A Metadata Description Scheme and Corresponding Visual Methods of Teaching Resources Libraries

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Abstract: Knowledge economy calls for educational innovation. To design and build teaching resources libraries of kernel curriculums are the component parts of educational innovation. This article discusses a series of technical problems about designing teaching resources libraries. Furthermore, it pays more attention to theoretic foundation and realization technologies of DCEd (Dublin Core Education metadata) that is used to construct curriculum resources libraries about information organization. Here we concretely talk over some problems in the course of developing a courseware, including breakdown of knowledge units, establishment of multimedia materials, description of elements (multimedia objects) of resources library using XML/RDF, index systems, and visual methods.

Keywords: Application of metadata; DCEd; Teaching resources; XML/RDF; Visualization

Knowledge economy needs lots of able innovators. Educational innovation is the key for bringing up such persons. Both formal education and continuation education need further educational innovation. Moreover, to create a group of teaching resources libraries of kernel curriculums is an important task of educational innovation. In the course of practical educational innovation, we discover that using DCEd (Dublin Core Education metadata) for designing and building teaching resources libraries is a effective way and teaching resources visualization is a vital direction in future.

1 Design and build of teaching resources libraries

A curriculum has its own particular content and structure. An integrated curriculum system consists of structure of sections & chapters and content of a textbook. Generally a textbook is divided into several chapters, sections, sub-sections and paragraphs. A paragraph maybe includes text, tables, figures and so on. Corresponding knowledge units make up of concrete content and there are hundreds even thousands knowledge units in a textbook. To design a teaching resources library is a design of database that considers knowledge units to be basic description objects and organizes them and indexes them.

From the perspective of technology a multimedia object (graphics, images, text, audios, animation, and videos) describes a knowledge unit; a teaching resources library about one curriculum is a multimedia database that includes the content of all knowledge units in the textbook. There are five steps about designing and realizing a teaching resources library

1.1 Breakdown into knowledge units and preferred representations

To divide knowledge units is a breakdown of every chapter, section, sub-section, and paragraph in the textbook. So we transform the textbook into the least building blocks (knowledge units) of knowledge concepts. And then we confirm representations of each knowledge unit (text, graphic, image, animation, audio, video). A right representation can exhibit the content of knowledge units very well. When we design and build a curriculum resources library about ***Information Organization Science***, we divide the textbook according to diferent chapters and sections and bring

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corresponding knowledge units. The first version of IOS (***Information Organization Science***) has more than 600 knowledge units and the second version of ISO has more than 800 knowledge units.

1.2 Creation of multimedia materials about knowledge units

After we confirm representations about each knowledge unit, we begin to make multimedia materials. We create computer files of multimedia materials by some computer software and hardware.

- Making some audio files about knowledge units by using musical equipments and software *CoolEdit2000*.
- Making some image files about knowledge units by using digital cameras, scanners and software *Photoshop*.
- Making some animation files about knowledge units by using software *Flash* and *Animation Pro*.
- Making some video files about knowledge units by using software *Premiere* and *iFilmEdit*.
- Integrating several interrelated multimedia materials (graphic, text and sound) into a micro node by using software *Authorware*.

So we make every multimedia element about every knowledge unit. According to different file types we create some special folders and store these multimedia materials in different folders. In fact, these multimedia material files compose a multimedia object database of teaching resources. In the course of developing courseware, firstly we set up some sub-folders: IO_Graphic, IO_Text, IO_Image, IO_animation, IO_Audio and IO_Video. Then we store every knowledge unit in a corresponding folder.

1.3 Description and storage of multimedia material objects

There are many ways to describe multimedia materials. It is an effective way to describe these materials using DCEd, and create XML files according to XML/RDF frame. In practice we need to describe these objects respectively according to different types of them: graphic, animation, audio, video, and text. For example, Fig.1 is a case about sending the airship that describes an image object using XML/RDF frame. The success in sending the airship, *Shenzhou No.5*, is a historical event in China.

