

Addressing the Challenges of Describing Alternative Format Materials: A Metadata Framework to Enhance Information Accessibility of People with Disabilities

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ABSTRACT

Library communities face many problems and limitations in describing alternative format materials based on the traditional MACHINE READABLE CATALOGING (MARC) structure. To address these problems, this research proposes an XML-based descriptive metadata framework that establishes general but fundamental bibliographic aspects of various alternative format materials by providing core elements that are essential in describing these materials. Different from existing bibliographic structures, the proposed metadata framework can represent a fundamental descriptive structure by establishing four upper-level categories, 17 core elements, and 10 sub-elements in a hierarchical structure optimized to alternative format materials. By using this principal descriptive structure, the proposed metadata framework can guide different institutions in the creation of bibliographic records for these materials in a consistent way. It is also expected to address the difficulties in describing alternative format materials in library communities and enhance the information accessibility of individuals with various types of disabilities. In addition, the proposed metadata framework is an alternative approach which functions as a mediator between heterogeneous characteristics of alternative format materials and the existing bibliographic structures in library communities.

Keywords: alternative format material, metadata framework, people with disabilities, metadata interoperability

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1. INTRODUCTION

A library is a social institution that should provide high-quality information services for all community users, including people with disabilities. Since the enactment of the Americans with Disabilities Act (ADA) in 1990, there has been increasing interest in information accessibility in the library communities for people with disabilities, along with the development of various alternative format materials, including braille books, audio books, and digital versions of general books (Nail-Chiwetalu, 2000). Alternative format material is generally defined as various formats that have been developed and used to support the information activities of people with disabilities (Nail-Chiwetalu, 2000). The library communities in many countries have increased provision of alternative format materials to improve information accessibility of people with disabilities (Lee et al., 2013).

However, there remain barriers that must be overcome regarding the provision of information services using alternative format materials. One of the representative difficulties is the bibliographic description of these materials because they have heterogeneous characteristics different from materials for general users. Most libraries have created bibliographic records for these materials based on the traditional MARC format, which was originally designed to describe traditional printed materials. Thus, it may not fully describe the unique characteristics of alternative format materials; as a result, people with disabilities are largely unaware of the range of library materials available in alternative formats (Walker & Keenan, 2015).

Regardless of these limitations and problems, there is no alternative format-specific descriptive tool that can fully describe and provide sufficient access points to materials in alternative formats. To address these problems, this research proposes an alternative approach by constructing a descriptive metadata framework optimized to alternative format materials.

Applying structured metadata may have many advantages over the traditional MACHine Readable Cataloging (MARC) format. Many alternative formats are currently generated by adopting information technologies and implemented using digital equipment; thus, metadata can provide richer bibliographic descriptions for these materials than the printed format-oriented MARC format. Further, it can comprehensively reflect their distinctive characteristics in bibliographic description and enhance the information accessibility for people with disabilities. This approach also provides a flexible structure that allows the

addition of elements from existing metadata standards, and complements the interoperability with existing bibliographic records.

2. THEORETICAL BACKGROUND

2.1. Heterogeneity of Alternative Format Materials

The use of alternative format materials in library services began in Britain when John Troughton, who was visually impaired, was admitted to St. John's University in 1656. Since 1857 when Liverpool Public Library started services for visually impaired people, which was the first public service for people with disabilities (Linley, 2000, p. 213), library communities have established policies for library services to support information accessibility for people with various types of disabilities. The American Library Associations (ALA) established a new standard for library services in 1978, which was the origin of the systematic public services for people with disabilities. In 2005, the Committee of Libraries Serving Disadvantaged Persons in the International Federation of Library Associations and Institutions (IFLA) suggested nine media formats that libraries should acquire to serve people with disabilities, including talking books, talking newspapers, talking periodicals, large print books, easy-to-read books, braille books, video/DVD books with subtitles and/or sign language, e-books, and tactile picture books (Irvall & Nielsen, 2005, p. 9). In addition to these formats, various alternative formats have been developed and included in library collections.

These formats have heterogeneous characteristics compared to general materials. The content in alternative formats is generally transformed from that of corresponding original materials in different formats (IMS Global Learning Consortium, 2002). Thus, both materials generally deliver identical or similar content and may share the same attributes, including author, subject, genre, and title of the work (Oliver, 2009, p. iii). During the transformation process, however, the original content is in most cases abridged or modified for suitability for each alternative format.

From a container perspective, many alternative format materials are currently published in complex formats in which physical and digital forms are combined, although traditional formats such as braille books are still broadly used. The adoption of these combined formats efficiently represents and delivers the content in a format optimized to each type of disability. Besides, the content of alternative format materials needs to be transformed and re-

produced using several digital formats and may require specific equipment such as barcode readers and Text-To-Speech (TTS) devices that can implement the digitized content in appropriate forms.

Because of the advantages of digital formats, users and library communities tend to prefer materials in digital form to traditional printed materials. One of the reasons for this tendency is the time gap between printed and digital formats of alternative format materials. It is generally admitted that two years are needed to transform the content of general materials into printed alternative formats, which is destructively long (Carey, 2007, p. 769). In addition, the production of high-quality braille books is too costly and those books are difficult to digitize (Carey, 2007, p. 772).

