Development of Association Recommend Function for a Cross-curricular Subject Education Database as an Example in Disaster Prevention Education

Hiroyuki MURAMATSU[a]*, Hideaki SHIMADA[a], Shingo KUMAGAYA[b] & Satoshi TANAKA[a]
[a]*Faculty of Education, Shinshu University, Japan*
[b]*First Element, Japan*
*muramatu@shinshu-u.ac.jp

Abstract: This study would like to suggest an association recommend function as a framework to compensate for the shortcomings of the search type method, by incorporating a recommend type information collection into the database, in order to effectively support teachers working on disaster prevention education. The similarity scores of individual contents in an item base were calculated, and a plug-in which displays the association mapping based on the calculation was developed. As a result of operation verification, the achieved recommend information targeted by the purposed association recommends function could be visually displayed.

Keywords: Recommend system, educational database, disaster prevention education

1. Introduction

Disaster prevention education in primary and secondary education has become an important issue, because in Japan natural disasters are often. Disaster prevention education in elementary and secondary education can be divided into extracurricular activities such as evacuation drills and disaster prevention lectures, and curricular activities such as research studies of disaster areas during social studies and the study of seismic mechanisms in science class. Current disaster prevention education is mainly handled individually, such as a single extracurricular event, or even within a subject itself. In disaster prevention education, it is necessary to consider the systematic-systematic teaching content (Sakurai, 2013). However, it is pointed out that practice of disaster education is difficult, because the disaster education includes a wide range of disciplines (Kishida et al, 2009).

Although class time is limited, measures can be suggested to enhance the effect of disaster prevention education, which will further gain importance in the future. For example, cross-curricular subject education can overcome the barrier between subjects and within/outside a subject, by promoting coordination between subjects or adding a new subject viewpoint in extracurricular activities. In addition to being time efficient, the contents can be taught from two or more viewpoints at the same time in a set time. This is considered to be connected to the establishment of knowledge by multifaceted connection, and the acquisition of "useful knowledge" which can promote the appropriate activities.

However, there are many obstacles in carrying out cross-curricular subject education. For example, while a junior high school science teacher may be able to explain the mechanism of a tsunami; this is difficult for teachers who do not teach science. Similarly, it is difficult for science teachers to teach subjects other than science. Elementary teachers can handle various subjects but each teacher has a different area of expertise outside the textbook. Under these conditions, a framework which can support teachers in the promotion of ideas leading to new application of cross-curricular subject education is needed.

For contents which are too large to browse personally, Ono, Asoh and Motomura (2011) classified the methods for a user to collect information into a search type or a recommend type. The search type is considered to be the conventional method used more frequently by teachers for class formation.

For example, Gijyutu.com (Gijyutu.com, 2014) gathers educational material for technical education, and various educational materials and practical ideas are stored as a database. Support from such an educational database can be seen in various areas. Not only on the Internet, but also various publications can be viewed as a type of database.

This kind of database is beneficial when designing a class, but most methods which use a database are premised by search type information collection by a teacher. However, search type information collection has the drawback of being a heavy burden for the teacher. This is also related to the problem that data in the database is not being utilized. Therefore, this study would like to suggest an association recommend function as a framework to compensate for the shortcomings of the search type method, by incorporating a recommend type information collection into the database, in order to effectively support teachers working on disaster prevention education.

According to Ono, Asoh and Motomura (2011), a recommend system should consist of a recommend engine which can predict the needs of a user and a user interface which displays the contents to the user. In this article, a specific recommend engine and user interface in the disaster prevention domain were experimentally created, and actual operations are reported.

2. Development

2.1 Specifications of "association mapping"

In the database which includes a mechanism to promote ideas leading to new practices as proposed by this article (hereinafter referred to as "this database"), the idea of an association search information display that expands an idea (hereinafter referred as "association"), as used in WebcatPlus (WebcatPlus, 2014), is thought to be more suitable than the generally used narrowing down search type. Clustering has also been used to display associated words in a concentric pattern according to distance from the search word in two dimensions. However, in many association systems, even though several association words are shown, which words should belong in different categories, as well as the strength or weakness of the words in relation to the search keywords, are not well reflected nor displayed in the same line. In this database, since various categories, such as school type and subject are thought to be set, visual information display (hereinafter referred as "association mapping") in a concentric pattern as suggested by Akiguchi was adopted (Akiguchi, 2011).