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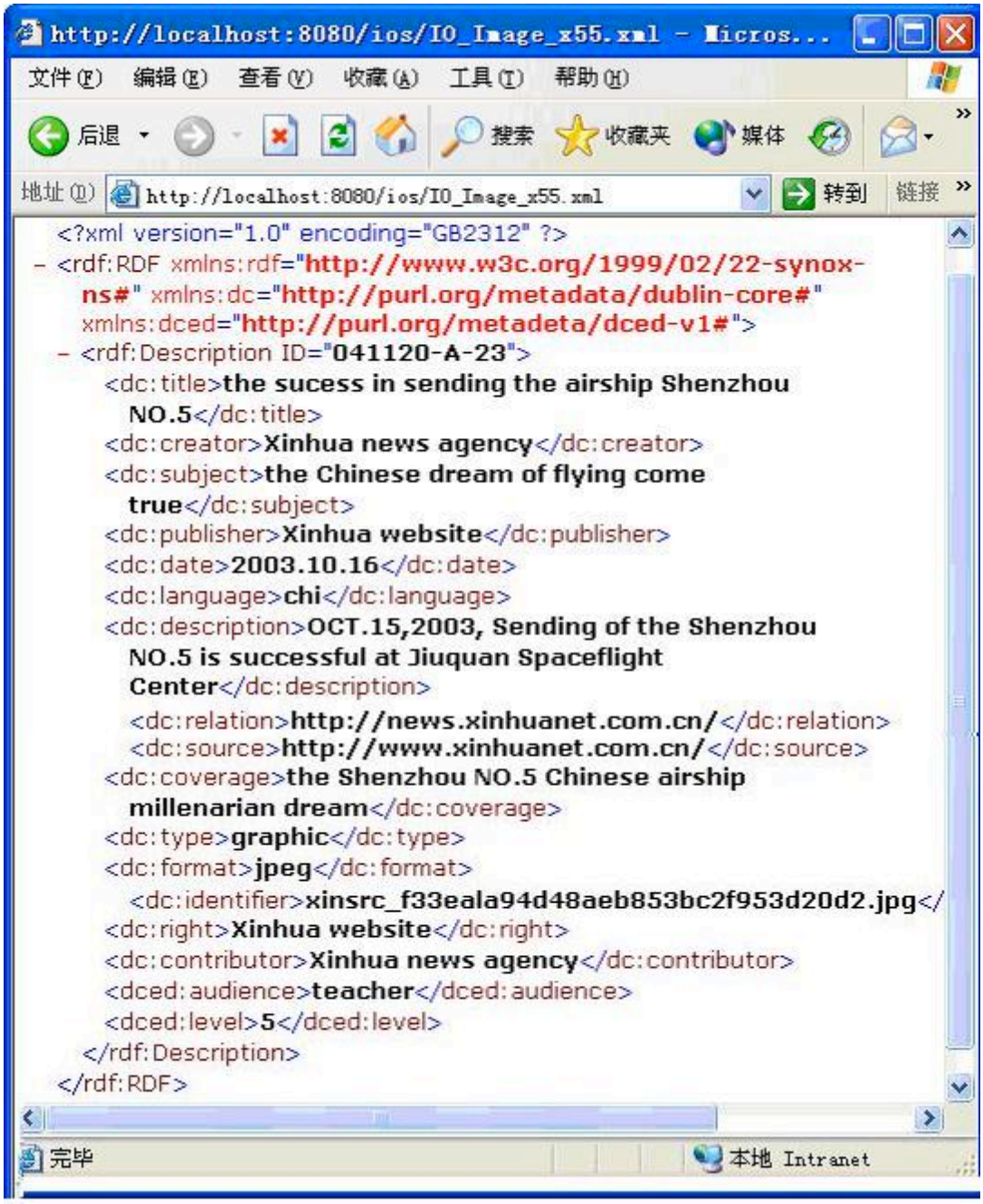

Fig. 1 The DCEd description about an image object

The content of section 5.2 of ***Information Organization Science*** is about multimedia information organization. We choose a graphic of sending the airship *Shenzhou No.5* to be an example. For video information, we set an example about television program ***I Love You China***. Fig.2 is the description about this material object using XML/RDF frame.

Descriptions of animation, audio and text are similar to Fig.1 and Fig.2. We set up a set of documents: IO_image.xml, O_text.xml, IO_audio.xml, IO_anim.xml and IO_video.xml, used to describe multimedia objects. These XMLfiles make up of an object description database corresponding to every knowledge unit (multimedia databases about whole teaching resources).