For these reasons, most alternative format materials are currently published in digital or composite formats with heterogeneous bibliographic aspects. These unique characteristics may enhance information accessibility for people with disabilities, compared to traditional printed formats which rely on tactile sensation. In contrast, this resulted in difficulties in creating bibliographic records based on traditional descriptive rules and structures, such as the MARC format, because of their rigid and printed format-oriented structure.

2.2. Problems of Current Bibliographic Tools in Describing Alternative Format Materials

Hundreds of years of cataloging have shown that bibliographic description is an important tool with which to meet users' information needs (Westlind, 2008, p. 428). Given this situation, it is imperative that library communities make efforts to provide detailed bibliographic descriptions for various alternative format materials to allow people with disabilities to efficiently and effectively access and utilize these materials. However, describing alternative format materials is not a simple task because of their heterogeneous characteristics and the continuous diversification of alternative formats. The following research identified the difficulties and limitations in describing materials in alternative formats.

Library communities in many countries generally follow some kind of national cataloging rules in describing alternative formats; these are mostly based on Anglo-American Cataloging Rules (AACR) (Westlind, 2008, p. 428). However, these rules were originally designed for general materials, especially printed book formats, not for alternative formats. Even worse, most of the rules for alternative formats focus on describing one specific type—

braille books.

In regard to this, Atinmo (2007, p. 834) pointed out difficulties that visually impaired individuals have faced in retrieving alternative format materials. Because cataloging records do not fully reflect the unique bibliographic aspects of these materials, they may need intervention by staff, relatives, and friends in the process of book selection. Todaro (2005, p. 259) also mentioned that library catalogs link materials to users and those materials cannot be located without catalogs. However, not many libraries provide cataloging records for alternative format materials because of differently formatted catalogs.

In addition to this lack of alternative format-specific descriptive rules, most alternative formats in current forms are now produced in a digital format or a combined analog and digital format. The traditional methods of resource description based on the AACR2R and MARC format may not create specific identification of search elements as well as the relations of search elements to a descriptive resource because they are restricted to International Standard Bibliographic Description (ISBD) based description elements (Hider, 2012, p. 115).

With respect to cataloging rules, Lee et al. (2013) pointed out that the lack of alternative format-specific cataloging rules may hinder information accessibility for people with disabilities. To solve these problems, they proposed the revision, modification, and expansion of the Korean Cataloging Rules and Korean Machine Readable Cataloging (KORMARC) fields that comprehensively describe the various types of alternative format materials.

In spite of these continuous efforts, these problems and limitations are severe in the library community in South Korea. The National Library for the Disabled of South Korea constructed and has maintained the Direct Rapid Easy Accessible Material Service (DREAM) database since 2014. It is a national sharing system for alternative format materials that allows people with disabilities to search and use various alternative format materials. The main purpose of this database is to provide comprehensive information services for people with disabilities, by integrating and managing bibliographic records for alternative format materials created by public libraries and libraries for people with disabilities in South Korea (National Library for the Disabled, 2016). As of December 2017, the DREAM database has provided a total of 284,735 bibliographic records for various types of alternative format materials, including braille books, large-print books, easy-to-read books, electronic braille books, video/DVD books with subtitles and/or sign language, voice braille books, Digital

Accessible Information System (DAISY), and Descriptive Video Service.

However, one of the problems of the DREAM database is that most of the bibliographic records were created in the KORMARC formation, which is one of the MARC formats for library collections in South Korea. Because of the fundamental limitations of the MARC format, the records contained in the database may describe only a few, but essential, bibliographic aspects of these materials, which may result in too-simple and incomplete resource description. Fig. 1 shows a bibliographic record in the DREAM database using the KORMARC format.

The material described in Fig. 1 is a DAISY format material published in 2000 for visually impaired individuals. Although this record is for an alternative format material, the description for the alternative format (fields 300, 500, 511, 518, and 521) and the corresponding original material (fields 200, 245, and 260) coexist in a single record. Fields 056, 653, and 700 describe the common aspects of both materials. Although these fields are essential in describing alternative format materials, this record seems to focus on the original material, with the addition of only a few aspects for the alternative format. This coexistence may make the record ambiguous, i.e., difficult to determine whether it is for the alternative format or the corresponding original material. In addition, it provides a very simple description for alternative format materials, and therefore it cannot provide sufficient access points appropriate to the unique characteristics of alternative format materials. Thus, there are many missing aspects that need to be described; for example, the publisher of the material. Even worse, this record describes the date of publication

as 1996, which is the publication date of the corresponding original material, although the described material was published in 2000 in the current format.

One of the reasons for these problems is the lack of alternative format-specific fields in the MARC format. As a result, each field is used arbitrarily in the description of alternative format materials, depending on institutions or catalogers, and different values are assigned to the same field. In addition, it is difficult to expand or add new fields optimized to alternative formats because of the rigidity of the MARC structure. For these reasons, the construction of an eclectic and flexible bibliographic structure is inevitable to describe the unique aspects of alternative formats.

2.3. Approaches to Overcoming Limitations of Current Bibliographic Tools

As early as 2002, librarians were recognizing the limitations of the MARC format and the need for something to replace it (Sprochi, 2016, p. 130).

