A Portable Authoring Tool for Organizing and Indexing Curricular Materials

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Abstract—Internet use has been encouraged for K-12 students in Taiwan, and many educators would like to break through the confines of traditional textbook-centered teaching to present activities that encourage students to explore and construct their own knowledge. But many educators are not well prepared to teach curricular materials in form of multimedia with the internet, and internet use is limited in scope and substance. Since this requires developing innovative materials and curriculum tailored to local students, educators have neither the time nor the information to do much of this from scratch. The internet provides a medium for sharing innovative pedagogical resources broadly. Governmental projects and educator organizations have already begun to post curriculum ideas on internet servers. However, it is difficult to obtain the right resources that meet specific needs, and play their multimedia materials in classrooms under a limited-bandwidth transmission environment. Educators need productivity tools for organizing lesson plans and presenting their collected materials off-line; moreover, they need tools for locating sites of materials by surfing the network, searching the individual curricular sources, adapting retrieved materials to their classrooms, organizing these resources in coherent lesson plans. This study designed and prototyped a portable authoring tool based on a Pedagogical Service Platform (PSP) that provides authoring and presentation supports for educators so they can make effective use of contemporary pedagogical resources posted on the internet by Taiwanese governmental agencies. PSP maintains information for finding pedagogical resources distributed on the internet and provides query and browsing mechanisms to explore what is available. The portable authoring tool are included for tailoring retrieved resources, creating supplementary materials, and designing innovative curriculum. Additionally, The framework also explores and demonstrates how the internet shapes and is shaped by classroom practices.

I. INTRODUCTION

The internet has the potential to transform pedagogical curriculum development beyond current horizons overseen. Under the Ministry of Education, Taiwan (TMOE), educators from K-12 and universities across the country are strongly encouraged to post their favorite curriculum ideas for others to share. However, difficulties have been arisen from using such potentially enormous, loosely structured sources of information on the initial step of this initiative [1], [2]. Although, many educators in Taiwan have still not adopted ingredients of the internet in their practice, most of them agree on the trend that the internet can be an essential resource in their teaching. Although some have been seeking productivity software to help them manage such tasks involving complex sources of information, the results are often frustrating. One of the major reasons is that the recent development of internet tools and resources is too pervasive in technologies. The educators are limited to access sufficiently these tool or technologies to try if the internet can be used in their practice. On the other hand, many instructors are not well prepared to teach curricular materials in multimedia form with the internet, and its use is limited in scope and substance [3], [4]. This requires developing innovative materials and curriculum tailored to local students, but educators have neither the time nor the information to do much of this themselves.

Therefore, though the internet has been recognized prevailingly as a medium for sharing curriculum, educators surfing on the internet and looking for suitable curriculum materials often run into several typical problems:

- Educators have to locate sites of curriculum ideas dispersed across the network according to their experience. The TMOE has provided several sites to accommodate curricular databases, but each has different interfaces, tools, and indexing schemes that must be learned before the curricula can be accessed.
- Educators also need search through the offerings at each site for useful items. Although many in-site search engines, such as Google Apps for scholars, might be helpful, there is no dedicated service system or service provider in Taiwan providing such dedicated services.
- Educators should tailor the items they find to the needs of their particular classroom, the current curriculum, their own teaching preferences, and the diversity of needs or learning styles of students.
- Furthermore, educators have to organize the curricula to fit their own ideas for employing these materials in classroom.
- Finally, educator should consider their facilities to present their materials, especially playing high-quality multimedia materials over internet on-line.

In this work, the issues above embody the guidelines in the design of a portable authoring tool based on Pedagogical Service Platform (PSP), which was been developed to help educators' locate, search, organize, and present curriculum

materials. In addition, this study uses ideas for how sharing curriculum ideas over the internet can be made more effective [7]. On Sec. III, the Pedagogical Service Platform (PSP) is presented. First, there are four operational levels: portable tool, curriculum service, material index, and material repository. In addition, there are four functional modules: locating, searching for resources of curricular materials, adapting to local needs, organizing resources into lesson plans, and tailoring and presenting a curriculum with low internet accessibility. Then an example of a problem-solving environment for preparing a literature course for students in 3rd-4th grade elementary schools is presented. An illustration based on a scenario where an educator develops a curriculum using portable authoring tool from scratch is provided to describe how portable authoring tool helps educators construct a student-centered and project-based curriculum. In conclusion, some issues that could be important for maximizing the effectiveness of the internet-related resources are presented.

II. TWLOM v2.0 FOR CURRICULUM EXCHANGE AND STORAGE

Initiating this project of PSP, two major and interrelated tensions arise immediately in considering the design of a platform for educative service. The first centers on determining an appropriate amount of guidance for the users. The second centers on the design of tools appropriate for different kinds of educators. Because educators in Taiwan have many responsibilities in addition to teaching, they have a substantial practical problem in designing educational curricular materials, due to insufficient time to search for curricular materials, even though these materials might be very useful. To alleviate these burdens, a unified metadata format should be established to facilitate exchange and search on curricular materials over hetero-databases. This standard should provide an interface unifying heterogeneous curricular materials distributed in databases on different sites to make searches more effective [8].

