

# Instruction Resource Recommendation Services for Elementary Schools in Taiwan

Hong-Ren Chen, and Fang-Yu Yeh

**Abstract**—In the past, there were more researches of recommendation system in applied electronic commerce. However, because all circles promote information technology integrative instruction actively, the quantity of instruction resources website is more and more increasing on the Internet. But there are less website including recommendation service, especially for teachers. This study established an instruction resource recommendation website that analyzed teaching style of teachers, then provided appropriate instruction resources for teachers immediately. We used the questionnaire survey to realize teacher's suggestions and satisfactions with the instruction resource contents and recommendation results. The study shows: (1)The website used "Transactional Ability Inventory" that realized teacher's style and provided appropriate instruction resources for teachers in a short time, it reduced the step of data filter. (2)According to the content satisfaction of questionnaire survey, four styles teachers were almost satisfied with the contents of the instruction resources that the website recommended, thus, the conception of developing instruction resources with different teaching style is accepted. (3) According to the recommendation satisfaction of questionnaire survey, four styles teachers were almost satisfied with the recommendation service of the website, thus, the recommendation strategy that provide different results for teachers in different teaching styles is accepted.

**Keywords**—Instruction resource, recommendation service, and teaching style.

## I. INTRODUCTION

NETWORK resources increase rapidly as a result of the Internet and IT advancement. This has facilitated knowledge sharing and promoted the generation of more new knowledge. As the amount of Internet users increases, information is continuously reproduced, spread and shared accordingly. Instead of inadequate information as in the past, users find too much information when searching the Internet. Portals are generally the public's first choice to access the immense data in the communication network. To facilitate users to search the required information fast, portals often provide classified and keyword search strategies. Though these features can shorten data search time and gather information distributed everywhere fast, the exact needs of users cannot be acknowledged from the portal search features alone. If the computer is posited as a kind of service and designed based on

customization, the output can provide services that meet the needs of individual users for the purpose of efficiency optimization. The recommendation system has thus been invented. By analyzing the needs of users, the recommendation system provides users with information and contents which interest them, so that the recommendation system further makes decisions to prevent users from getting lost in the immense information.

There are many studies investigating and practicing the recommendation system, most emphasizing the application of recommendation strategies for e-commerce and e-learning [1-8]. Though scholars have proposed different recommendation approaches and applications, practical studies on teaching resources recommendations from the viewpoint of teachers are inadequate. Particularly, more and more teachers are currently producing digital teaching resources and applying CAI to their courses as the government promotes IT in its education policy. Also, many teaching resource websites have been established in the concerted efforts of educational institutions and teachers of all levels. Though the amount of teaching resources increases, very few of them have recommendation service functions. This study implemented a teaching resource recommendation website; analyzed the teaching style of course teachers; effectively classified teaching resources; designed a set of recommendation rules to filter teaching resources required by teachers; and investigated the content satisfaction of the recommended teaching resources of teachers with different teaching styles.

## II. RECOMMENDATION STRATEGY

The recommendation system makes recommendations based on its understanding of users and information recommended. That is, a certain recommendation approach is applied to analyze user preferences and behaviors and provides users with meaningful information or information which interests them based on the analysis results. Also, it helps users to make decisions in the complex information environment within the shortest time. The aim of such a system is to solve the current information overload problem. The interaction between users and the recommendation system may affect the process and results of the recommendation [1, 2, 4, 6, 7]. Therefore,

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TABLE I  
 COMPARISONS OF EXPLICIT AND IMPLICIT RECOMMENDATIONS

	Explicit recommendations	Implicit recommendations
Recommendation approach	The system makes recommendations based on the conditions input by users.	The system identifies the user preferences by collecting data or observing user behaviors.
Example	Websites may survey the personal data of users and products that interest them	The browsing or searching records of users are collected to find out the websites or types of data that interest users.
Data collection volume	Small	Large
System load	Low	Heavy
Data accuracy	Higher	Lower
User load	Heavier	None

recommendations can be either explicit or implicit, and the advantages and disadvantages are tabulated below and shown in Table I.

Common recommendation approaches including non-personalized recommendation, item-to-item correlation, demographic-based recommendation, content-based approach recommendation, collaborative filtering approach recommendation, and hybrid approach recommendation are described below.

#### A. Non-Personalized Recommendation

The non-personalized recommendation makes recommendations based on the top-N information or items. As the preference of individual users is not considered, common information is recommended to all users; for example, the Weekly Top Ten Bestsellers of bookstores is the common information for all users.