From the perspective of the digital environment, Coyle (2007, 2016) mentioned that entries in MARC format are determined by cataloging rules that may not be suitable in the current Web environment. In addition, the format is hardly suited to database storage and manipulation. Roine (2017) also insisted that the MARC format may not be suited for producing open and linked data in the changed information environment. Instead of MARC format, she suggested Bibliographic Framework (BIBFRAME), which is expressed in Resource Description Framework (RDF) format in order to clearly describe digital format resources and their reciprocal relations. Other researchers have also mentioned BIBFRAME to be fully compatible

| | | |
|-----|-----|---|
| 000 | | \$a nim k |
| 001 | | \$a BUB2003000002 |
| 005 | | \$a 20031224134018 |
| 007 | | \$a sd fungnnpned |
| 008 | | \$a 031224s1996 ulkzzn fn c kor |
| 020 | | \$a 8985193686 |
| 035 | | \$a (111028)00006257 |
| 040 | | \$a 111028 \$c111028 \$e KORMARE |
| 056 | | \$a 030 |
| 245 | 0 0 | \$a Most Weird Stories in the World \$h [sound recording]/ \$d Taeseok Yang |
| 260 | | \$a Seoul: \$b Dong JJok Na Ra, \$c 1996 |
| 300 | | \$a 1 Disc(3 hours and 24 min): \$b digital; \$c12cm |
| 500 | | \$a Compact disc material recorded in DAISY format |
| 511 | 8 | \$a Reader: Jeongran Cho |
| 518 | | \$a Recorded by Korean Braille Library at January 29, 1999 |
| 521 | | \$a For people visually impaired |
| 653 | | \$a World |
| 653 | | \$a Story |
| 700 | 1 | \$a Taeseok Yang |

Fig. 1. KORMARC (Korean Machine Readable Cataloging) record for an alternative format material.

with Resource Description and Access (RDA) cataloging code, which is a new cataloging rule that can deal with the changed information environment (Baker et al., 2014; Kroeger, 2013; Sharma et al., 2018).

Different from these suggestions for adopting new cataloging rules, many research has proposed to adopt bibliographic metadata in describing resources. By mentioning the limitations of traditional bibliographic tools, Tennant (2002, p. 102) enumerated some of the inherent problems with the MARC format and suggested an XML-based system that would allow for flexibility and granularity of data. Westlind (2008, p. 426) also opined that metadata and bibliographic control are demanded because accessible alternative format materials are predominantly digital and increasingly dynamic. Consequently, he mentioned the dynamic characteristics of accessible materials and that the need for dynamic cataloging must be put into focus. In the same context, several researchers insisted that MARC records are replications of card cataloging and at no point can discrete data elements be adequately extracted from MARC for incorporation into the Web. Therefore, it might be necessary to adopt metadata in library communities in order to bring bibliographic records together in a structured way (Gardner, 2012; Thomale, 2010). Similar to these findings, Moledo (2018) insisted on the need for bibliographic metadata for alternative format materials as information about the functioning of library services and its accessibility by ensuring navigation throughout those materials.

In contrast, some research has pointed out that library operations contain high-quality structured metadata, but it is seldom integrated or linked with other Web resources (Knight, 2011; Tharani, 2015). In order to overcome these limitations in resource description, it might be necessary to share bibliographic metadata over the Web for libraries. Understanding these limitations, many research efforts have proposed approaches to apply metadata to describe alternative format materials.

The Croatian Library for the Blind, in co-operation with the Croatian Association of the Blind, started a project to create a digital archive, which is a digital collection for visually impaired people (Rightscom, 2007). The aim of this project is to collect the full text of various information sources for these people, as well as books and magazines, in the most accessible way by using modern communication technologies. The collected resources are described and incorporated using the Dublin Core element set.

Westlind (2008, p. 428) proposed an approach to col-

laborate Dublin Core and RDA. He applied this collaboration to the use of Dublin Core in DAISY, which is one of the representative alternative formats. However, the Dublin Core elements in DAISY have been criticized for not being useful for libraries with high requirements in terms of bibliographic information.

In 2004, the National Instructional Materials Accessibility Standard was developed in co-operation with the American Printing House for the Blind and the Center for Applied Special Technology. It is a file format for digital textbooks and instructional materials for students with visual and print disabilities. It is based on XML syntax and has achieved the highest degree of content access and flexibility in providing alternative format materials (National Center on Accessible Educational Materials, 2011). However, it is criticized as most of the current files are unusable because it rarely contains basic structural organization such as paragraph breaks, page breaks, and page numbers.

In 2018, Round Table on Information Access for People with Print Disabilities (2018) provided a guideline for producing Accessible eText, which is designed to provide a person with a print disability with equivalent access to the alternative version of an original material. This guideline insists that an accessible eText version of a print document should provide the same information as the original print document, including all meaningful elements of the print document, i.e., publishing information. It also focuses on providing structural markup for the eText version of materials by providing enhanced metadata information. They considered metadata for alternative format materials to facilitate the understanding, use, and management of the materials. However, this guideline does not provide the details of how to describe various types of alternative format materials and how to support the information accessibility of users.