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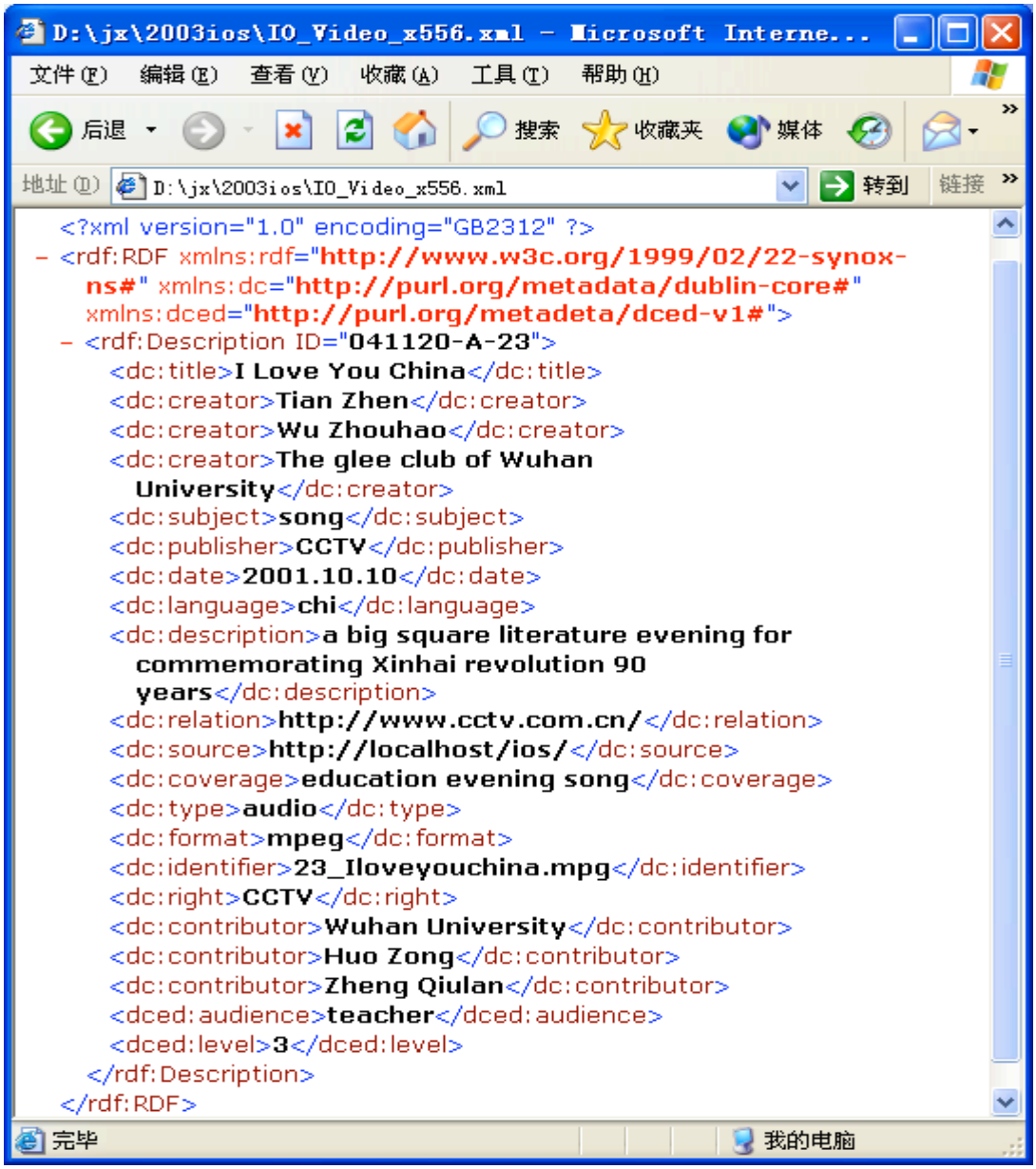

Fig. 2 The DCEd description about a video object

1.4 Mechanism creation of index

It is important to create corresponding index files in order to improve speed of storing & extracting multimedia objects. An example for creating an index according to attribute 'title' is as follow:

```
<?xml version="1.0" encoding="UTF-8"?>
- <list>
  - <index>
      <content>the macro structure of system classification
          method</content>
      <path>
          http://localhost:8080/ios/xxzz/resource/flash/0201txflfhgjgswf
          </path>
    </index>
```


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```
- <index>
    <content>The success in sending the airship Shenzhou No.
      5</content>
    <path>http://localhost:8080/ios/IO_Image/sz031015.jpg
     </path>
  </index>
- <index>
    <content>I love you China</content>

