

Knowledge Representation of Educational Metadata in Linked Open Data: Promoting the Educational Use of Digital Cultural Heritage

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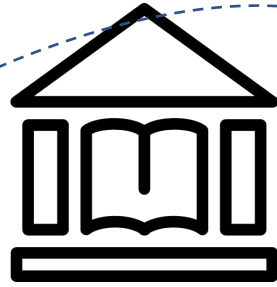
2024 Rich Semantics Workshop
In conjunction with ICADL 2024 @ Malaysia

Development of Diverse Active Learning Approaches

Inquiry learnings using various learning resources



Students



School library

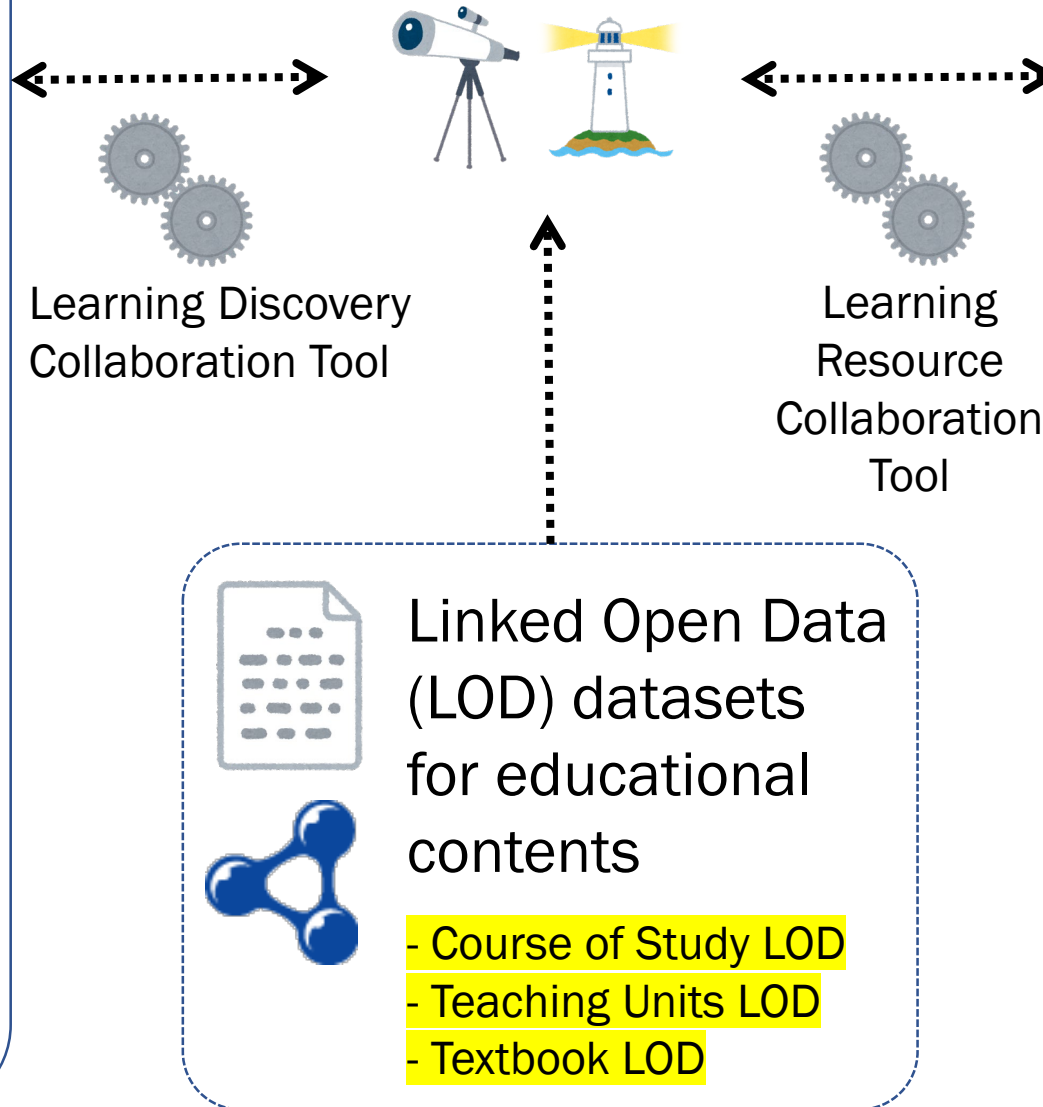


Teachers

Selection of learning resources and their utilizations in teaching

Bridge Model

Connections with School Education



Research Objectives

- (Goal) **Enrich learning resources**: Provide rich and diverse learning resources that enable students and teachers to deepen their learning experiences, moving beyond the traditional **silos of textbooks**.
- Propose a Methodology: Develop a **Bridge Model** to effectively connect digital archives with educational practices, fostering seamless integration into teaching and learning processes.
- Publish LOD Datasets: Design and implement a series of **Linked Open Data (LOD) models and datasets** as a foundational framework for the educational use of digital archives.

Courses of Study

- In Japan, the government establishes the Courses of Study about every ten years, which define the content to be taught in primary and secondary education. Textbooks used in schools are certified based on these guidelines by the government.
- Traditionally, the Courses of Study have been provided just as a textual document, but to enhance their usability, the government has introduced standardized identifier, Courses of Study Code in 2020.
 - ✓ These codes assign standardized 16-digit identifiers to each sections and sentences of the Courses of Study.

Example of Courses of Study Code

- (Courses of Study for Elementary schools)

- Section 4. SCIENCE

- A. Matter/Energy

8260233100000000

✓(1) Object and weight Regarding the properties of objects, provide instructions to help pupils acquire the following items, through exploring activities in which pupils compare 8260233110000000 ng attention to the shape and volume of the objects.