Despite these limitations, library communities have attempted to adopt various metadata schemes to describe alternative format materials. This tendency may be inevitable because most of the current alternative formats adopt digital technologies, which are difficult to describe using traditional bibliographic tools. Metadata is sufficiently flexible to describe the unique and heterogeneous bibliographic aspects of alternative format materials to provide sufficient access points to these materials. In contrast, there is no standardized metadata convention that can be fully applied to the description of various types of alternative format materials.

3. RESEARCH OBJECTIVES AND METHODS

3.1. Research Objectives

Alternative format materials are created not for general users, but for people with different types of disabilities who have many difficulties in accessing and utilizing information resources. In order to support the information accessibility of these people, it is necessary to have a structured metadata designed to manage alternative format materials. It should also be able to overcome the limitations of current bibliographic tools, support the integration, management, and processing of bibliographic records, and be suitable in the current Web environment.

For these reasons, this research attempts to construct a metadata framework optimized to alternative format materials, which can address the problems of traditional MARC structure and other existing metadata schemes when they describe those materials. The proposed metadata framework is not constructed from scratch, but is based on the existing bibliographic structures currently used in library communities, such as the MARC format and Metadata Object Description Schema (MODS).

3.2. Data Collection

The data set used to construct a metadata framework is from the analysis of existing bibliographic records for alternative format materials currently used in the library community. The records analyzed were mainly from the DREAM database. The records contained in the database may describe only a few, but essential bibliographic aspects of alternative format materials, which may result in incomplete resource description. Although the database has many limitations in describing alternative format materials, it paradoxically shows the essential and core bibliographic aspects of these materials, which should be included in the resource description. By analyzing the KORMARC fields commonly used in describing various types of alternative format materials, the core and essential bibliographic aspects of those materials can be identified and extracted. By taking advantage of its limitation, this research analyzes and identifies the KORMARC fields and assigned values to extract core aspects of alternative format materials. Table 1 shows the analyzed KORMARC fields that are currently used in describing alternative format materials.

As shown in Table 1, several fields are used in describing alternative format materials, although they are not alternative format-specific. These fields and assigned values can be divided into three categories: content related,

Table 1. KORMARC fields used to describe alternative formats

| Field | Definition |
|-------|--------------------------------------|
| 056 | Korean Decimal Classification number |
| 245 | Title statement with medium format |
| 260 | Publication, distribution, etc. |
| 300 | Physical description |
| 500 | General note |
| 511 | Participant or performer note |
| 518 | Date/time and place of an event note |
| 521 | Target audience note |
| 534 | Original version note |
| 653 | Subject index |
| 700 | Added entry – Personal name |
| 710 | Added entry – Corporate name |

KORMARC, Korean Machine Readable Cataloging.

physical forms related, and context related fields. Some of the fields, such as 056, 245, and 653, contain the same values as the corresponding original materials. Although these fields may not be sufficient to describe every aspect of the alternative format materials, they are considered to be bibliographic aspects indispensable to describing these materials. For these reasons, they were extracted as potential core elements that constitute a consistent and persistent bibliographic framework optimized to alternative format materials.

These extracted core elements function as container elements that encompass detailed and related elements as sub-elements. This is an efficient approach as it provides a hierarchical structure, which shows the element relationships and clearly represents the multi-aspect characteristics of these materials.

4. CONSTRUCTION OF A METADATA FRAMEWORK FOR ALTERNATIVE MATERIALS

In constructing a metadata framework, this research focuses on establishing core elements that are essential in describing alternative format materials. The proposed core elements can be categorized into three groups: *Intellectual*, *Physical*, and *Contextual* elements. The elements in each category may function as container elements with sub-elements appropriate to sufficiently describe the detailed aspects of alternative format materials. Controlled

vocabularies are also proposed to achieve consistency in assigning values for some elements.

4.1. Intellectual Category

The elements in the *Intellectual* category describe the aspects related to the content of alternative format materials. The category also includes elements related to the participants involved in generating alternative format materials in the current forms. The elements proposed in this category are shown in Table 2.

In general, the content of a resource is created by a person or group of people and published by a person or an institution. In contrast, there are more agents involved in the generation or publication of alternative format materials than in the corresponding original materials. They may include readers, braille translators, and the agents who transform the original materials into alternative formats. Although they are not responsible for the original content of the materials, they play critical roles in transforming or generating alternative format materials. Therefore, it might be necessary to differentiate them from the author(s) of corresponding original material(s) and describe their roles. The element <agents> is proposed to incorporate the individuals and participants involved in the transformation and generation of alternative format materials. It has sub-elements that specify each participant, such as <brailleTranslator>, <reader>, and <signLanguageTranslator>. More elements can be added, if necessary, to describe other participants and their roles.

It might also be necessary to differentiate the publication of alternative format materials from that of corresponding original materials in a similar manner to the element <agents>. Although both materials may share identical or similar content, they are different items with different pub-

lishers and different user groups. The proposed element <altPublication> indicates the publication of alternative format materials. It has sub-elements such as <altPublisher>, <altDateIssued>, <altDateRecorded>, and <altPlace>, which specify the publication related information.

In some cases for materials for people with hearing disabilities, it might be necessary to indicate whether the materials provide additional languages, such as sign languages and subtitles, and what types of languages they provide. The element <altLanguage> is proposed with the sub-element <subtitle>, which indicates the languages of subtitles provided. For sign languages, 'signLanguage' can be applied as an attribute of the element <altLanguage> with a value of 'yes' to indicate that the material provides sign language. If there is no sign language provided, the attribute 'signLanguage' is not used.

