codes Committee has deemed most appropriate for each major topic.

The BISAC Subject Headings list was developed to standardize the electronic transfer of subject information. The headings can be used for transmitting information between trading partners, as search terms in bibliographic databases, as access points for database searching, and as shelving guides. Many businesses require that publishers use BISAC Subject Headings when submitting data for all formats (physical and digital).

Extent of References

The committee recommends no more than three headings, depending on the complexity of the title. This recommendation is based on the typical number of codes accepted by downstream trading partners. The number of codes any publisher can supply is dependent upon its systems and that of its trading partners; theoretically, an unlimited number of headings may be used.

The most specific subject(s) applicable to a product should be provided. The practice of supplying both a specific and a general subject heading on a given product is discouraged; use of the most specific heading possible is strongly encouraged. One of those subjects should be considered the "main subject" of the product; generally, all subjects should be listed in their order of importance. For example, if "HISTORY / Military / World War I" has been chosen, those who follow this philosophy would not use "HISTORY / Military / General." For further guidelines, please visit the FAQ and Tutorial on the BISG website.

4. Keywords

Definition

In 2014 the BISG Keywords Working Group authored a best practices document containing recommendations for keyword population. Please refer to this free document, *Best Practices for Keywords in Metadata*, for guidelines on the use of keywords in ONIX metadata. In particular, the "Structuring Keywords" section contains the most detail, and populated examples are included. While keywords may be used to express CCSS themes or learning goals in ONIX metadata, they should be used in conjunction with the other fields referenced here.

Extent of References

In general, keyword population should be limited to a maximum of 500 characters; the first 250 characters are the most important.

5. Descriptions

Definition

Many publishers will likely choose to utilize the Main Description field to convey CCSS, NGSS, and other specific learning objective attributes. Guidance from users of publisher-supplied data indicates that a basic line such as "supports the Common Core State Standards" is too generic, yet a typical CCSS alignment statement with multiple dot notations can easily become too cumbersome to be desirable in the limited space of a description.

One possible compromise is to include a somewhat more detailed statement (such as "correlates to the Common Core State Standards in English Language Arts") while using other metadata fields listed here and keywords to illustrate the use of the content and related learning goals. Key text features (such as a glossary, bibliography, etc., as well as a unique perspective, setting, or theme) should also be called out in descriptions.

Extent of References

In addition to a Main Description, some publishers may choose to utilize a second description, aimed more specifically at the school and library markets, to provide educational standards-based learning objective details. The downside to this approach is that the number of ONIX recipients who will agree to display a separate description is currently limited.

6. Additional Recommended Audience Metadata

While the above recommendations may serve the needs of teachers and librarians who need to document dot notation in order to receive a purchase authorization from their school system, following only these recommendations will fall short of the needs of educators and data recipients who are actively attempting to interpret the various educational standards in use and to critically apply learning objectives to content in order to build collections and meet the needs of individual students. Therefore, publishers should seriously consider supplying additional metadata as noted below.

Reading Levels (Text Complexity)

Reading levels refers to the text complexity of the materials. Leveling is widely used in the education market to indicate the reading level of a particular book as well as to recommend similar books on the same level. This practice can influence and, in some cases, be mandatory due to the adoption of CCSS and other educational standards or be necessary as a student, parent, teacher, or school system decides whether to buy a book or other learning material. In particular, Reading Standard 10 in the CCSS for English Language Arts presents a staircase of increasing text complexity that progresses from beginning reading and builds toward college and career readiness. Quantitative text complexity, which addresses such aspects of a text as sentence length and word frequency, can be measured by a variety of leveling systems. The CCSS specifically mention (in Appendix A of the CCSS for English Language Arts) the Lexile Framework for Reading by Metametrics. Also mentioned in supplemental information associated with the standards are ATOS by Renaissance Learning, Degrees of Reading Power© (DRP©) by Questar Assessment, Inc., Flesch-Kincaid, Reading Maturity by Pearson Education, SourceRater by Educational Testing Service, and Easability Indicator by Coh-Metrix. Brief descriptions of these systems, as well as an updated table displaying the text complexity grade bands and associated ranges from these measures, can be found within the CCSS documentation, as referenced in Appendix 1. Although the CCSS do not specifically reference the Fountas and Pinnell or the Guided Reading leveling systems, many educators use these systems as an indicator of both quantitative and qualitative text complexity.

Per the recently updated BISG/BNC *Best Practices for Product Metadata: Guide for North American Data Senders and Receivers*, leveling is now recommended on titles intended for use in the educational market. Levels for some specific systems can currently be supplied via ONIX. These include the Lexile Framework for Reading by Metametrics, ATOS by Renaissance Learning, and Fountas and Pinnell by Heinemann. It is recommended that publishers partner with the developers of these leveling systems to procure reading levels for their books and that these levels be sent to booksellers and distributors along with traditional metadata. The best practice is to supply the most up-to-date levels for whichever systems an individual publisher may work with. Further, publishers are discouraged from assigning internal levels to books and transmitting that data as part of one of

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these leveling systems. Any publisher-proprietary leveling should be expressed using the age and grade tags of ONIX.

Interest Levels

In addition to the reading level information that helps educators and librarians determine whether the quantitative complexity of a text is appropriate for a given grade level or a particular student's reading ability, narrow and specific interest levels should also be included in metadata. The leveling systems developed to measure quantitative text complexity address only the readability of a book; they do not address the maturity of the content and themes of a book. Books with less text and shorter sentences, or those written in nontraditional narrative form, such as poetry, plays, or graphic novels, can have very low reading levels, so it is highly recommended that interest levels be included in metadata to guide educators, librarians, and parents in selecting books for readers.

Grade Levels

Further, grade levels are also key information for educators and librarians identifying books for educational use, and references should be supplied in ONIX if other Educational Taxonomy or CCSS dot notation references are present. Grade-level recommendations should be in line with the CCSS dot notations for a given title, if dot notations are provided.

Age Levels

Age levels are also of interest for educational titles. The BISG/BookNet Canada publication *Best Practices for Product Metadata: Guide for North American Data Senders and Receivers* provides details on this topic. Please refer to that document for further details.

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Transmitting Data

ONIX 3.0

This section provides examples of the metadata discussed above as supplied in ONIX 3.0. It is a reflection of the capabilities of ONIX as planned for July 2015. Please check the EDItEUR website for the most recent ONIX documentation.

