"S × UKILAM" Collaboration to Connect Local Digital Resources and School Education: Workshop and Archiving to Construct Network of "People" and "Data"

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Abstract. The purpose of this study is to construct a network of people and data to connect diverse local digital resources and school education. Accordingly, we propose the S × UKILAM (School × University, Kominkan, Industry, Library, Archives, and Museum) collaboration, in which school teachers and institutions that hold and publish resources cooperate to create learning materials. As part of the project, three national workshops were held involving participants from 83% of prefectures and 197 institutions. The questionnaire suggested the effectiveness of the workshops and also identified the problems encountered in utilizing the resources. The 62 diverse learning materials co-created based on the workshops were made available as a secondary-use archive, creating a database in a format that can be machine-readably linked to various learning contents and resources.

Keywords: Digital archive · Local resources as learning materials · Educational metadata, MLA · S × UKILAM · IIIF · LOD · Digital humanities · Japan search

1 Introduction

In 2015, UNESCO emphasized the educational functions of museums and recommended collaboration with schools [1]. Subsequently, the "Education for Sustainable Development 2030 [2]" adopted by the United Nations also indicated learning tangible and intangible cultural heritage [3].

In addition, the Courses of Study, which are considered the basis of Japan's education program, were revised between 2017 to 2019. These guidelines aim to foster an respect for local cultural heritage in cooperation with institutions such as libraries and museums and conduct inquiry-based learning that utilizes various resources based on "questions" [4]. It was also indicated that learning to access digital materials using ICT should be included in the curriculum. Furthermore, in the context of the "GIGA (Global and Innovation Gateway for All) school concept" and online learning, which assumed significance in the wake of the COVID-19 pandemic, there has been a growing demand for using diverse resources as digital materials for learning.

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Accordingly, it is imperative to facilitate the use of digital data of diverse resources from different regions in school education.

2 Relevant Research and Issues

2.1 Local Resources and School Education

The use of local resources can help students associate national history and contemporary issues with their daily lives and perceive them as familiar [5–8]. Meanwhile, local resources are difficult to utilize in their original form in school education. The resources used in primary and secondary education should be contextualized in line with the objectives of the unit and should be read and understood by the learners themselves.

Therefore, teachers are required to convert them into learning materials based on their developmental stage [9]. Accordingly, the importance of visiting Museums, Libraries, and Archives (MLA) facilities to collect materials has also been suggested [10].

However, these methods are subject to constraints of time and distance. Many teachers face time constraints to prepare for classes due to work overload [11], so they may not have the time to visit MLA facilities. There may also be situations where there are no facilities nearby or where sufficient resources are not held in local facilities.

In this backdrop, a survey asking teachers about the barriers they experience in teaching the subject indicated a "lack of appropriate learning materials," with many expressing anxiety about collecting and utilizing "local resources" [12]. Although the need to use local resources has been demonstrated, the linkage between daily learning and diverse local resources has not been sufficiently examined [13].

2.2 Digital Archive and School Education

One of the methods to solve time and distance issues when using local resources as learning materials is the utilization of digital archives built by MLAs in various regions. However, although some practical examples are reported [14, 15], their educational utilization has been limited, which can be attributed to the following issues.

Absence of Learning Design Linking Resources and School Education. First, a systematic method of linking digital resources to learning in school education has not been established [16]. The resources stocked in digital archives are not categorized based on the educational field, such as the units in which they can be utilized. Therefore, many teachers and learners are not aware of the existence. Therefore, there is a need to con-sider methods for connecting digital archive resources with the school's curriculum [17].

Unclear and Strict Guidelines Regarding Secondary Use of Resources. Second, there are issues surrounding the rights of digital archive resources. In Japan, there are many cases where the rights and conditions of use of resources in digital archives are unclear or restrictive [18]. This situation is a barrier to the utilization of the materials.

Accessibility to Diverse Resources. Third, with the acceleration of information technology, digital resources are widely available online, making it difficult to recognize what resources are available where, and access the required resources. Using "Japan Search", a integrated platform that enables cross-search of various metadata [19], can be a good solution. However, it is still labor-intensive to search for learning materials from a vast amount of information and consider how to utilize them in the classroom.

2.3 Comparison of Digital Archives Utilization

Europe and the USA operate integrated digital archives and content linking of educational use to these resources. For example, Europeana has aggregated metadata of digital content from EU countries and established dedicated pages to support thematic views and educational use [20]. The Digital Public Library of America has also developed educational activities based on the establishment of "Primary Source Sets," which compiles and publishes resources, learning materials and teaching guides [21]. With regard to this project, ABBOTT et al. (2015) argue that curation of resources specific to educational purposes, outreach activities, and collaboration with institutions of education are important for the effective use of digital heritages [22].