      <path>http://localhost:8080/ios/IO_video/23_IloveyouChina.
      mpg</path>
  </index>
  .....
</list>
```

According to common methods of information retrieval and special demand for information retrieval, we create corresponding index files respectively for description databases using XML. So several index files make up of an index database that is specially used to information retrieval.

To sum up, index database results from description database that depends on teaching resources multimedia database. Three different databases are integrated into a united organism (see Fig. 3). It provides a fast channel for storing & extracting information to user and creates a more eficient service platform.

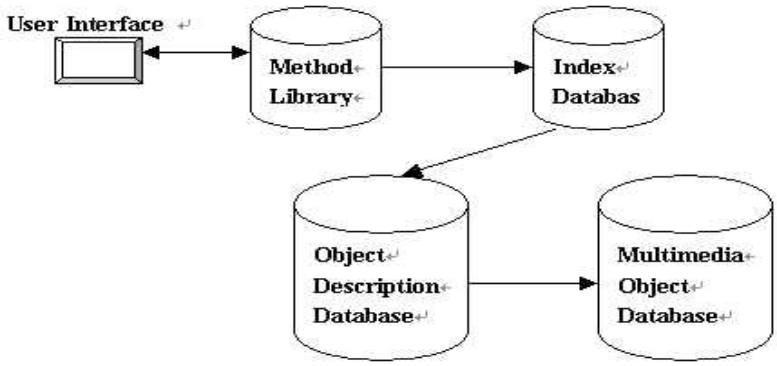

Fig. 3 The structure of teachingresources database

1.5 Configuration of application programs and creation of method libraries

After building index mechanism, it is convenient to adopt multimedia objects of knowledge units. Considering the demand of teaching, to configure special application programs is efficient to every aspect of teaching.

A courseware of one curriculum consists in some sub-system: sub-system for teaching, sub-system for self-study sub-system for examination and sub-system for training. These sub-systems make up of an application system. We reduce these applications to operations or methods, which form a method libraryThey use different methods to operate teaching resources databases.

2 Visualization of teaching resources

In the last decade, teaching resources came into the era of digital management and realized network of environment, multimedia of description and modularization and integration of application systems. At present, information resources management

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goes direct to visualization and intelligence. Visual methods are important to create teaching systems. When we create teaching resources libraries, we also pay attention to information visualization and intelligence.

Fig. 4 The macro structure of systematic classification method

For one thing, we describe and form the content of teaching using the knowledge structure systems and to design it using knowledge units those are basic building blocks.

For another thing, we make the visual description of information contents. There are many description methods based on visualization. Here we discuss some visual methods about text information. We choose different methods according to different content and form of each knowledge unit.

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2.1 Visualization of text information

There is a knowledge unit about the macro structure of systematic classification method in chapter 2 of ***Information Organization Science***—*classification description language of information resources organization*. It is difficult to understand and memory this structure because its description based on text is too prolixity. We create an animation file using Flash. Firstly we draw the macro structure using color frame dynamically and step by step. Both color and figure are fascinating and when mouse passes it will shine (see Fig. 4). If mouse stay in a module and click it, there will appear a color animation frame with caption and activate audio files immediately. Graphics, text and sounds are synchronous. This method is vivid and efficient to study. To integrate graphics and caption animations (and sounds) is common method to visualize curriculum content.

2.2 Text information visualization about procedure

The procedure visualization can be realized by transferring it into flow charts. This is a procedure about reading image data from a database.