Educational Taxonomy 1.0

a. Reference name:

<Subject>
<SubjectSchemeIdentifier>B1**</SubjectSchemeIdentifier>**
<SubjectSchemeVersion>1.0**</SubjectSchemeVersion>**
<SubjectCode>EDTX100**</SubjectCode>**
</Subject>

b. Short Tags

<subject>
<b067>B1**</b067>**
<b068>1.0**</b068>**
<b069>EDTX100**</b069>**
</subject>

CCSS Dot Notation

Cite the full CCSS dot notation points as subjects within ONIX. With the use of the full CCSS dot notation (**CCSS.ELA-Literacy.RI.K.1**), as discussed within the CCSS guidelines, rather than the shorter dot notation some publishers have adopted to date (**RI.K.1**), the references remain as uniform as possible and remove any ambiguity about the learning goals, or standards, that apply to a given title.

c. Reference name:

<Subject>
<SubjectSchemeIdentifier>A4**</SubjectSchemeIdentifier>**
<SubjectCode>CCSS.ELA-Literacy.RI.K.4**</SubjectCode>**
</Subject>

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d. Short Tags

```
<subject>
<b067>A4</b067>
<b069>CCSS.ELA-Literacy.RI.K.4</b069>
</subject>
```

Main Subject (BISAC)

a. Reference Name

```
<Subject>
 <MainSubject/>
 <SubjectSchemeIdentifier>10</SubjectSchemeIdentifier>
 <SubjectSchemeVersion>2014</SubjectSchemeVersion>
 <SubjectCode>JUV047000</SubjectCode>
</Subject>
```

a. Short Tags

```
<subject>
 <x425/>
 <b067>10</b067>
 <b068>2014</b068>
 <b069>JUV047000</b069>
</subject>
```

Short Description (for a general audience)

a. Reference Name

```
<TextContent>
 <TextType>02</TextType>
 <ContentAudience>05</ContentAudience>
 <Text>The Rookie Read-About® series brings a broad array of topics to vibrant life with striking, full-color
photos and just the right amount of fun, factual, fascinating text. Correlates to the Common Core State
Standards in English Language Arts.</Text>
</TextContent>
```

b. Short Tags

<textcontent>
  <x426>02**</x426>**
  <x427>05**</x427>**
  <d104>The Rookie Read-About® series brings a broad array of topics to vibrant life with striking, full-color photos and just the right amount of fun, factual, fascinating text. Correlates to the Common Core State Standards in English Language Arts.**</d104>**
</textcontent>

Audience

a. Reference Name

<Audience>
  <AudienceCodeType>01**</AudienceCodeType>**
  <AudienceCodeValue>04**</AudienceCodeValue>**
</Audience>

b. Short Tags

<audience>
  <b204>01**</b204>**
  <b206>04**</b206>**
</audience>

Text Complexity

Lexile Measure

a. Reference Name

<Complexity>
  <ComplexitySchemeIdentifier>06**</ComplexitySchemeIdentifier>**
  <ComplexityCode>560L**</ComplexityCode>**
</Complexity>

b. Short Tags

<complexity>
  <b077>06**</b077>**
  <b078>560L**</b078>**
</complexity>

Fountas and Pinnell Text Level Gradient

Note that this code is not meant to be used for Guided Reading levels.

a. Reference Name

```
<Complexity>
  <ComplexitySchemeIdentifier>05</ComplexitySchemeIdentifier>
  <ComplexityCode>G</ComplexityCode>
</Complexity>
```

b. Short Tags

```
<complexity>
  <b077>05</b077>
  <b078>G</b078>
</complexity>
```

ATOS Level for Books

a. Reference Name

```
<Complexity>
  <ComplexitySchemeIdentifier>07</ComplexitySchemeIdentifier>
  <ComplexityCode>4.2</ComplexityCode>
</Complexity>
```

b. Short Tags

```
<complexity>
  <b077>07</b077>
  <b078>4.2</b078>
</complexity>
```

Interest Level (in years)

a. Reference Name

```
<AudienceRange>
  <AudienceRangeQualifier>17</AudienceRangeQualifier>
  <AudienceRangePrecision>03</AudienceRangePrecision>
  <AudienceRangeValue>4</AudienceRangeValue>
  <AudienceRangePrecision>04</AudienceRangePrecision>
  <AudienceRangeValue>6</AudienceRangeValue>
</AudienceRange>
```

b. Short Tags

```
<audiencerange>
  <b074>17</b074>
  <b075>03</b075>
  <b076>4</b076>
  <b075>04</b075>
  <b076>6</b076>
</audiencerange>
```

Grade Level

a. Reference Name

```
<AudienceRange>
  <AudienceRangeQualifier>11</AudienceRangeQualifier>
  <AudienceRangePrecision>03</AudienceRangePrecision>
  <AudienceRangeValue>K</AudienceRangeValue>
  <AudienceRangePrecision>04</AudienceRangePrecision>
  <AudienceRangeValue>1</AudienceRangeValue>
</AudienceRange>
```

b. Short Tags

```
<audiencerange>
  <b074>11</b074>
  <b075>03</b075>
  <b076>K</b076>
  <b075>04</b075>
  <b076>1</b076>
</audiencerange>
```

ONIX 2.1

This section provides examples of the metadata discussed above as supplied in ONIX 2.1. It is a reflection of the capabilities of ONIX planned for 2015. Please check Editeur for the most recent ONIX documentation.

Educational Taxonomy

a. Reference Name

```
<Subject>
```

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```
<SubjectSchemeIdentifier>B1</SubjectSchemeIdentifier>
<SubjectSchemeVersion>1.0</SubjectSchemeVersion>
<SubjectCode>EDTX100</SubjectCode>
</Subject>
```

b. Short Tags

```
<subject>
<b067>B1</b067>
<b068>1.0</b068>
<b069>EDTX100</b069>
</subject>
```

CCSS Dot Notation

Cite the full CCSS dot notation points as subjects within ONIX. With the use of the full CCSS dot notation (**CCSS.ELA-Literacy.RI.K.1**), as discussed within the CCSS guidelines, rather than the shorter dot notation some publishers have adopted to date (**RI.K.1**), the references remain as uniform as possible and remove any ambiguity about the learning goals, or standards, that apply to a given title.

a. Reference Name

```
<Subject>
  <SubjectSchemeIdentifier>A4</SubjectSchemeIdentifier>
  <SubjectCode>CCSS.ELA-Literacy.RI.K.1</SubjectCode>
</Subject>
```

b. Short Tags

```
<subject>
<b067>A4</b067>
<b069>CCSS.ELA-Literacy.RI.K.4</b069>
</subject>
```

Main Subject (BISAC)

a. Reference Name