Meanwhile, although local authorities in Japan have been releasing learning guidance plans or operating websites for sharing learning materials with limited membership [23], these contents are mainly text-based, and no scheme has been established to link a variety of primary sources with school education. In addition, an open-access environment has not been developed in which learning materials and their material resources can be freely used for secondary purposes in schools. In order to promote the use of digital resources, in addition to cooperation with various institutions, accessibility should be improved by relying on the highly interoperable IIIF (International Image Interoperability Framework) [24]. It is also necessary to consider schemes for sharing meaningful cases of using the resources [25].

3 Methods

3.1 Overview

The purpose of this study is "to construct a network of people and data to connect diverse local digital resources and school education."

We propose the following methods to achieve the elements extracted from the issues of previous research: "linking diverse local resources and school education" and "sharing in a format that enables secondary use." The overall diagram of this study, including the proposed methods, is shown (see Fig. 1).

1 Organize workshops in which school teachers and institutions that hold and publish resources such as MLAs, can collaboratively create learning materials from diverse resources.
2 Prepare a learning materials archive based on the products created in the workshops.

a. To enable easy sharing and utilization of the workshop results in primary and secondary education, metadata based on the perspectives of the educational field ("educational metadata") are added.
b. To enable free secondary use, educational materials and educational metadata are comprehensively displayed and published using the IIIF.
c. Develop LOD (Linked Open Data) as a basis for educational metadata to facilitate the retrieval of resources and learning materials to other digital contents.

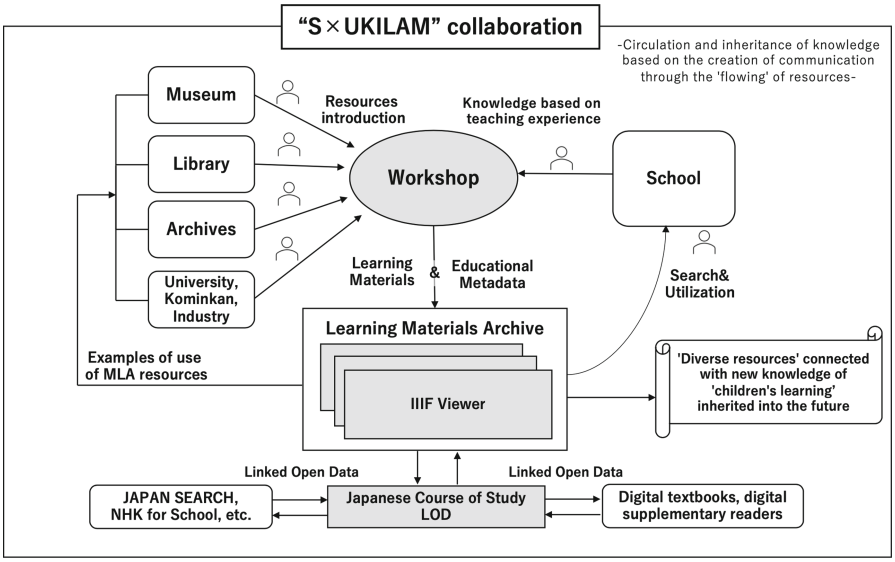

Fig. 1. Overall diagram of the proposed methodology in this research.

3.2 Organizing Workshops

In order to connect diverse local digital resources and school education, it is imperative to construct a network of "people." Accordingly, we organized workshops where school teachers and personnel from institutions that hold and publish resources collaboratively create educational materials.

To facilitate participation from remote locations, the workshop is held online (zoom). In addition, to encourage active discussion, breakout functions are used during the core time for discussion and development of learning materials, in which school teachers and personnel from institutions that hold and publish resources are categorized into mixed teams for minor group work. As a collaborative workspace, Google drive is utilized and a shared folder for each group of participants to support the collaborative work. After conducting the group-based discussions and learning material development work, all participants share their results. The workshop flow is shown below.

- Part I: Explanation about the workshop: 30 min.
- Part II: Discussions and work on the creation of learning materials: 110 min.
- Part III: Presentation of discussions and learning materials created: 40 min.