```
string filename
long filenum,getlen,filelen
blob a,b
// reading the data of image files
filename = p_1.picturename
if filename<>"" then
    filelen = filelength(filename)
    filenum = fileopen(filename,StreamMode!)
    getlen = fileread(filenum,b)
    do while getlen = 32765
        getlen = fileread(filenum,a)
        b = b+a
    loop
    fileclose(filenum)
end if
```

Such text information is not clear We take pains with reading and understanding it but we obtain less knowledge. When we make it visual, it will be changed completely (see Fig.5). We spend less time and obtain more knowledge. Visualization gets twice the result with half the effort.

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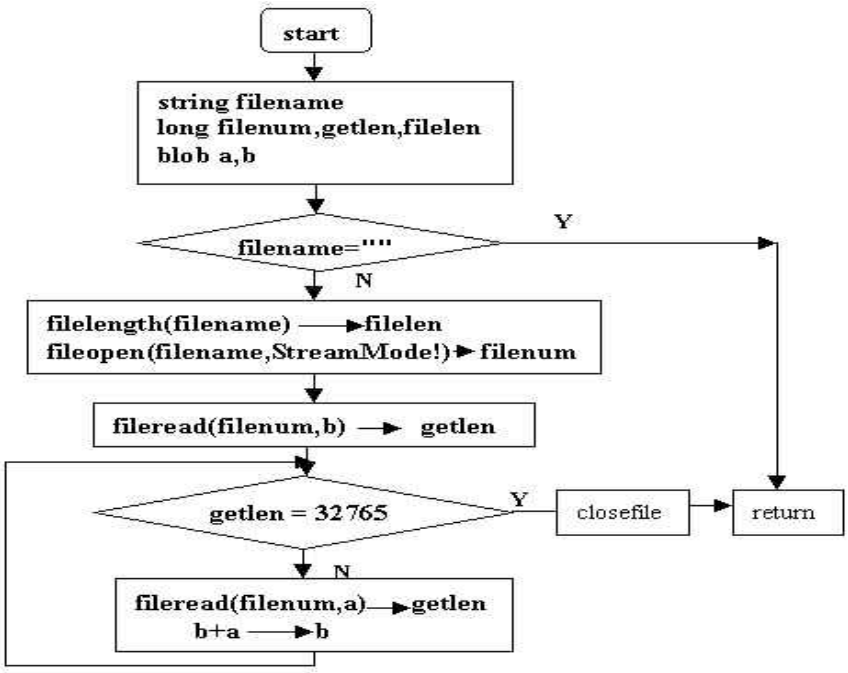

Fig. 5 A flow chart

2.3 Visualization of information classification on network

We also discuss information classification on network in chapter 2 of ***Information Organization Science*** Network has its own classification system, such as Yahoo, Sohu. Yahoo has 14 main categories andSohu has 16 main categories. They have different sub-categories and third categories..... At present, browsing and consulting classification system on network by massive text is an inefficient and awkward way. It will be clear at a glance when we describe these categories by a cone.

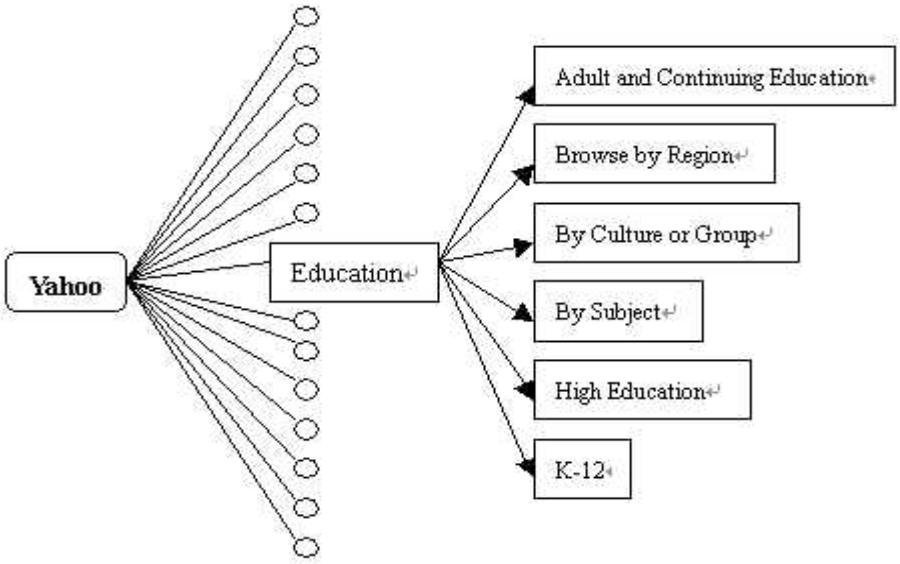

Fig. 6 A cone

Just as a saying says, one picture is better than 1,000 words. Fig.6 displays a part of the classification system of Yahoo. Visual display makes knowledgeunits clear, concise and lets user understand easily and effectively. Zoom in and zoom out

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according to different level is a common method in a cone.

3 Conclusions

Constructing teaching resources libraries is a basic work of educational innovation. DCEd metadata is an effective scheme among many description methods based on the contents of knowledge units. It is simple and easy to create object description libraries and index databases using XML/RDF Adopting the visual interface in application systems of teaching resources libraries is a wise choice for improving teaching quality

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