```
<BASICMainSubject>JUV047000</BASICMainSubject>
  <BASICVersion>2014</BASICVersion>
```

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b.   Short Tags

<b064>JUV047000**</b064>**
  <b200>2014**</b200>**

Short Description

a.   Reference Name

<OtherText>
  <TextTypeCode>02**</TextTypeCode>**
  <Text>The Rookie Read-About® series brings a broad array of topics to vibrant life with striking, full-color photos and just the right amount of fun, factual, fascinating text. Correlates to the Common Core State Standards in English Language Arts**</Text>**
</OtherText>

b.   Short Tags

<othertext>
  <d102>02**</d102>**
  <d104>The Rookie Read-About® series brings a broad array of topics to vibrant life with striking, full-color photos and just the right amount of fun, factual, fascinating text. Correlates to the Common Core State Standards in English Language Arts**</d104>**
</othertext>

Description for Teachers/Educators

a.   Reference Name

<OtherText>
  <TextTypeCode>28**</TextTypeCode>**
  <Text>CCSS.ELA-Literacy.RI.K.3. With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.**</Text>**
</OtherText>

b.   Short Tags

<othertext>
  <d102>28**</d102>**
  <d104>CCSS.ELA-Literacy.RI.K.3. With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.**</d104>**
</othertext>

Audience

a. Reference Name

<AudienceCode>04**</AudienceCode>**

b. Short Tags

<b073>04**</b073>**

Text Complexity

Lexile Measure

a. Reference Name

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  <ComplexitySchemeIdentifier>06**</ComplexitySchemeIdentifier>**
  <ComplexityCode>560L**</ComplexityCode>**
</Complexity>

b. Short Tags

<complexity>
  <b077>06**</b077>**
  <b078>560L**</b078>**
</complexity>

Fountas and Pinnell Text Level Gradient

Note that this code is not meant to be used for Guided Reading levels.

a. Reference Name

<Complexity>
  <ComplexitySchemeIdentifier>05**</ComplexitySchemeIdentifier>**
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</Complexity>

b. Short Tags

<complexity>
  <b077>05**</b077>**
  <b078>G**</b078>**
</complexity>

ATOS Level for Books

a. Reference Name

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b. Short Tags

<complexity>
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  <b078>4.2**</b078>**
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Interest Level

a. Reference Name

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  <AudienceRangePrecision>03**</AudienceRangePrecision>**
  <AudienceRangeValue>4**</AudienceRangeValue>**
  <AudienceRangePrecision>04**</AudienceRangePrecision>**
  <AudienceRangeValue>6**</AudienceRangeValue>**
</AudienceRange>

b. Short Tags

<audiencerange>
  <b074>17**</b074>**
  <b075>03**</b075>**
  <b076>4**</b076>**
  <b075>04**</b075>**
  <b076>6**</b076>**
</audiencerange>

Grade Level

a. Reference Name

<AudienceRange>

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  <AudienceRangePrecision>03</AudienceRangePrecision>
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  <AudienceRangePrecision>04</AudienceRangePrecision>
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</AudienceRange>
```

b. Short Tags

```
<audiencerange>
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  <b075>03</b075>
  <b076>K</b076>
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  <b076>1</b076>
</audiencerange>
```

Appendix 1: Definition and Resources

Common Core State Standards (CCSS)

The CCSS is a set of high-quality academic standards in mathematics and English language arts/literacy (ELA). These learning goals outline what a student should know and be able to do at the end of each grade. The standards were created to ensure that all students graduate from high school with the skills and knowledge necessary to succeed in college, career, and life, regardless of where they live.

The CCSS for Literacy in History/Social Studies, Science, and Technical Subjects specifies the literacy skills and understanding required for college and career readiness in multiple disciplines.

College, Career & Civic Life (C3) Framework for Social Studies State Standards

The C3 Framework was created to assist states in upgrading their existing social studies standards and to help school districts prepare students for effective and successful participation in college, careers, and civic life.

Next Generation Science Standards (NGSS)

The NGSS is a set of new K–12 science standards that are rich in content and practice, and arranged in a coherent manner across disciplines and grades to provide students an internationally benchmarked science education.

21st Century Skills

21st Century Skills were created to help every child succeed as effective citizens, workers, and leaders by fusing the "4 Cs"—Critical thinking and problem solving, Communication, Collaboration, and Creativity and innovation—with the related disciplines.

Resources

CCSS Overview: http://www.corestandards.org/

CCSS Dot Notation: http://www.corestandards.org/developers-and-publishers/

Supplemental Information from CCSS Appendix A:
http://www.corestandards.org/assets/E0813_Appendix_A_New_Research_on_Text_Complexity.pdf

C3 Framework: http://www.socialstudies.org/c3

NGSS Overview: http://www.nextgenscience.org/

21st Century Skills Overview: http://www.p21.org/

Appendix 2: Need for Educational Metadata

Throughout the creation of this document, work was undertaken to clarify and confirm the value of the inclusion of educational standards and learning objectives within product metadata for multiple stakeholders as well as to capture what the value and/or use of the metadata actually is or is expected to be. A variety of routes were taken in order for the working groups to be as inclusive of various perspectives and points of view as possible. Further detail is provided here on the process and the outcomes of this validation.

Value of the Educational Taxonomy in the Marketplace

Bookselling

Marketing
Marketing professionals need to be able to quickly and easily identify titles that are applicable to specific customers or disciplines. It is crucial for them to create campaigns that provide solutions for the challenges posed as schools develop curricula that meet learning objectives within educational standards such as the NGSS. Given the large number of titles produced every year, the Educational Taxonomy will help marketers quickly identify a range of titles to meet the needs of a particular teacher or subject matter, outside the realm of CCSS exemplar texts. The taxonomy will also be a catalyst for introducing lesser-known titles into the curriculum while complying with standards, thus expanding the range of options available to educators and parents.

Discovery of related works
Book discovery online happens through many types of searches, including keywords, subject browsing, and browsing related titles. This taxonomy will allow retailers and libraries to build browsing functions on their sites based on the controlled list of learning objectives. This will also allow educators and parents to find similar resources to a book they identified by title or author.

Merchandising
The merchandising of titles allows book publishers, sellers, and wholesalers to stimulate the interest of retail consumers. As school districts focus their curriculum on student skill sets and learning objectives, they seek titles that will support these goals. The Educational Taxonomy will allow the marketplace to highlight the support of these skills and objectives within titles in their inventory. Consumers can make more informed decisions by knowing the educational objectives covered by a particular title; feeding the consumers this information will allow them to target purchases and be more inclined to purchase those titles they know will include support of specific skills. Use of the Educational Taxonomy will provide an advantage to merchandisers, who can present to consumers titles meeting their exact needs regarding aspects of the curriculum.

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Consumers

Once the Educational Taxonomy is in place and being used by the publishing industry supply chain, consumers searching for books to fulfill learning objectives will have a greater chance of finding appropriate books. For example, for parents, librarians, and teachers looking for books appropriate for a lesson on multiple narratives or one on fact and opinion, a search on retailers' sites or a general web search will be more effective with this data in place. The Educational Taxonomy is the first standardized way to point out how books support general learning objectives. Without such a mechanism, opportunities to connect materials to learning objectives may be missed, leading consumers to turn to a narrow band of books (e.g., Common Core "exemplar" titles) when a wider appropriate selection is available.

Content Creation

Publishing Workflow
Many publishing companies are now gathering data about how their books align with learning objectives of educational standards such as the Common Core. This data is being shown within marketing materials and online, with the aim of supporting teachers, librarians, and other educational professionals as they make purchasing decisions and then utilize materials in their collections. The availability of an industry-approved taxonomy for learning objectives will enable companies to create appropriate database fields to hold this data. Thinking about the appropriate code from the taxonomy beginning with the acquisition of a title will support a smooth workflow through the title-development process, and onward through the marketing of upcoming as well as backlist titles.

Content Management Systems
If used consistently across appropriate titles in a publisher's title data repository (both print and digital formats), the taxonomy will improve the utility of the data repository. This is useful both in a repository of published content (an archive of publications) and in a repository designed for the development of publications. The latter will prove especially useful, enabling a publisher to systematically and accurately query its repository to find "content below the title level" that addresses the desired learning objectives across all titles in the repository. This will facilitate both the development of new titles and the creation of derivative versions of existing titles, and eliminate the duplication of information in existing publications.