4.2. Physical Category

Because many alternative format materials are currently published in extremely different formats from general printed materials by applying state-of-the-art information technologies, it might be necessary to indicate the containers of these materials and describe their physical characteristics. The *Physical* category is proposed to describe these heterogeneous physical characteristics of alternative format materials (Table 3).

Various formats with heterogeneous characteristics are currently applied in publishing or reproducing materials for people with disabilities. Indicating their formats is vital because it is directly connected to the utilization of the content of the materials. The element <altFormat> is proposed for this purpose and is expected to support the selection of alternative formats appropriate for each type of disability.

Table 2. Proposed elements in the *Intellectual* category

| Core elements | Sub-elements | Attributes | Controlled vocabulary |
|------------------|--------------------------|--------------|--|
| <agents> | <brailleTranslator> | - | - |
| | <signLanguageTranslator> | - | - |
| | <reader> | - | - |
| <altPublication> | <altPublisher> | - | - |
| | <altDateIssued> | encoding | - |
| | <altDateRecorded> | encoding | - |
| | <altPlace> | - | MARC Code List for Geographic Areas (margac) MARC Code List for Countries (marccountry) |
| <altLanguage> | <subtitle> | signLanguage | - |

MARC, MACHine Readable Cataloging.

Table 3. Proposed elements in the *Physical* category

| Core elements | Sub-elements | Attributes | Controlled vocabulary |
|----------------|------------------|------------|--|
| <altFormat> | <physicalFormat> | - | Alternative physical format (physicalformat) |
| | <fileFormat> | - | Alternative file format (fileformat) |
| <equipment> | - | - | - |
| <altCondition> | - | - | - |
| <volume> | - | - | - |

Table 4. Proposed controlled vocabulary for alternative formats

| Alternative physical format (physicalformat) | | Alternative file format (fileformat) | |
|--|--|--------------------------------------|--|
| Value | Description | Value | Description |
| talking materials | Talking books, newspapers, and periodicals, including reading text | txt | Plain text |
| large print | Large print books | rtf | Rich text format |
| easy-to-read | Easy-to-read books | html | Hypertext Markup Language |
| braille | Braille books | pdf | Portable Document Format |
| e-braille | Electronic braille, including Web braille and e-books | wav | Waveform Audio File Format |
| dvs | Descriptive Video Service (DVS) | mp3 | Moving Picture Experts Group Layer-3 Audio |
| tactile | Tactile picture books | brf | Digital braille |
| e-text | Electronic text | daisy | Digital Accessible Information System |
| human daisy | Human DAISY | | |
| e-braille score | Electronic braille scores | | |
| barcode | Barcode-inserted | | |

One of the difficulties related to the use of this element, however, is that there is no standardized way of indicating specific formats applied to these materials. Therefore, this research proposes a controlled vocabulary to consistently assign values to the element and precisely indicate the specific formats of these materials. The proposed list of alternative formats is basically based on the formats provided by IFLA. Some formats, such as human DAISY, are added to reflect newly emerging formats. Besides these physical formats, there are file formats applied to generate these materials, which also need to be differentiated from physical formats (Table 4). These different types of formats can be indicated by applying the sub-elements <physicalFormat> and <fileFormat>.

Some of these formats, especially the digital formats, may require specific equipment or software to implement their content. One of the representative examples is the barcode-inserted book, which requires equipment that can read barcodes and implement the content in an ap-

propriate format. Because various equipment customized to each alternative format is currently used, the element <equipment> is proposed to precisely indicate the equipment required in the bibliographic descriptions. It can also be used to describe system or software requirements, for example, screen reader software and TTS software.

In the case of printed materials, such as braille or tactile picture books, the condition of wear-out affects the use and administration of these materials. The element <altCondition> is proposed to indicate the current condition of each printed material. It can also be applied to describe the specific condition of digital formats, such as the condition of the sound recording.

Another consideration is that many alternative format materials, especially in printed formats, consist of packages of multiple volumes with identical content to the corresponding original materials. The description of these materials needs to indicate this bibliographic composition. The element <volume> indicates the total number of

Table 5. Proposed elements in the *Contextual* category

| Core elements | Sub-elements | Attributes | Controlled vocabulary |
|-----------------|-------------------|---------------|--|
| <altAudience> | - | - | Target audience (targetaudience) |
| <altVersion> | - | contentStatus | Alternative physical format (physicalformat) Alternative file format (fileformat) |
| <altIdentifier> | - | - | - |
| <corresponding> | All MODS elements | - | - |

MODS, Metadata Object Description Schema.

volumes and the specific volume number of each divided item. This research suggests the formation of the assigned value as ‘*specific volume number/total number of volume*’, for example, ‘3/4’. This element can be applied to both printed and digital format materials, if necessary.

4.3. Contextual Category

The *Contextual* category describes the context of the use of alternative format materials. It includes elements that indicate target audiences, different versions of materials, and various relationships between alternative formats and other related materials (Table 5).