□a. Develop knowledge and understanding of th 8260233111000000 and acquire skills for observations, experiments, and other 8260233111000000

➤(a) The weight of an object remains unchanged e 8260233111100000 changes.

➤(b) Objects may differ in weight even when their volum 8260233111200000

□b. Develop abilities to generate questions and express them regarding the properties of objects, through investigating the relationship between the object's shape and their weight, and the relationship 8260233112000000 lume and their weight, based on their differences and similarities.

✓(2) Effects of forces generated by w 8260233120000000

Japanese Course of Study (CoS) LOD

Japanese Course of Study LOD

Japanese Course of Study Linked Open Data (LOD) is a dataset which includes information for course of studies published, as well as the related information such as the subject areas, the subjects, and the course of study codes.

Sources: [学習指導要領コードのコード表 \(全体版\) について](#) by Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan

CoS code:

<https://w3id.org/jp-cos/>

[About Japanese Course of Study LOD »](#)

List of Course of Study

- [Elementary School Curriculum Guideline 1989-03 Notification](#)
- [Elementary School Curriculum Guideline 1998-12 Notification](#)
- [Elementary School Curriculum Guideline 2008-03 Notification](#)
- [Elementary School Curriculum Guideline 2017-03 Notification](#)
- [Elementary and Lower Secondary Department of Special Needs Education School Curriculum Guideline 2009-03 Notification](#)
- [Elementary and Lower Secondary Department of Special Needs Education School Curriculum Guideline 2017-04 Notification](#)
- [Kindergarten Curriculum Guideline 2008-03 Notification](#)

Japanese CoS LOD dataset provides all assigned CoS codes as permanent URIs and offers access to the past thirty years of CoS text and codes.

Example of Item in CoS LOD

<https://w3id.org/jp-cos/8260233111200000>

(b) Objects may differ in weight even when their volume is the same.