EPUB
The Educational Taxonomy will provide a consistent, standardized, and referenceable vocabulary to describe the learning objectives addressed by a given title. The same terms that are incorporated into ONIX feeds or provided as external metadata associated with the delivery of content to a Learning Management System could be used

within the EPUB file. Both EPUB and EDUPUB (a profile of EPUB 3) provide features for incorporating such metadata at the title or publication level within the EPUB itself.

The terms from the taxonomy can also be associated with more granular portions of *content below the title level*: units, chapters, sections, exercises, quizzes, videos, and other components of a publication. This will provide the same benefits for those components as those cited for titles above. The latest EPUB and EDUPUB specs provide a specification for "Distributable Objects," so that such "chunks" could be characterized by the vocabulary either in their context within a title or when distributed as a separate resource. The standardized vocabulary will enable systematic identification without requiring the actual narrative text in each title to conform to the standard: thus the author and publisher will have the freedom to tag a given set of learning objectives in a unique way on a given chapter of a given title, while associating the standard vocabulary with that "chunk" to facilitate interoperability.

Metadata Flow

MARC
School libraries use MARC records for their online catalogs. Publishers who use the Educational Taxonomy in ONIX will provide K–12 wholesalers and MARC record providers the opportunity to use publisher-supplied terms as they create their records.

Schema.org
Schema.org is a collection of vocabularies for HTML page markup that supports structured data interoperability across all major web browsers. The Learning Resource Metadata Initiative (LRMI) team leaders worked comprehensively on behalf of publishers' needs to build a set of Schema.org properties that reach the audience their learning resources serve, addressing the areas where resources are "lost in white space" on the web. The inclusion of the LRMI tagging schema into Dublin Core & Schema.org is creating a path for learning resources to surface in searches more readily. LRMI includes alignment tags to standards, along with tags that define and point to the educational framework of the standard(s) assigned. The Educational Taxonomy values will enhance the LRMI/schema.org/Dublin Core Educational Resource Specification, as the Educational Taxonomy resides in the undefined space between standard resource metadata (which includes title, author, age level, time required, and resource type) and standards/alignment (CCSS strands etc.). The inclusion of the taxonomy will allow resources to be found based on objectives, regardless of their alignment with any one standard. If educators are looking for resources to meet objectives that are not strictly tied to standards, without the taxonomy they do not currently have a way to easily do so.

Selling/Ordering

Retail Websites

Surveys circulated to educators and librarians by the Educational Taxonomy Working Group showed that retailer websites play a significant role in the search and discovery of classroom titles. When a search on these websites is conducted using keywords, the result is often far more hits than are relevant. Retailers' use of the Educational Taxonomy will ensure greater search result accuracy for those seeking titles targeting specific learning objects. In addition to educators, parents and students may be searching for titles for use with classroom assignments or to further their studies on an objective being addressed in the classroom. The working group's surveys show that these consumers generally turn to retail websites as a source for identifying titles on a certain subject or objective. If online retailers apply the taxonomy appropriately, consumers will more frequently order titles targeting the objective they need; the result will be fewer returns to the retailer.

Publisher Websites

The Educational Taxonomy, when used for faceted searching within a publisher's website, will enable discovery of titles that address the learning objectives the publisher describes. Such a search will be much more efficient and effective than a more unstructured, keyword-based search; and it will also be much more useful than proprietary, publisher-specific vocabularies, which require educators to explore each publisher's resources in a unique way.

Wholesalers Ordering Systems

Wholesalers will usually be recipients of the Educational Taxonomy terms, although on occasion they may also apply them as part of their collection development services. For wholesalers who offer online access to their catalog, the most likely use will be as part of searching indexes similar to, or perhaps included within, those offered to consumers for online searching. The forward-thinking wholesaler may want to feature the Educational Taxonomy terms as a separate grouping in its user interface in order to draw attention to them. Wholesalers may opt to develop a tutorial to assist their end users (retailers, libraries, consumers) in the search process.

Schools & Libraries

Integrated Library Systems (ILS)

For online catalog records, most public libraries use an intermediary (such as a vendor like Baker & Taylor) to map ONIX data to the MARC fields, and this can be a tedious process. However, the benefits of using an intermediary are both financial and practical as it guarantees a (relatively) consistent metadata experience on all catalog records, alleviates strain on library resources, and minimizes in-house cataloging. Therefore, publishers will be best served by distributing the Educational Taxonomy terminologies in ONIX to their trading partners for

reuse in library systems. The Educational Taxonomy terms will help patrons, including teachers, parents, and students, better identify the most relevant items as they review a library catalog.

Leveling Scheme Records

Leveling schemes provide web portals for educators to look up titles. Educational taxonomy terms will be beneficial when used in such schemes and will provide enhanced information to these records. A teacher will then see both the level and the educational objectives in a single place.

School Library Collections Records

School librarians, teachers, and administrators need to identify materials best suited to the needs of their students. Having the Educational Taxonomy terms in the metadata they see and search with means better matches and easier justification of purchase decisions. In their collections, school librarians want to include titles that support the curriculum of classroom teachers. The classroom teachers will rely on the school library to provide supplementary materials for a lesson on a particular learning objective or skill. The Educational Taxonomy will allow school librarians to allocate their materials budget to those titles that best support teachers' lessons plans and teaching goals.
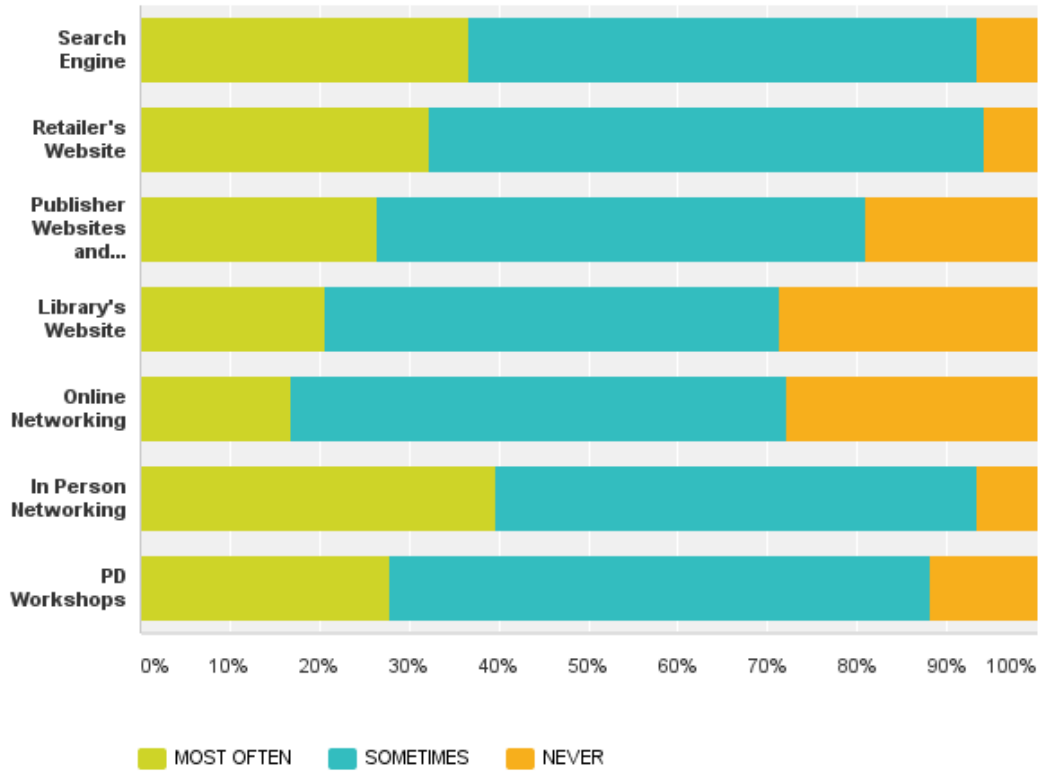
Educational Taxonomy Survey Results