#### B. Item-to-Item Correlation

The item-to-item correlation makes recommendations based on the correlations among items; for example, consumers buying nutritional cereals will also buy fresh milk.

#### C. Demographic-Based Recommendation

The demographic-based recommendation makes recommendations based on demographic data, such as gender, education, age and social status. First the system will classify users by their demographic data and categorize the preferred information of each particular user class; for example, pupils usually prefer cartoon-related information.

#### D. Content-Based Approach Recommendation

The content-based approach recommendation analyzes user interests and preferences based on the user information collected in advance. This information may include the searching, downloading and browsing records of users. This approach shows the attributes of individual objects based on the content of items to be recommended; calculates the level of correlations between the user preferences and recommended items; and matches the preferences and recommended items. For example, if the user information indicates that a particular user is interested more in travel-related information, the system

will prioritize information with travel attributes and recommend these to the user.

#### E. Collaborative Filtering Approach Recommendation

The collaborative filtering approach recommendation assumes that users prefer the recommendations of people having the same interests and thoughts. Therefore, the system categorizes users with the same interests in the same group based on the user information collected. As users of the same group have greater similarity and the information they choose is easier to be accepted by other users in the same group, the system thus recommends users information chosen by other users in the same group. For example, users A and B are categorized in the same group because their data retrieval records are similar. Then, if user B has recently retrieved *The Da Vinci Code*, the system predicts that user A also prefers the same book, and thus recommends it to user A.

#### F. Hybrid Approach Recommendation

The hybrid approach recommendation combines the two or more approaches listed above to make up the disadvantages of one approach with the advantages of another in order to make better recommendations. For example, after analyzing the correlations among readers and among collections based on the user information, the library collection system applies the collaborative filtering approach to arrange a recommended reading list for readers. Then, it further employs the content-based approach to sort the books on the list based on the interests of individual readers in order to recommend the appropriate collections to readers.

This study adopted the explicit recommendation approach. When users log into the website, the system will request them to complete the Teaching Style Inventory. Four teaching styles are classified with data collected from the survey after analysis. Then, the system classifies the teaching resources and matches them with the teacher attributes of these four teaching styles. Therefore, this study applied the hybrid approach recommendation, which combines demographic-based and Content-based approach recommendations.

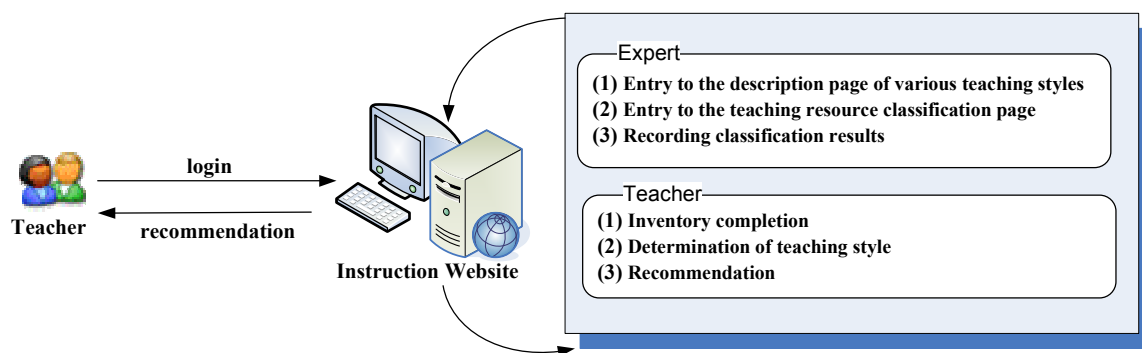


Fig. 1 Flowchart for Instruction Website

### III. TEACHING STYLE

The Teaching Style Inventory that is used in this study was developed according to the Gregorc Transactional Ability Inventory [9] edited by Chang [10], and it was translated, reviewed by experts and tested for validity and reliability. The inventory contains 40 items divided into four sections based on the Mind Styles Model proposed by Gregorc and Ward. With this model, the concrete sequential, concrete random, abstract sequential and abstract random scores can be obtained. The style with the highest score is the teaching style of a teacher. The syntax of the inventory matches the domestic habits more appropriately. In addition to classifying teaching styles and defining the preferred teaching methods of teachers with different teaching styles, the inventory suits the objective of this study: recommending suitable teaching resources to teachers based on their teaching styles.