3.3 Preparing the "Learning Materials Archive"

For collaboration between diverse resources and school education based on digital archive, it is essential to construct a network of "data." Therefore, we develop a learning material archive that stores the materials produced in the workshops in a form available for secondary use. Furthermore, "educational metadata" which is critical for connecting diverse resources and school education in terms of "data," are assigned to the learning materials. Some of the elements that are assigned to the material are:

- Target of learning (grade, subject, area, unit, etc.)
- Time information and Location information (period, latitude and longitude etc.)
- Key words (President Roosevelt, WWII, etc.)
- Meta-learning information (learning scenarios, learning guide codes)

The aforementioned "educational metadata" is stored with the material metadata in the internationally interoperable IIIF viewer's manifest file, thereby improving accessibility and providing a better understanding of the material. In addition, as the specifications of IIIF are based on the premise of open data sharing, the license indication is mandatory, and downloading is possible.

The interface design of the archive enables users to search for educational materials by sorting them according to the elements of the assigned "educational metadata." The econdary use criteria for the learning materials are basically CC BY 4.0 [26], which is recommended. For resources with copyright or secondary use restrictions, the basic policy is to grant a license of EDUCATIONAL USE PERMITTED [27], provided the criteria will ultimately be decided through discussion in the workshops.

Among the "educational metadata" described in the previous section, the Code of Study Guidelines is expected to become a particularly important factor in the future. The Code of Study Guidelines is open data released by MEXT (Ministry of Education, Culture, Sports, Science and Technology) in 2020 [28]. By considering a LOD model using this as a hub, it is believed that it will be possible to connect digital archive materials, including digital textbooks and digital supplementary readers in the future.

We have developed and published the "Japanese Course of Study LOD" as a data set using RDF (Resource Description Framework) and SPARQL when the URI is attached to the guidelines and codes and made publicly available [29]. The LOD data is published in structured RDF format under the same license as the original code tables [30].

4 Results and Discussion

4.1 Organizing the Workshop

We held three workshops between July 2021 and March 2022, with entries from 39 (83%) prefectures and 197 institutions from Hokkaido to Okinawa, thereby creating an

opportunity for professionals with diverse affiliations and attributes to converge at one place. The attributes of the participants' institutional affiliations are listed below.

Elementary, junior high and high school, school librarians (49 schools), educational committees and local government officials (22 institutions), university students and researchers (34 institutions), libraries, museums, archives and art galleries personnel (62 institutions), companies and NPOs personnel (30 institutions).

The workshop discussions were based on the common goal of making diverse resources into learning materials, and communication sparked by daily concerns, issues, and questions about the utilization of resources from different attributes.

In this research, a questionnaire survey of the participants was conducted. The results are shown below. Note that the data presented in this paper are based on the results of the questionnaire from the first to the third workshops, which were cumulated (N = 159).

Regarding the evaluation of the workshop in relation to purpose and motivation, 97.4% of respondents (n = 156) noted that the workshop was either extremely helpful or helpful. The perspectives expressed by participants on the "purpose and motivation for joining the workshop" are shown in (Fig. 2, Fig. 3). Regarding the question "What issues from the workshop topics do you feel are especially important?" (n = 155, *multiple answers possible), the results are shown in (Fig. 4).

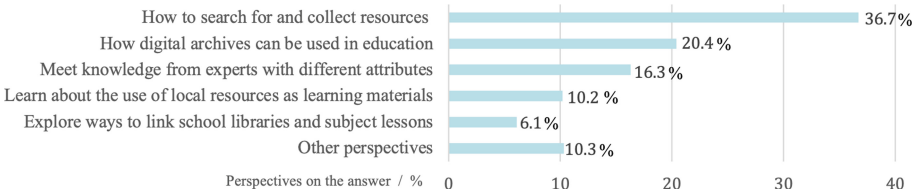

Fig. 2. Purpose and motivation for joining the workshop; School personnel (n = 49)

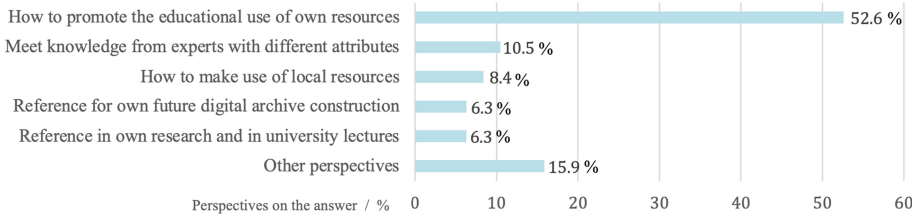

Fig. 3. Purpose and motivation for joining the workshop; Personnel from MLAs, research institutions, companies and NPOs (n = 95)

The results showed that many participants believed that creating opportunities for collaboration and networking between school and MLAs et al. was particularly important, thereby confirming the significance of creating opportunities for communication.