Initial Survey to Educators

At the onset of this project, the Educational Taxonomy Working Group created and distributed a survey to educators regarding their searching habits. Of the 136 respondents, 49% were teachers, 14% were school media specialists, and the remainder were from other areas of the library or school environment. The majority (60%) worked with students of elementary school age (K–4).

The survey asked respondents how they most often identify books for use in their library or classroom. Networking in person with other educators and using a search engine were the two means most often used (see figure 1 below).

Figure 1

Respondents were asked what criteria they most often used when searching to identify books for use in the classroom or library. Most respondents indicated that they use subject or content area (92%) or age range/grade level (90%). Other criteria used are indicated in figure 2 below.

Answered: 136   Skipped: 0

Learning objectives
Age range or grade level
Subject or content area
Terms from lesson plans
Terms from a standard
Author or thought leader
Core teaching strategies
Text features (glossary,...
Point of view terms
Text type (procedural,...
Other:

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%
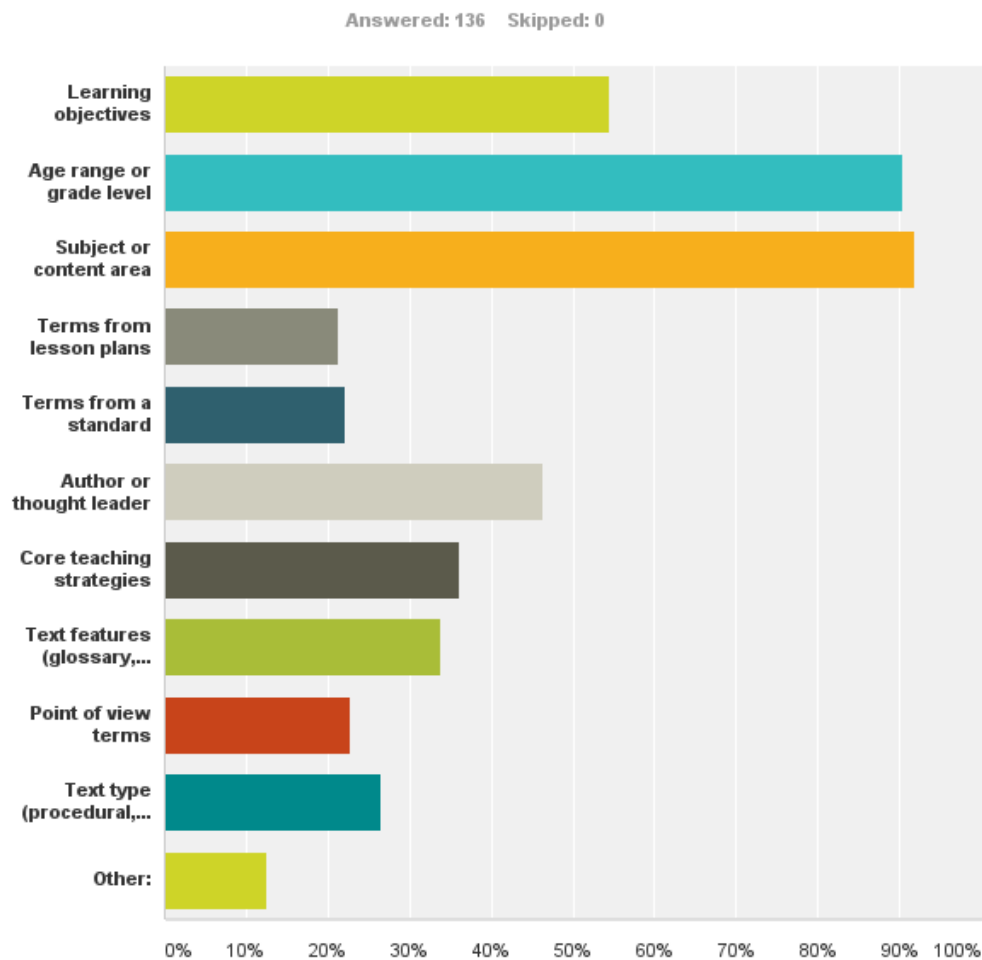
Figure 2

When respondents were asked what information is lacking on the websites (of, e.g., retailers, libraries) that would help in finding classroom resources more quickly and effectively, the most common answer was reading levels. This was followed by variations of content (e.g., table of contents, index, etc.), alignment with standards, and learning skills.

One respondent commented that "teachers are really desperate for an easy-to-use source for classroom libraries and book rooms. They need a resource that can help them build collections tailored for their students, for their curricula, and for their CCSS needs. Guided reading and leveled content reading are a huge need right now, in addition to short, meaty text (even excerpts) for close reading." Another stated that educators "are looking for a

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magical combination of engaging, beautifully written and designed books that are at the appropriate reading level for the grade and align with the curricular units/themes being studied at a particular point in the year."

After the Educational Taxonomy terms were developed, two surveys sought to validate with educators and the marketplace the concept of the taxonomy and some specific terms from the taxonomy.
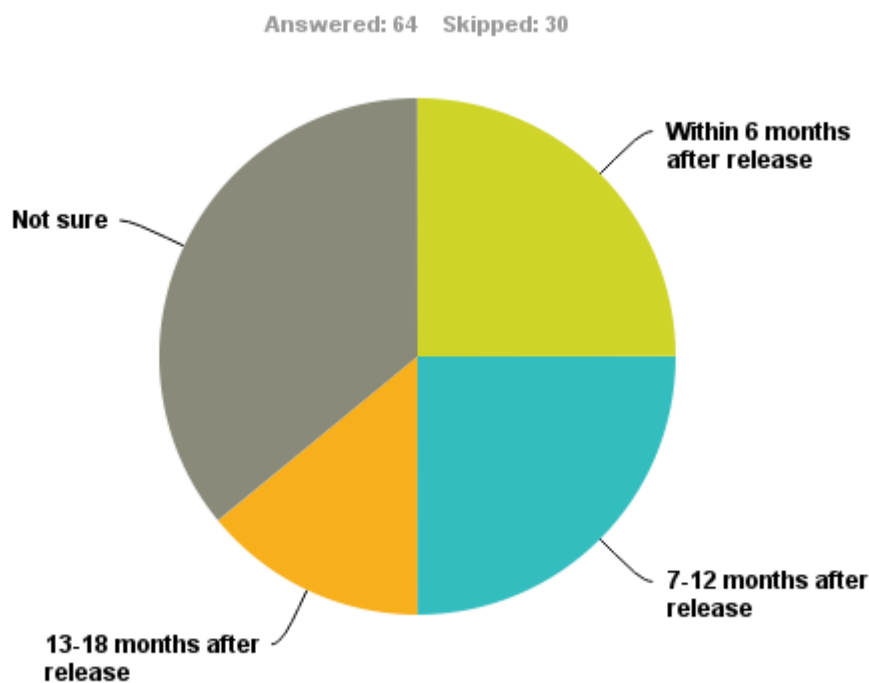
Marketplace Survey