There are various types of disabilities for which alternative formats are designed or published. Therefore, it is necessary to indicate the main target audiences with specific types of disabilities for whom alternative format materials are published. The element <altAudience> and a controlled vocabulary for types of disabilities are proposed to indicate the target audiences and assign values in a consistent manner (Table 6). This element can have multiple values, if necessary.

The content of the original material is generally transformed or reproduced in various alternative formats. Thus, the content is interrelated and can be considered as different versions of identical or similar content. The element <altVersion> is used to identify these different versions and indicate the formats of available versions. Although the values of the element can be assigned in the form of plain text, the proposed controlled vocabulary for the element <altFormat> can also be applied.

Another consideration for the element <altVersion> is that the content of the original material is usually modified or abbreviated when transformed to or reproduced in alternative formats. It might be useful if the content status is indicated in the bibliographic description. Thus, this research proposes the attribute ‘contentStatus’ for the element <altVersion>. Possible values of the attribute are ‘full’, ‘abbreviated’, and ‘modified.’

Table 6. Controlled vocabulary for target audience (targetaudience)

| Value | Description |
|--------------|---|
| vision | Mainly for visual impairment |
| hearing | Mainly for hearing impairment |
| intellectual | Mainly for intellectual disabilities |
| learning | Learning disabilities, including verbal and non-verbal disabilities |
| physical | Physical disabilities |
| mental | Mental health impairment |

The element <altIdentifier> is expected to indicate various identifiers assigned to the described materials, including URI and DOI. Although many alternative formats can be accessed on the Web or provided through Web databases, numerous printed formats remain on shelves. Therefore, this element can also be used to indicate shelf location, if necessary.

In addition to these proposed elements optimized to alternative format materials, it may be helpful if the description for the corresponding original material is provided, because it can support users in understanding the described alternative format materials and retrieving appropriate alternative format materials. Nevertheless, it should be separated from the description of alternative format materials to make it clear that the record is for alternative format materials.

The element <corresponding> is proposed to satisfy this purpose and can be used to indicate original materials. By using the independent element <corresponding>, the description of the original material can be separated from that of the alternative format material in one record. For the description of original materials, this research proposes the reuse of elements in MODS as sub-elements of <corresponding>. Because MODS contains sufficient bibliographic elements for various types of resources, the reuse of MODS elements can provide an efficient rich

resource description. In addition, it can achieve interoperability with existing MODS records.

When using the element <corresponding>, however, not all aspects of corresponding materials need to be described, because the proposed metadata framework describes alternative format materials. The sub-elements of the element <corresponding> are used selectively only when it is necessary to provide a description for corresponding materials.

4.4. Shared Category

Most alternative format materials and corresponding original material share many common aspects, including author, title, subject, and genre. However, one of the problems with respect to this perspective is that the description for both materials coexists in a single record without any formal descriptive rule. To address this ambiguity, this research proposes the application of the ‘1:1 discipline’ (Urban, 2014), in which each resource description should be used for one resource only—an alternative format material.

Nevertheless, these common aspects need to be reflected in the bibliographic description because they are significant access points to alternative format materials. Thus, the proposed metadata framework should include not only alternative format-specific elements, but also elements to describe common aspects.

The *Shared* category is proposed to describe these common aspects of both materials. The elements in this category may indicate original content-related aspects, which may not be changed even if the original content is transformed or reproduced. Although the description for these aspects coexists in a record for an alternative format material, it is categorized into the additional category *Shared* and can be separated from the categories of core elements. The proposed elements in the *Shared* category are shown in Table 7.

The elements shown in Table 7 correspond to the MODS elements and KORMARC fields. Thus, the value of each element can be reused from the existing MODS elements or MARC fields, if necessary.

5. IMPLEMENTATION OF THE PROPOSED METADATA FRAMEWORK BASED ON XML SYNTAX

The purpose of the proposed metadata framework is to establish general but fundamental bibliographic aspects that are the touchstone of describing various aspects of al-

Table 7. Proposed elements in the *Shared* category

| Proposed elements | Description |
|-------------------|---|
| <title> | Title proper for original material |
| <author> | Statement of responsibility for original content |
| <subject> | Terms representing the primary topics of content |
| <classification> | Classification numbers assigned to original content |
| <genre> | Category characterizing the content of original content |
| <targetAudience> | Intellectual level of the audience of original content |

ternative format materials. Through the core elements established based on these essential aspects, it can function as a basic bibliographic framework for alternative format materials. It is also sufficiently flexible to support local use by adding new descriptive elements and reusing existing metadata elements and to satisfy the unique purposes of local institutions.

The proposed metadata framework adopts a hierarchical structure that can represent the semantic relationships between the elements. It consists predominantly of 17 core elements and 10 sub-elements. Some attributes and controlled vocabularies are also applied to specify the meaning of each element and to achieve consistency when assigning values for elements.

These components of the proposed metadata framework are categorized based on the proposed core element categories. These categories are established as upper-level elements located at the top of the hierarchical structure. They indicate the essential core bibliographic aspects of alternative format materials, and encompass core elements related to each aspect as their sub-elements.

If elements from existing metadata standards are added, they can be placed under core elements as their sub-elements, not as core elements. This is because the core elements construct the entire structure optimized to alternative format materials, which should remain unchanged to form a consistent descriptive structure. Thus, the existing elements can only be added to complement or refine the semantic range of core elements.