The results also showed that many participants believed that understanding the conditions for secondary use of resources was also important, which can be attributed to the fact that the concerns and issues from different perspectives, which are usually difficult to interact with, were shared through the workshop. It is worth noting that interest

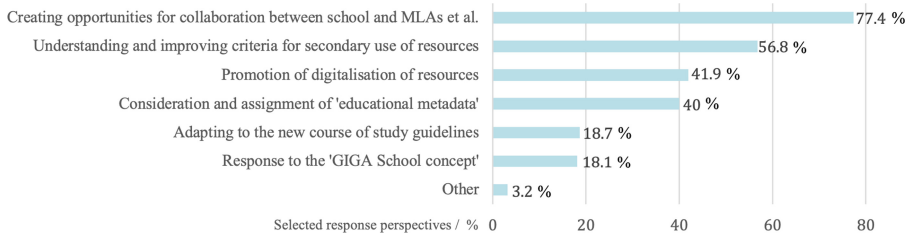

Fig. 4. "What issues from the workshop topics do you feel are especially important?" (n = 155, *multiple answers possible)

was also shown in consideration and assignment of educational metadata as a point of discussion for connecting education and digital archive resources in the future.

Others suggested that the track record of utilization of digital archive resources is necessary as evidence for budget requests. This indicates the importance of creating opportunities to make school personnel aware of the existence of MLA resources from the perspective of digitalization of the archive and its sustainability, to gain knowledge of what is needed to promote their use in schools through dialogue, and to develop and accumulate classroom practice using the materials produced. Consequently, we believe that it is important to create dialogue and communication between school and MLA personnel, in order to connect diverse local digital resources and school education.

4.2 Preparing the "Learning Materials Archive"

The "Learning Materials Archive" included a compilation of learning materials that were the deliverables of the workshop and was made available in September 2021. The archive has since been expanded with each workshop, and as of July 2022, 62 learning materials have been released with "educational metadata" and licenses to enable secondary use [31].

Although the content of learning materials tends to be more social studies and history-related due to the resource characteristics of the institutions participated, it is characteristic that learning materials were produced from various perspectives, such as inquiry learning, Japanese, art, disaster prevention, geology, biology, ESD (Education for Sustainable Development), etc. Furthermore, learning materials produced from cross-curricular perspectives, such as social studies × Japanese, social studies × health and physical education, which are unique due to discussions between participants with diverse attributes, resulting in creation that is not bound by preconceived notions.

As indicated by the characteristics of the learning materials that were awarded good practices in the Europeana Education Competition [32], upcoming learning materials need to go beyond subject boundaries and contribute to the development of competencies related to equality, diversity and sustainability. Our "Learning Material Archive" could serve as a foundation to support new learning designs that break away from the traditional teaching frameworks and perspectives of the Japanese education system.

4.3 Developmental Expansion of the S × UKILAM Collaboration

This section provides examples of development that emerged from participation in the workshops. As a first stage of development, Hamamatsu and Minato city held workshops. They focused more on local resources and local school teachers and MLAs gathered to discuss how to develop learning materials that utilize local resources.

Furthermore, based on this local workshop, the next stage of development was initiated in both municipalities in a different way. In Hamamatsu, the study of the use of local digital resources as learning materials was carried out as an "official duty" throughout the year, namely as a formal task within work hours. In Minato, a plan is underway to gather examples of the use of local digital resources and to award prizes for exceptional learning materials and practices. Despite their different approaches, it is hoped that these developments will make the use of local digital archive resources routine for more teachers and learners in schools, rather than just for a few teachers.

5 Conclusion

In this paper, we discussed the practice of the S × UKILAM collaboration, as a methodology for constructing a network of people and data to connect diverse local resources and school education.

This practice has created a community of diverse experts collaboratively developing local resources into learning materials. Furthermore, released diverse learning materials as an archive for secondary use. The results of the questionnaire revealed the importance of dialogue with experts of different attributes. Additionally, there are developing community-based activities, such as local authorities emerging as official duty to make local digital resources into learning materials.

In conclusion, our proposal method of the S × UKILAM collaboration has enabled the construction of a network of people and data to connect diverse local resources and school education. We will continue to consider the possibility of connecting diverse resources and school education in a more effective and serendipitous way through community interactions by holding regular workshops.

However, there is a problem to the assignment of educational metadata, which requires a certain knowledge and experience in education. Therefore, it is necessary to consider the creation of a framework to facilitate the assignment of "educational metadata" even without specialist educational knowledge. In the future, we are going to solve these problems and develop the LOD of the archive of educational materials. Through these practices, we will create methods for flowing the various resources stocked in each region to as many learners as possible and inheriting new knowledge that emerges from these resources to the future.

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