Survey Demographics

In order to gauge interest and usage of the Educational Taxonomy within the marketplace, the working group distributed a survey to BISG membership and others in the publishing marketplace, inviting them to review sample terms from the taxonomy and to comment. Of the 94 respondents, 62% were from publishers, 30% from distributors/wholesalers, and 9% from other segments of the industry. Of the publisher respondents, 63% were from trade publishers, 47% from pre-K–12 education publishers, and 42% from higher education/scholarly/professional publishers or other. Respondents held positions in sales/marketing/buying (59%), metadata/IT/editorial (20%), and other (21%) areas of their company.

Cumulatively, the respondents indicated that they considered their most important end user to be school librarians/media specialists, followed by librarians, classroom teachers, and finally retail customers.

Taxonomy Usage

As noted above, the working group provided respondents with a list of sample terms and asked for comments on them. Just over 79% of them indicated that the terms/phrases in the taxonomy would add value to marketplace metadata. About 64% of respondents felt that the sample phrases were applicable to many disciplines; 60% felt they were expressive of thought not currently being provided in their metadata; and 40% felt the phrases were meaningful overall. An impressive 97% felt they would apply these terms/phrases to titles meant for school sales, and 66% felt they would apply them to titles meant for library sales. Overall, 61% felt that these terms enhance the BISAC subject.

The most commonly cited drawbacks to the taxonomy were that the terms would add extra time to the metadata creation process (85% of respondents) and that it created the need to create new data fields within their internal systems (81%). That being said, 25% indicated they would definitely adopt the new taxonomy, and 72% indicated they possibly would. Implementation time frames were estimated by those who answered "definitely" or "possibly" to this question in figure 3 below.

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Within 6 months after release

Not sure

7-12 months after release

13-18 months after release

Figure 3

The most common limitations expressed in getting the terms to end consumers were lack of an applicable field in ONIX (57%), lack of an internal database field (55%), lack of resources for adding values to data (51%), and the inability by retail partners to display data (48%).

Educator Survey

Survey Demographics

In order to gauge interest and usage of the Educational Taxonomy among educators, the working group distributed a survey to groups of teachers and media specialists inviting them to review sample terms and to comment. The survey generated an impressive 1,842 respondents; 67% were school librarians/media specialists, 14% were public librarians, 10% were elementary or secondary educators, and 9% worked in other segments of the field. The majority of respondents regularly engage with elementary school age students (71%), but others regularly work with middle school (36%), pre-K (33%), and high school (25%) age students.

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When asked about the tools used to research purchasing decisions, respondents indicated that they rely most on professional development resources (ranked as the number one source by 47% of respondents), followed by media reviews (42%) and publisher catalogs or websites (31%). In their searching, 51% indicated that they have used terms related to student skills development to assist them in identifying appropriate resources.

As detailed in figure 4 below, many respondents indicated they would like to be able to better relate course materials to learning objectives, especially materials intended not only for classroom use, such as best sellers, award winners, and other consumer books.

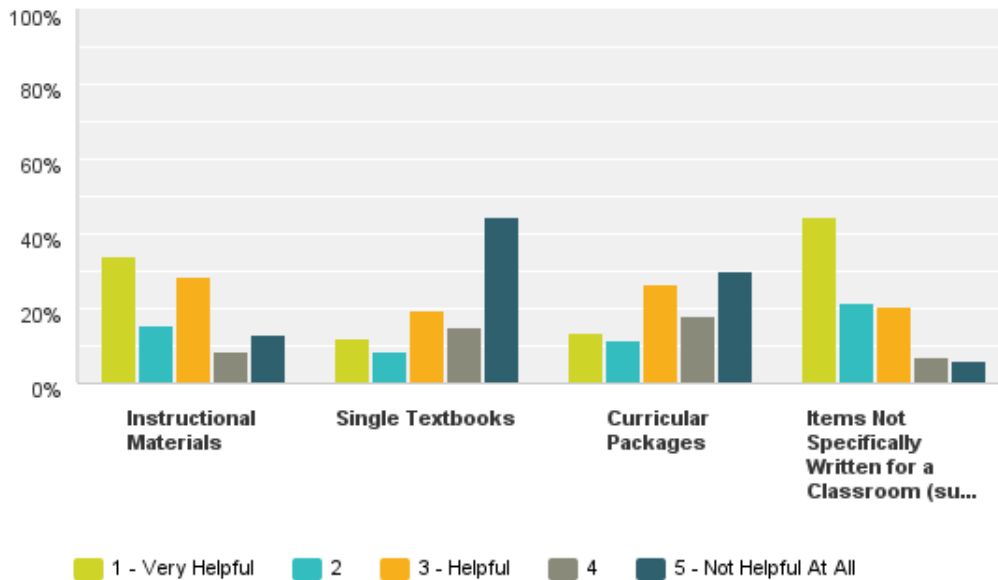*Figure 4*

Taxonomy Usage

When asked if they would utilize a taxonomy related to the development of student skills if it were available, 57% indicated that they would be very likely or likely to use it. The survey presented respondents with a sampling of terms included in the taxonomy; 47% indicated they would be very likely or likely to use such exact phrases in their searching, and 53% indicated that seeing these student skills among a title's metadata would be likely to influence their purchasing decision. However, 62% were only somewhat likely or not likely to trust student skill development information as provided by a publisher.

The responses from the educators on their overall thoughts about using the taxonomy terms to search for appropriate resources were mostly positive. Many who were skeptical expressed a willingness to try and an openness to learning more about them. They would be more open to using the taxonomy if the terms included more definition for each individual term and if they were provided with some support while getting used to them. Some of the more positive responses were for the terms "reflect higher-level thinking skills," "would save time and allow us to have more useful books in the library," and are "exactly what the students need."

We asked educators to consider their own specific needs while creating our student skill terms and to tell us from personal experience and students' needs the main student skill phrases they would use in searching. The most commonly cited phrases included "analyze media"; "cite supporting evidence"; "compare and contrast"; "compare point of view"; "construct"; "explanations and design solutions"; "critical thinking"; "define problems"; "engage in argument from evidence"; "expository text"; "gather relevant information from multiple sources"; "generate ideas"; "identify main idea and supporting details"; "inference"; "informational text"; "point of view"; "character development narrative"; "summarize"; and "write explanatory texts." Many of these directly overlap with those provided in the taxonomy. These results seem to validate the notion that educators are, in fact, searching by these types of skills.