<https://w3id.org/jp-cos/8260233111200000>

[Home](#) / [Elementary School Curriculum Guideline 2017-03 Notification](#) / [第1章](#) / [第2章](#) / [第4節](#) / [第2](#) / [【第3学年】](#) / [2](#) / [A](#) / [\(1\)](#) / [ア](#) / [\(イ\)](#)

Details

Course Of Study [Elementary School Curriculum Guideline 2017-03 Notification](#)
Course Of Study Revision [Elementary School Curriculum Guideline 2017-03 Notification](#)
Source [【82V11】 Code for Elementary School Course of Guideline published in 2017, version 1.1 \(2021-08-20 release\)](#)

Item Number	Number	2309
	Source	【82V11】 Code for Elementary School Course of Guideline published in 2017, version 1.1 (2021-08-20 release)
	Type	Line Number

Description of Course Of Study (イ) 物は、体積が同じでも重さは違うことがあること。

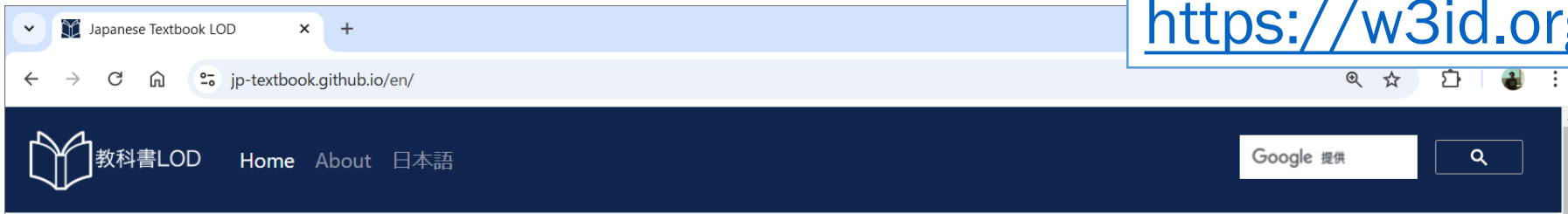
Item

Code of Course of Study Item 8260233111200000

- Each item (code) in CoS has a corresponding page on CoS LOD.

Japanese Textbook LOD

<https://w3id.org/jp-textbook/>



Japanese Textbook LOD

Japanese Textbook Linked Open Data (LOD) is a dataset which includes bibliographic information for textbook guideline enforced in 1992, as well as the related information such as the subject areas, the subjects, teaching guidelines.

<https://w3id.org/jp-textbook/>

[About Japanese Textbook LOD »](#)

Current Curriculum Guideline (Since AY2020)

Elementary School [Curriculum guideline](#)

[Japanese Language](#) [Penmanship](#) [Social Studies](#) [Map](#) [Arithmetic](#) [Science](#) [Living Environment Studies](#) [Moral Education](#) [Health](#) [English](#) [Moral Education](#)

Lower Secondary School [Curriculum guideline](#)

[Japanese Language](#) [Penmanship](#) [Social Studies\(Geography Area\)](#) [Social Studies\(History Area\)](#) [Social Studies\(Literature Area\)](#) [Social Studies\(Information Area\)](#) [Music\(General\)](#) [Music\(Instrumental Music\)](#) [Art](#) [Health and Physical Education](#) [Technology and Home Economics\(Technology Area\)](#) [Technology and Home Economics\(Home Economics Area\)](#) [English](#) [Moral Education](#)

Upper Secondary School [Curriculum guideline](#)

Japanese Textbook LOD is a dataset which includes bibliographic information for textbooks published up to now since the 7th CoS guideline enforced in 1992, as well as the related information such as the subject areas, the subjects, teaching units, compiling prospectus and the courses of study.

Example of a Textbook Data in Textbook LOD

<https://w3id.org/jp-textbook/小学校/2019/理科/301>

- Textbooks contain several teaching units, similar to a table of contents.