To substantially implement the proposed metadata framework, however, it is required to have a standardized syntax for metadata. This research adopts an XML syntax because it is sufficiently flexible and expendable to add new elements and reuse existing elements from other

metadata standards by using namespaces. In addition, the XML syntax can support the use of attributes for every element in a simple way, which can make the meaning of each element more precise.

In the XML syntax, the proposed element categories function as upper-level container elements, such as <intellectual>, <physical>, <contextual>, and <shared>. These elements do not have any actual values, but hierarchically organize related core elements as sub-elements. The use of these upper-level elements can also clearly separate the description for alternative format materials from the common aspects shared by both materials in a single bibliographic record. Fig. 2 shows an example of a metadata record based on the proposed metadata framework (pmf).

The record in Fig. 2 is for the same alternative format material shown in Fig. 1. In the record, there are four upper-level elements, namely <intellectual>, <physical>

```
<?xml version="1.0"?>
<Metadata
  xmlns:mods="http://www.loc.gov/standards/mods/v3/mods-3-6.xsd"
  xmlns:pmf="" >
<pmf:shared>
  <pmf:classification type="kdc"> 030 </pmf:classification>
  <pmf:title> Most weird stories in the world </pmf:title>
  <pmf:name> Teaseok Yang </pmf:name>
  <pmf:subject> World </pmf:subject>
  <pmf:subject> Story </pmf:subject>
</pmf:shared>
<pmf:intellectual>
  <pmf:agent>
    <pmf:reader> Jeongran Cho </pmf:reader>
  </pmf:agent>
  <pmf:altPublication>
    <pmf:altPublisher> Korean Braille Library </pmf:altPublisher>
    <pmf:altDateIssued encoding="w3cdtf"> 2000 </pmf:altDate>
    <pmf:altDateRecorded encoding="w3cdtf"> 1999-01-29 </pmf:altDate>
    <pmf:altPlace> Recorded by Korean Braille Library </pmf:altPublisher>
  </pmf:altPublication>
</pmf:intellectual>
<pmf:physical>
  <pmf:altFormat>
    <pmf:physicalFormat> Compact disc material </pmf:physicalFormat>
    <pmf:fileFormat> Recorded in DAISY format </pmf:fileFormat>
    <pmf:fileFormat authority="fileformat"> daisy </pmf:fileFormat>
  </pmf:altFormat>
  <pmf:volume> 1 Disc (3 hours and 24 min) </pmf:volume>
  <pmf:equipment> DAISY reader </pmf:equipment>
</pmf:physical>
<pmf:contextual>
  <pmf:altAudience> For people visually impaired </pmf:altAudience>
  <pmf:altAudience authority="targetaudience"> vision </pmf:altAudience>
  <pmf:altVersion> Audio book </pmf:altVersion>
  <pmf:altVersion authority="physicalformat"> braille </pmf:altVersion>
  <pmf:corresponding>
    <mods:name> Taeseok Yang </mods:name>
    <mods:originInfo>
      <mods:publisher> Dong JJoK Na RA </mods:publisher>
      <mods:dateIssued encoding="w3cdtf"> 1996 </mods:dateIssued>
      <mods:place> Seoul, South Korea </mods:place>
    </mods:originInfo>
  </pmf:corresponding>
</pmf:contextual>
</Metadata>
```

Fig. 2. Record created using the Proposed Metadata Framework (pmf).

<contextual>, and <shared>. Each core element under the upper-level elements is used to describe the detailed aspects of alternative format materials. If a core element has sub-elements, however, the element does not have any actual value and functions as a container element by encompassing related elements as sub-elements. In this case, the actual values are assigned to the sub-elements. For example, the core element <pmf:agent> is designed to describe individuals who participated in the generation of the described material. Because the semantic range of the element is not sufficiently specific to describe or indicate their roles, however, the element has the sub-element <pmf:reader>. Therefore, an individual participating as a reader is assigned as the value of the sub-element. In this manner, sub-elements function to specify or refine the broad meaning of core elements and can provide a detailed bibliographic description.

For the corresponding original materials, the core element <pmf:corresponding> can be used to provide specific information related to the original materials. Although it can deal with all aspects of the original material by reusing all MODS elements as its sub-elements, it is expected to use a few sub-elements only when they are necessary to complement the description of the alternative format material. In Fig. 2, for example, the publication date of the original material may be useful to the users of the alternative format material. Thus, the element <dateIssued> from MODS is used to indicate the publication date of the original material.

To reuse the elements from existing metadata standards such as MODS, it is required to declare the XML namespaces. In this example, the MODS element set is declared using namespaces (e.g., xmlns:mods="http://www.loc.gov/standards/mods/v3/mods-3-6.xsd") and the elements from MODS are reused in the description.

With respect to the use of the proposed elements, all elements are repeatable and optional to satisfy local needs in a flexible way. However, each of the four upper-level elements can be used only once to maintain the entire structure of the proposed metadata framework.