Next, a method to consider how to recommend the contents (practical information and various resources) registered in this database was considered. Collaborative filtering is used to recommend the contents from many data sets. Collaborative filtering is largely divided between user based recommendations and item based recommendations. User based recommendations are suitable when the preferences of the user has original value, such as an EC production recommendation. Item based recommendations are judged only by similarity between items. In this database, item based recommendation is adopted since it is difficult to reflect user preference. To calculate similarity scores between items, the main body text, classification category, and tag of each content were targeted.

Various resources, such as practical information, educational material, thesis material, and survey material, exist in the targeted contents of this database. Furthermore, inclusion not only of text data, but also of images and movie data is expected. The database system itself must be able to flexibly process various data. Hence, use of CMS which is generally used to construct websites was decided and WordPress with a high world share was adopted.

WordPress is an open source CMS with high customizing flexibility and additional functions can be added as plug-ins. Plug-ins can be developed by PHP. Consequently, by using WordPress and developing the purposed associations recommend function as a plug-in, construction of a system with a higher degree of freedom was considered possible. A plug-in with a recommend function also exists in WordPress, but it only has a list type display.

From the above, we decided to achieve the purposed association recommend function as a plug-in for WordPress (hereinafter referred as "this plug-in") by calculating the similar score of each content in the item base (hereinafter referred as article), and perform association mapping (hereinafter referred as "mapping") based on the calculation.

2.2 Development of the Association Recommend Function
2.2.1 Calculation of Similar Score of Contents

This plug-in consists of three processes, namely 1) acquisition of related data from all articles, 2) setting of similarity weighting, 3) map creation and display.

For 1) acquisition of related data from all articles, the results of a morphological analysis for the text data of the main text body of the article, and the category and tag information set for the article, are acquired. An Internet service (Yahoo! Japan, 2014) which is provided as a Japanese language morphological analysis API, is used for morphological analysis of the text data in the text body of the article. The process is carried out in advance in order to increase the processing speed of the morphological analysis for all articles.

To carry out morphological analysis, three information items from the category and the tag of each article are abstracted from each article text in the WordPress database. Results of the morphological analysis are added to the database as meta information for each article.

In 2) setting of the similarity weighting, the system administrator can set the use rate of each information item when calculating the similarity score from the results of the morphological analysis and three information items of each article.

2.2.2 Preparation and Display Method of Association mapping

In 3) map creation and display, similar articles are plotted in two dimensions by the multi-dimensional scaling method, in order to present a map centered selection and display the article. First, the morphological analysis results of the entire article are acquired by repetition processing. Next, the posting ID of the selection and article display (which becomes the evaluation standard) is determined. Next, the Pearson's correlation coefficient with other articles is calculated and the results stored. In that case, the calculated value is added by obtaining the weighting rate set in the basic settings, and set as the evaluation value.

By using the above evaluation values, and determining the distance between the article display and other articles by multi-dimensional scaling, a map which can respond to various display settings and display title length, can be drawn/displayed for the determined distance between the articles.

3. Implementation

3.1 Implementation

This plug-in was installed in a Linux, Apache 2.2.16, PHP 5.2.17 and MySQL5.5.1 environment. WordPress 3.8 was used for CMS. PHP and JavaScript were used to develop this plug-in. Moreover, Clickable CanvasjQuery (Wizard cord, 2014), a jQuery plug-in, was used for mouse event processing.

This plug-in can be assembled from the WordPress managing screen, after downloading and installing the plugin in the WordPress plug-in folder. Various settings can be set from the settings screen. First, morphological analysis of entire article is carried out using Igo, a morphological analysis engine by YahooAPI on the "Recommend Information Map." The administrator directs the start of morphological analysis by pressing the button (Figure 1). Next, on the Basic Settings page, the similarity weighting of the article text body, Tag (Default Value 2), and category (Default Value 2) are set. Default weight values are set as 6, 2, and 2, respectively, for a total of 10, with weighting of the article text body is prioritized. At the same time, map settings for article display number (Default Value 8), balloon size of the article title (Default Value 100px), and display map size (Default Value 640×640) can be adjusted (Figure 2).