新しい理科 3

<https://w3id.org/jp-textbook/小学校/2019/理科/301>

[Home](#) / [Elementary School Curriculum Guideline](#) / [Science](#) / [Science](#) / [新しい理科](#)

Details

Title	新しい理科 3
Editor(s)	毛利 衛 大島 まり ほか101名
Publisher	東京書籍株式会社
ISBN	9784487105533
The total pages	182
Dimensions	A4
Target grade	3
Authorized year	2019
Textbook catalogue	Textbook Catalogue for Elementary School of 2019

[まずは「なんで？」を、さがしてみよう。](#)

Page of Textbook

Textbook [新しい理科 3](#)
Page 表紙裏～p. 3
Type <http://schema.org/Chapter>

[理科の学び方](#)

Page of Textbook

Textbook [新しい理科 3](#)
Page p.4～5
Type <http://schema.org/Chapter>

[1春のしぜんにとび出そう](#)

Page of Textbook

Textbook [新しい理科 3](#)
Page p.6～13
Type <http://schema.org/Chapter>

Example of a Teaching Unit Data in Textbook LOD

9物の重さをくらべよう - 教科書LOD × +
jp-textbook.github.io/AA/100000003/244
<https://w3id.org/jp-textbook/AA100000003244>

9物の重さをくらべよう

<https://w3id.org/jp-textbook/AA100000003244>

- Each teaching unit includes links to the corresponding Courses of Study (CoS) items.

Home / 小学校学習指導要領 / 理科 / 理科 /

詳細情報

ソート順	3244
単元種別	標準の学習内容
単元名	9物の重さをくらべよう
学校種別	小学校
検定年	2019
教科	理科
種目 (科目)	理科
対象学年	3
教科書の該当ページ	教科書

教科書の該当ページ

教科書	新しい理科 3
ページ	p.116~125
Type	http://schema.org/Chapter

学習指導要領の細目

<https://w3id.org/jp-cos/826023311100000> 第1章 / 第2章 / 第4節 / 第2 / 〔第3学年〕 / 2 / A / (1) / ア / (ア)
物は、形が変わっても重さは変わらないこと。 [NHK for Schoolコンテンツを検索](#)

<https://w3id.org/jp-cos/8260233111200000> 第1章 / 第2章 / 第4節 / 第2 / 〔第3学年〕 / 2 / A / (1) / ア / (イ)
物は、体積が同じでも重さは違うことがあること。 [NHK for Schoolコンテンツを検索](#)

<https://w3id.org/jp-cos/8260233112000000> 第1章 / 第2章 / 第4節 / 第2 / 〔第3学年〕 / 2 / A / (1) / イ
物の形や体積と重さとの関係について追究する中で、差異点や共通点を基に、物の性質についての問題を見だし、表現すること。 [NHK for Schoolコンテンツを検索](#)

学習指導要領の細目 (ラベル)