The response was not entirely positive, though, with several respondents noting that the taxonomy was not useful with elementary school students because the terms were too complicated or academic; others said they felt the terms were too generic and that "a good teacher can make most resources work for teaching a particular skill."

One of the most commonly cited drawbacks of the terms was a lack of trust in the publisher's ability to assign them. Those who commented expressed a concern that publishers are often disconnected from and lack understanding of students, teachers, and curriculum, and therefore lack the ability to appropriately align materials with standards. One respondent expressed a concern about "who evaluates the resources and assigns the terms." Other respondents were more frank; one stated:

I place limited trust in what a publisher says their resource(s) provides. Many times I feel that publishers know curriculum buzzwords and use them to sell an item. However, the publisher's depth of understanding of what it truly takes to effectively teach that skill is limited.

Another noted, "I like using the terms to search for resources. I, however, have been burned in the past when a publisher claimed one thing and, once I had the book in hand, it wasn't anything like they said."

Yet another commented, "As long as the books really do help with the skills/terms, fantastic."

CCSS Metadata Needs

Participants in the CCSS Working Group reflected the interests of:

- Trade and school wholesalers/publishers

- Trade and school distributors

- Public librarians

Additional representatives from the following interested parties were interviewed by the working group during its working sessions:

- School and public librarians

- School media specialists

- School and trade publishers

Finally, a survey was conducted in order to judge priorities and ascertain preferences among a larger group of stakeholders. Participation was reflective of the target market:

- 35% librarians

- 27% publishers

As determined by this research, the expected users of CCSS alignment data are primarily librarians, teachers, and media specialists, although it is acknowledged that administrators, curriculum specialists, and parents are a valid secondary audience. Both audiences currently face a number of challenges related to CCSS alignment information—specifically: finding it, understanding it, and assessing its credibility. The information is provided through numerous channels and at varying levels of specificity (e.g., vague statements such as "Common Core

related") and in various formats (e.g., keywords or CCSS code notations). (More details can be found in [Appendix 4](#).) These channels include:

- Publisher web portals and online catalogs

- Collateral materials from sales reps

- Teacher web portals

- Book labels (publishers)

- Book labels (librarians)

- ONIX records

- MARC records

The goals for these audiences were also analyzed. The working group found two broad categories for using CCSS alignment metadata, as follows:

1. To support delivery of effective education:

    a. Prepare specific teaching (and/or curriculum) guides at both title and chapter levels

    b. Create editorial content for teachers, students, and parents

    c. Inform product users of CCSS applications for book titles

    d. Suggest ways for teachers to tie books to the curriculum

    e. Inform teachers on curriculum specifics covered in the text

2. To support purchase decisions:

    a. Provide public librarians with information they need to make a purchase

    b. Include data in marketing materials

    c. Prepare book clusters online and physical book collections for sale to schools and libraries

    d. Inform sales staff of CCSS applications for book titles

    e. Create ad hoc title lists for customers

Appendix 3: CCSS Notation in Use

The research of the CCSS Working Group in 2014 revealed widely varying practices for communicating Common Core metadata used in the industry today. These include:

Applying CCSS dot notation:
Employing outsourced or in-house resources to evaluate content against pedagogical requirements for each CCSS learning goal and grade level.

Using a correlation service and providing all ELA correlation results for website posting.

Applying CCSS learning goals:
Creating and using an in-house taxonomy list of keywords to apply to titles as applicable. The keywords reference skills identified with the CCSS.

Mentions supplied for website or ONIX purposes:
Mentioning CCSS in book descriptions via a standard statement (e.g., "Common Core aligned").

Citing CCSS dot notation at the end of book descriptions.

Listing CCSS learning goals as keywords within the description.

Tagging titles with a Y or N indicator in a CCSS dedicated field.

Identifying CCSS dot notations as separate data points.

Using multiple dot notations per title.

Listing CCSS strands as a separate data point (e.g., ELA or Math).

Appendix 4: Background and Scope of Work

Educational Taxonomy Working Group

Process

The working group took the following steps and relied on the following considerations in creating this taxonomy:

- Reviewed educational standards (a list of these standards can be found in Appendix 1) and identified a list of proposed terms.

- Put the CCSS document and NGSS documents through a machine indexer in order to identify further proposed terms.

- Collated terms across subject areas, deduped, and standardized the language of the keyword phrases.

- Grouped remaining strings by like action to ensure clarity of the skills and avoid duplication.

- Ran suggested key phrases through search engines and analyzed them against search results (for number of hits and relevance of hits). Revised terms based on results.

- Ensured terms did not overlap with those existing in the 2014 edition of the BISAC Subject Headings.

- Decided where the taxonomy belongs in ONIX. Once agreed that it should be sent in the subject composite, the group developed and assigned codes to the literal values in the list.

- Looked at the VitalSource/CourseSmart taxonomy for overlap and organization. Looked at use cases and how instructors were using the taxonomy to locate specific books for their courses.

- Reviewed possible usage for the taxonomy based on the research of the working group throughout the development of the taxonomy.

- Conducted two rounds of surveys (a preliminary survey and a feedback survey to both educators and the marketplace).

- Attempted to validate usage of dot notation and the taxonomy through surveys of educators and the marketplace.

Limitations

The working group identified the following limitations of using the Educational Taxonomy that a publisher should consider when implementing its use:

- The taxonomy must be adopted by both data senders and recipients in order for it to be effective and be visible to the end user.

- A time investment is required for publishers and/or data aggregators to apply the tags.

- Learning objectives can be subjective and application of these is only as helpful as the data supplied.

- Publishers may lack the expertise to apply these tags (though some may employ educational experts).

- The role of the taxonomy in text complexity analysis is just one step in the evaluation of materials for educational use (other steps include evaluating text complexity and completing alignment with grade level and reading level).

- If a company already has a proprietary system in place, it may be reluctant to put forth the effort to adopt a second system. If a company is using separate systems, it needs to ensure that the two systems are linked and maintained.

- Existing proprietary methodologies for presenting this data may not align with the BISG Educational Taxonomy.

- Proprietary systems may be more granular than the Educational Taxonomy, so it may not meet the needs of some users.

- This is not the sole search resource for marketing materials for use in education; it needs to be used in conjunction with other data elements, such as leveling information, age/grade range, and BISAC subject.

- There is the potential for confusion and duplicative effort in data creation.

- There is the potential for inconsistency within the metadata if this information is maintained in multiple places.

CCSS Working Group

Background

In the fall of 2013, the BISG Metadata Committee created the Common Core Working Group to research and gather data around the practice of sending CCSS indicators with print and digital metadata records throughout the US supply chain. The specific mandate of the working group was to create recommendations for handling the CCSS notation in ONIX, including tags and code list changes necessary to do the following: implement the ideas, recommend if ONIX should allow for similar process for state-specific CCSS notation should a publisher wish to supply it, limit the number of interpretations that can be made of the data, and determine best practices for the number of codes that should be expressed for each title.