On the display screen of each article, the map image is displayed at the bottom of the article. By clicking on the image, the map can be displayed (Figure 3). By moving the cursor over the article displayed on the map (mouse-over), the entire title can be displayed. By clicking on a displayed article icon, display can be switched to the corresponding article. Also, the map can be enlarged or reduced for better readability.

3.2 Operation Verification

Fifty two articles were used as test data. These articles consisted of 47 implementation
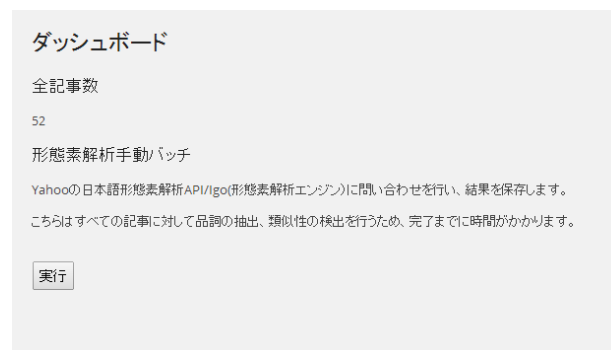

Figure 1. The execution screen of morphological analysis

Figure 2. The setup screen

Figure 3. The map screen of Recommendation information

reports/news (14 kindergarten/preschool, 15 elementary, 15 junior high and 7 high schools) from each school category, 1 report, 27 research thesis. Some of these articles overlapped categories. For example, the study contents related to disaster prevention education in "Geographical Field of Junior High School Social Studies" can be cited. The text body of the article can be considered to be related to the goal of study guidance procedures and disaster prevention education. Study guidance procedures are the basis for consideration of the educational contents of each subject. More specifically, since this study focuses on cross-curricular subject education which overcomes the barrier between subjects and within/outside a subject, by setting the study guidance procedures as the base, contents of displayed information can be verified, which is thought to standardize confirmation of association recommend function operations. Mapping with the default settings is shown in Fig. 3. Rating results which become the basis for mapping is shown in Table 1. Articles are sorted in the order of correlation strength with the source article. The category includes formal information of each article like kinds of school, grades, subjects, etc. The tag includes additional keywords of each article.

From the rating results, information beyond social studies and geography was displayed, such as a comparison of the contents of new and old studies in other subjects, including domestic science, and nursery implementation was displayed as related information. A total of 12 articles were tagged as study guidance procedures, but according the article text body and the category similarity, tagged information beyond study guidance procedures could also be displayed. From these results, we determined that the purposed association recommends function was achieved.

Table 1: Result of a rating

Rank	Article Summary	Category	Tag	Correlation
_	（Source）Learning content of disaster prevention education in junior high school social studies geographical area "	Junior high school, Social studies	Course of study, Social studies	_
1	Comparison of old and new disaster prevention education in the "junior high school technology and home economics home	Junior high school, Home economics	Course of study, Home economic	0.98
2	Learning content related to disaster prevention education in the "High School Science"	High school, Science	Course of study, Science	0.97
3	Learning content new and old comparison of disaster prevention education in the "high school base fo home economic"	High school, Home economics	Course of study, Home economic	0.97
4	Prototype of disaster prevention education for children picture book that targets the historical earthquake of Akita Prefecture	Nursery, Practice	Picture book, Earthquake	0.97
5	Realities and challenges of creating a disaster manual and disaster prevention education and training programs of infant children with disabilities	Junior high school, Practice	Disabilities, Infant	0.96
6	Attempt of Disaster Education in Home Economics Clothing area	Junior high school, Practice	Home economics, Clothing	0.96

4. Conclusion

The purpose of this study was to develop an association recommend function as a mechanism to support teachers working in disaster prevention education. The similarity scores of individual contents in an item base targeting WordPress were calculated, and a plug-in which displays the association mapping based on the calculation was developed. As a result of operation verification, the achieved recommend information targeted by the purposed association recommends function could be visually displayed. In the future, we plan to increase the contents and carry out an evaluation test for teachers in greater detail. In addition, we plan to continue to consider the possibility of user-based recommendation function.

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