The Teaching Style Inventory that is used in this study was developed according to the Gregorc Transactional Ability Inventory (TAI) edited by Chang. It contains 40 items divided into four sections based on the Mind Styles Models [11-12]. To ensure that the inventory matches the teaching habits in Taiwan, items were translated, reviewed by experts and tested for validity and reliability. Based on the scores, teaching styles were classified into four types defined by Gregorc: concrete sequential, concrete random, abstract sequential and abstract random. The type with the highest score is the teaching style of a teacher. In addition to classifying teaching styles and defining the preferred teaching methods of teachers with different teaching styles, the inventory suits the objective of this study: recommending suitable teaching resources to teachers based on their teaching styles.

### IV. RESEARCH METHOD AND EVALUATION STRATEGY

Teaching resources and teaching styles were categorized with the online expert review. The teaching resource website was established with the recommendation system developed with these categories and a set of recommendation rules. The effect of the system was valuated by experiments conducted on samples selected from elementary school teachers in a particular city teaching Natural Sciences and Life and Technology, the population, by means of a mixed sampling design comprising cluster sampling and accidental sampling. First, administrative districts were clustered, and sampling was conducted on

individual clusters. A total of 12 elementary schools were selected for the online survey. The system of teaching resource recommendation websites operates in two stages: expert inventory and teaching resource recommendation as shown in Fig. 1 and described below.

#### A. Expert Inventory

Experts logged into the teaching resource recommendation website with a personal account and password from PCs.

##### 1) Entry to the description page of various teaching styles

This page explains to experts the characteristics of various teaching styles before classifying teaching resources.

##### 2) Entry to the teaching resource classification page

After understanding the characteristics of different teaching styles, experts proceeded to the teaching resource classification page and reviewed all teaching resources before classifying them.

##### 3) Recording classification results

When classifying, the system recorded the results in the teaching resource inventory to facilitate future statistics and use.

#### B. Teaching Resource Recommendation

Samples logged into the teaching resource recommendation website with a personal account and password from PCs.

##### (1) Inventory completion

Samples were asked to complete the Teaching Style Inventory immediately after their logging in the website in order to determine the teaching style of samples.

##### (2) Determination of teaching style

The teaching style of samples was determined based on the inventory results: concrete sequential, concrete random, abstract sequential and abstract random.

##### Selection of suitable teaching resources

After determining the teaching style of samples, the system recommended suitable teaching resources to individual samples based on the recommendation rules established by this study.

##### (3) Recommendation

Recommended teaching resources were presented to individual samples in a web-based manner. Also, samples were requested to complete the

User Satisfaction Questionnaire to survey their satisfaction with this website.

The Recommendation Satisfaction Questionnaire is the evaluation instrument of this study. By analyzing the results obtained from the survey, the user satisfaction with the contents of the teaching materials, recommendation mechanisms and information contained in this system was surveyed to determine the suitability of system. Items in the questionnaire were developed based on the user satisfaction measurement proposed by [13, 14].

## V. RESULTS

In terms of content satisfaction, results of the User Satisfaction Questionnaire indicate that the content satisfaction of samples of all four styles is statistically significant as shown in the single sample t-test. This suggests that samples of all four styles are satisfied with the contents of teaching resources recommended by this website. Therefore, the idea of preparing suitable teaching resources for teachers of different styles is acceptable. In terms of recommendation satisfaction, the results of the User Satisfaction Questionnaire indicate that the system recommendation satisfaction of samples of all four styles is statistically significant as shown in the single sample t-test. This suggests that samples of all four styles are satisfied with the recommendation feature of this website. Therefore, the strategy of making different recommendations for teachers of different styles is acceptable.

## VI. CONCLUSION

Based on the results of this study, the following three recommendations are made for education and future studies.

### A. Provide Teachers with Customized Services Based on the Teaching-Style-Based Recommendation Strategy

Results of the satisfaction survey on the teaching resource recommendation website implemented by this study indicate that samples hold a positive attitude towards the content and strategy of recommendation based on different teaching styles. Therefore, in terms of education, the recommendation strategy proposed in this study can shorten the teaching resource searching time by providing teachers with customized services.

### B. Integrate Teaching Resources to Reduce Costs

Though users can search a large amount of teaching resources over the Internet with a keyword search, and as some links are obsolete and some contents are identical, the search is more difficult and tiring than imagined. Therefore, an integrated teaching resource base for integrating teaching resources is recommended to reduce network resources occupied by repeated data and the reading time of repeated data of teachers.

### C. Develop Teaching Resources Based on the Characteristics of Teachers of Different Teaching Styles

Results of this study indicate that samples approve the recommendation of teaching resources based on their teaching styles. Therefore, teachers or publishers interested in this area can also consider teaching styles when designing teaching

resources in order to develop more suitable teaching materials for teachers with different teaching styles.

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