The working group also described some key elements that would be covered in its research and the resulting recommendations. To ensure the recommendations would be most useful to such consumers as parents, administrators, teachers, and librarians, it was necessary to hear from a wide cross section of the industry. Therefore, the working group invited a variety of stakeholders to participate in meetings and surveys. A list of individuals and companies that participated in this Working Group appears at the beginning of this document.

Limitations

It is important to note that, at the start of these projects, no specific metadata fields existed to represent CCSS-specific data in ONIX, a situation that led to a variety of practices being adopted in the marketplace. Examples of practices can be found in Appendix 3. The CCSS contain recommendations for dot notations and URIs, but metadata standards related to product transmissions to businesses and end users, such as MARC and ONIX, do not currently accommodate these fields. As a result, all members of the supply chain—including editors, metadata creators, publishers, distributors, and retailers—need guidance on how to structure, store, and transfer this information.

Furthermore, CCSS are new not only to book publishers and the book supply chain, but also to educators and librarians. As such there is no consensus in the marketplace as to a preference for one method of communication over another. Through its research, the working group found that dot notations are important for upper-level administrators during the acquisition process, and descriptions or keywords are more useful for librarians and educators implementing texts into the curriculum and determining their instructional use. It is also expected that the needs of the audience for CCSS-related information will change over time as the standards are implemented, users become accustomed to them, and the standards are leveraged to improve teaching practices. What is needed for notation today may not be the same as what will be needed in the future. For example, CCSS dot notation may be the highest priority for teachers today, while in the future, text complexity and exemplar language may be more useful. This document is an effort to allow parties to start communicating metadata in some recommended ways, and these recommendations will evolve over time with the use of the CCSS.

In addition, it is important to note that with any recommendations for new metadata fields there is a lag time between the creation of the data and implementation as supply chain partners integrate the new data and fields into their workflow and displays. Yet the process needs to start somewhere. School curriculum publishers have already started tagging items, as have some trade publishers.

This document suggests that five references of educational objectives or dot notations be supplied, yet in reality an educational material could contain 200–500 alignment values describing CCSS or other state-standard learning goals. Communicating all of these references in ONIX (or via any other method) would entail extremely large data transfers and could overwhelm the end user, which could mean the metadata transferred is not helpful to the recipient. In addition, while educational publishers may need to go to the expense of assigning a large number of values, trade publishers and nontextbook educational vendors may not be able to justify the cost of applying more than a few codes to a given title or have the knowledge to do so. Therefore, this document focuses on communicating the most relevant information for the majority of end users and does not address other state-standard metadata options.

Finally, this document is not designed to recommend any methodologies for determining alignment of products to the CCSS, such as measures for determining text complexity or reading level. The goal of this project is to facilitate the communication of any existing alignments assigned through the various methods available to a publisher.

Interoperability Limitations

The working groups reached out to the parties responsible for MARC 21 and the Learning Resource Metadata Initiative (LRMI)—which is now being governed and maintained by the Dublin Core Metadata Initiative (DCMI) and has been incorporated into Schema.org—in order to ensure that the group's recommendations for ONIX updates offer a parallel structure to these other schemas. From these discussions and research, the working groups detailed tag and structure similarities between these schemas to show where educational standards metadata elements would most likely be stored in each schema. Further work will be necessary to incorporate the Educational Taxonomy and CCSS dot notation into these schemas.

Appendix 5: Educational Taxonomy (Version 1.0)

Code	Descriptor
EDTX010	Analyze and interpret data
EDTX020	Analyze media
EDTX030	Analyze poetry
EDTX040	Analyze text structure
EDTX050	Apply geometric concepts in modeling situations
EDTX060	Define problems
EDTX070	Build vocabulary
EDTX080	Cite supporting evidence
EDTX090	Collaborate with others
EDTX100	Communicate effectively
EDTX110	Compare and contrast
EDTX120	Compare points of view
EDTX130	Conduct short research projects
EDTX140	Construct compelling questions
EDTX150	Construct explanations and design solutions
EDTX160	Construct supporting questions
EDTX170	Control and express variables
EDTX180	Create charts and graphs
EDTX190	Create media products
EDTX200	Demonstrate ability to recall
EDTX210	Demonstrate close reading

EDTX220	Demonstrate editing and revision skills
EDTX230	Demonstrate foundational reading skills
EDTX240	Demonstrate understanding of figurative language
EDTX250	Describe qualitative change
EDTX260	Describe quantitative change
EDTX270	Determine a central idea or theme
EDTX280	Determine meanings of symbols and key terms
EDTX290	Determine helpful sources
EDTX300	Develop and use models
EDTX310	Develop understanding of variability and distribution
EDTX320	Distinguish between fact and opinion
EDTX330	Engage in argument from evidence
EDTX340	Experiment with transformations
EDTX350	Use area and volume formulas
EDTX360	Follow multistep procedures
EDTX370	Gather relevant information from multiple sources
EDTX380	Generate ideas
EDTX390	Develop hypotheses
EDTX400	Identify cause and effect
EDTX410	Identify chronology and sequence
EDTX420	Identify fact and opinion
EDTX430	Identify primary and secondary sources
EDTX440	Identify problems and solutions
EDTX450	Infer and interpret

EDTX460	Integrate and synthesize information
EDTX470	Integrate quantitative and visual information
EDTX480	Construct linear models
EDTX490	Make geometric constructions
EDTX500	Make inferences and justify conclusions
EDTX510	Make judgments and decisions effectively
EDTX520	Model and interpret physical, social, and mathematical phenomena
EDTX530	Model with mathematics
EDTX540	Obtain, evaluate, and communicate information
EDTX550	Perform contextualized problem solving using graphs, tables and equations
EDTX560	Perform pattern transformations
EDTX570	Plan, research, and conduct investigations
EDTX580	Make predictions
EDTX590	Read character development narrative
EDTX600	Read first-person narrative
EDTX610	Read informational text
EDTX620	Read literary text
EDTX630	Read multiple narratives
EDTX640	Read narrative informational text
EDTX650	Read second-person narrative
EDTX660	Recognize relative position [numbers]
EDTX670	Represent and analyze patterns and functions
EDTX680	Summarize and describe distributions
EDTX690	Summarize complex concepts, processes, or information

EDTX700   Take informed action

EDTX710   Understand and evaluate random processes

EDTX720   Understand congruence

EDTX730   Understand meanings of operations and how they relate to one another

EDTX740   Understand measurements and attributes of objects

EDTX750   Use argumentation skills

EDTX760   Use context clues

EDTX770   Use discussion and presentation skills

EDTX780   Use listening skills

EDTX790   Use mathematics and computational thinking

EDTX800   Use probability to evaluate outcomes

EDTX810   Use technology to produce writing

EDTX820   Visualize relationships

EDTX830   Write arguments

EDTX840   Write informational text

EDTX850   Write explanatory texts

EDTX860   Write routinely over extended time frames