In addition to the proposed element set, controlled vocabularies and attributes are used. When applying controlled vocabularies, this research applied a universal 'authority' attribute to indicate the controlled vocabulary used to assign values to elements. This universal attribute can be applied to any element in the proposed metadata framework. Currently, library communities adopt various controlled vocabularies to consistently describe bibliographic aspects of information resources, including

World Wide Web Consortium Date and Time Format (W3CDTF), Relator Code and Term List (marcrelator), MARC Genre Term List (marcgt), iso639-2b, and MARC Form of Item Term List (marcform). These controlled vocabularies can be applied to the proposed element set by using the universal attribute 'authority'.

Regarding the description of the formats of alternative format materials, however, the current controlled vocabularies may not be appropriate when indicating alternative formats because they are focusing on the formats of general materials. Thus this research uses Alternative Physical Format (physicalformat) and Alternative File Format (fileformat) presented in Table 4 in order to consistently and clearly indicate the specific formats of alternative format materials.

Besides this attribute, several universal attributes can be applied, such as 'type' and 'encoding,' which are used to indicate 'the type or format' and 'the structured formation' of the assigned values, respectively. Other than these, some attributes are applied only to specific elements such as 'signLanguage' and 'contentStatus' in the elements <altLanguage> and <altVersion>, respectively. Moreover, the controlled vocabularies currently used in MODS and MARC can also be applied in the proposed metadata framework, if necessary.

Although this is a very simple example of the proposed metadata framework, it provides a general but fundamental bibliographic structure by substantially establishing core elements that are essential in describing alternative format materials. Different from other research focusing on suggesting the theoretical adoption of metadata in describing alternative format materials, this research proposed a substantial descriptive metadata structure that can be applied to the management, processing, and integration of bibliographic records for alternative format materials.

The proposed metadata framework is a bibliographic structure that can provide extended access points by interlinking metadata records for original material and alternative format materials through establishing the *Shared* category. In addition, the *Contextual*, *Physical*, and *Intellectual* category provides more effective and optimized access points to those materials compared to general metadata standards by clearly describing the unique characteristics of alternative format materials. These bibliographic functions of the proposed metadata framework support the management of alternative format materials for library communities and enhance the retrieval of those materials for people with disabilities.

It is also a flexible structure that allows the addition of new elements in the structure if new types of alternative formats with heterogeneous characteristics need to be described. Thus, the proposed metadata framework is expected not just to describe those resources, but also to address the problems and limitations of the current formats or structures in describing alternative format materials in library communities and enhance the information accessibility of people with disabilities.

Overall, the proposed metadata framework can provide a bibliographic environment that can create high-quality metadata records optimized for alternative format materials. Existing metadata standards do not sufficiently provide bibliographic fields or elements that can reflect the unique characteristics of alternative format materials, and thus face many limitations in managing and retrieving metadata records for those materials. In addition, those metadata records created using existing metadata standards exist as independent units, which make it difficult to interrelate or share the same contents at the record level. In contrast, the proposed metadata framework can provide extended access points to alternative format materials, because it has element sets with 17 core elements and 9 sub-elements optimized to the bibliographic characteristics of those materials. Thus, it can create high-quality metadata records compared to the existing metadata standards with few elements for alternative format materials.

6. CONCLUSION

Library communities in many countries have provided various types of alternative format materials to support information accessibility for people with disabilities. Because of their heterogeneous characteristics, however, descriptions of these materials based on traditional bibliographic tools such as MARC have faced many problems and limitations. In addition, new alternative formats have emerged with the development of information technologies, which worsen these problems. To address these difficulties, this research proposes an alternative approach to construct a descriptive metadata framework optimized to alternative format materials.

The purpose of the proposed metadata framework is to establish general but fundamental bibliographic aspects by providing core elements essential to describing alternative format materials. It can be an efficient approach because a single metadata scheme may not provide all of the elements that can fully describe every aspect of various types of alternative formats. Thus, this research aims to provide

a simple but principal bibliographic framework for alternative format materials. It is also sufficiently flexible and expandable to satisfy the needs of local use by allowing the addition of new elements and the reuse of existing metadata elements.

The proposed metadata framework has a hierarchical structure by establishing the four categories of the core elements as upper-level elements: *Intellectual*, *Physical*, *Contextual*, and *Shared*. These upper-level elements function to indicate essential bibliographic aspects of alternative format materials, and encompass core elements related to specific aspects of these materials. The proposed metadata framework consists of 17 core elements and 10 sub-elements under each upper-level element. Some attributes and controlled vocabularies are also applied to specify the meaning of each element and to achieve consistency when assigning values for each element.

The proposed metadata framework is implemented based on the XML syntax, and can describe the bibliographic aspects of alternative format materials in both their current and future forms. Thus it is expected to address the difficulties in describing alternative format materials in library communities and enhance information accessibility for individuals with various types of disabilities.

The proposed metadata framework is an alternative approach with which to construct a mediator between the heterogeneous characteristics of alternative format materials and existing bibliographic structures in library communities. It can also be adapted to the evolved bibliographic environment because it would have the competency to be expanded to existing and evolving metadata schema.

Although it is limited to the provision of core elements for alternative format materials, it can represent a fundamental descriptive structure by establishing core elements optimized to alternative formats that can consistently guide different institutions in the creation of bibliographic records for these materials. In addition, it is flexible and expandable to allow the addition of descriptive elements to satisfy their unique purposes. Thus, library communities with different purposes can expand the structure to satisfy their information needs and to support their information services for individuals with disabilities.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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