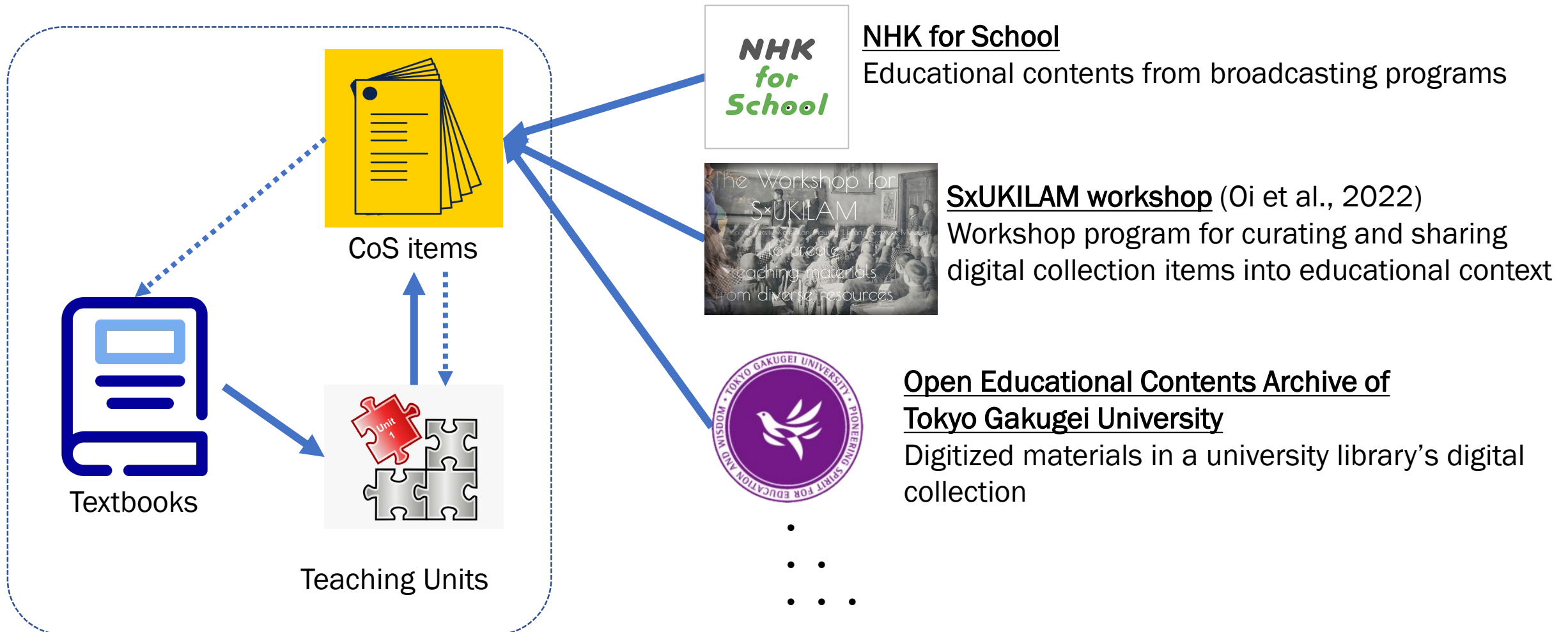
A(1)
小学校3年理科(東書)2019年検定教科書編修趣意書

編修趣意書

配当時数

配当時数	7
Type	http://schema.org/Duration

Use-case Scenarios with Our Bridge Model (1)



Linked Open Data (LOD) datasets for educational contents

Masao Oi, et al.: "SxUKILAM" Collaboration to Connect Local Digital Resources and School Education: Workshop and Archiving to Construct Network of "People" and "Data". 2022, Proceedings of ICADL 2022, 125 - 134. https://doi.org/10.1007/978-3-031-21756-2_10

Use-case Scenarios with Our Bridge Model (2)

- Through the CoS items, various teaching units, educational objectives, and learning content are interconnected:
 - ✓ **Students can deepen their learning** by exploring high-resolution digital archive content similar to the illustrations found in their textbooks.
 - ✓ **Students become capable of independently searching** for their own learning materials, enabling them to extend their learning beyond the resources at hand.
 - ✓ **Sharing and searching** for links between teaching materials and CoS items created by other teachers or educational material companies can significantly reduce the time and cost of lesson preparation for teachers. This also enhances learning outcomes, offering substantial benefits.
- Based on our experiences, links between CoS items and digital resources are more effective when aligned with teaching plans or teaching units, as they are more compatible with educational practice.
 - ✓ In other words, directly connecting standalone digital content to learning objectives, such as those outlined in CoS, is often challenging...

Future Works

- Research Challenges
 - ✓ Develop applications for searching CoS items and learning resources and its evaluation
 - ✓ Develop the methodologies for streamlining the process of linking to enable extensive link descriptions
 - Q: How and who is responsible for adding links between resources and the CoS items?
- Challenges in Social Implementation
 - ✓ The need for national strategy on (digitalized) educational systems and national educational data infrastructure
 - ✓ The importance of social acceptance in sharing foundational educational data, especially on the constraints of private companies' business models