Therefore, integrating the heterogeneous curricular materials accommodated in the servers funded by TWMOE, Taiwan Learning Object Metadata version 2.0 (TWLOM v2.0) is established as the standard descriptor for curriculum resources [9]. This section briefly introduces the experience gained in early prototyping of TWLOM v2.0 that combines LOM metadata items with more advanced forms of information or knowledge represented in the TMOE-funded curricular databases. Furthermore, these metadata records can be effectively linked to sharable conceptualizations in the form of ontology.

III. PEDAGOGICAL SERVICE PLATFORM (PSP)

The Pedagogical Service Platform is organized within the perspective of pedagogical objectives depicted which demand a pedagogical platform of open scenarios and adequate internet-based blended-learning environments [5]. The framework for the architecture, shown in Fig. 2, includes four functional layers: (a) portable tool level, (b) curriculum service level, (c) material index level, (d) material repository level.

These interact with fundamental challenges of preparation of curriculum to produce wide variation in internet use. The architecture motivated the needs of users was analyzed in user case.

Operating in such a dedicated layered architecture, the teachers on the portable tool level organize lesson plans and present their collected materials off-line. Additionally, if they want to search new internet materials for their lessons, they need dig deep down to the material repository level for queries about curricular materials with mediations from medium levels - course service and material index levels. It is quite difficult to obtain the right resources that meet specific need and tailor them appropriately for their application in classrooms. They, either teachers or students, need sophisticated tools to assist such elaborate behaviors - locating sites for materials dispersed over the network, searching the individual curricular sources, adapting retrieved materials to their classrooms, organizing these resources in coherent lesson plans, and sharing their experiences across the internet. Therefore, the work introduced in this article develops four functional modules executed vertically over the layers of the system architecture to provide authoring and presentation supports for educators such that they can make effective use of contemporary pedagogical resources on the material repository level. This level stores a tremendous range of curricular materials produced by a variety of Taiwanese governmental projects over the past decade. Tools are included for tailoring retrieved resources, creating supplementary materials, and designing innovative curriculum. Meanwhile, PSP encourages educators to download, annotate, and upload successfully used curricula to its server to share their ideas with other educators.

IV. PORTABLE AUTHORING TOOL

When internet traffic is slow the internet is unavailable, users should opt to download batches of curricula and resources beforehand and then work with them in the restricted environment. Therefore, after a set of interesting items has been selected based on information in the keywords-based, PSP downloads the items to a local computer with transparency of where or how to download. The items are then available for modification, printing, or distribution to students.

A portable authoring tool is provided as a stand-alone version based on PSP that is used when internet accessibility is limited. In other words, the portable tool is actually a concise PSP, whose tool programs and the light data base approximately occupy 400 MB disk, so they can be stored on and executed from a USB Flash. The way of operation on the full and the concise versions is almost the same. Therefore, users can export or combine their editing works on either of two platforms according to the internet situation.

The portable authoring tool was designed and developed for Web applications. The platform consists of several slightly tailored servers - a web server, a light-weight MYSQL, and a tailored Moodle platform, where some codes are modified for newly identified functions, together with a repository with
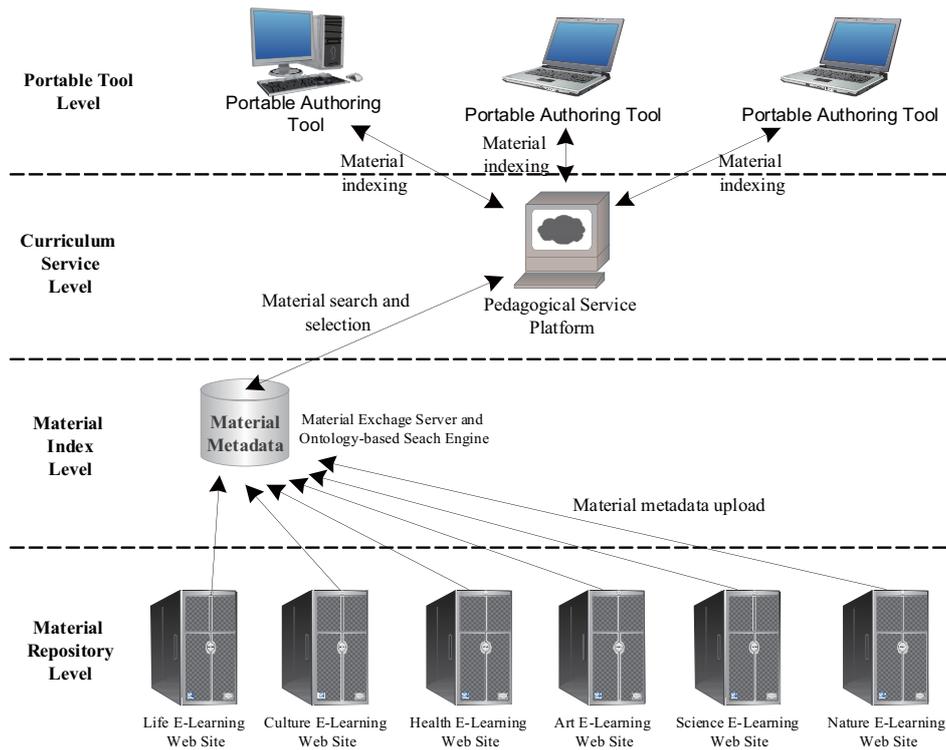
Fig. 1. The framework of Pedagogical Service Platform.

many curricular templates and examples. For easy maintenance, a mechanism of automatic detection on the directory system of the flash assigned to which virtual disk in a computer is provided to keep users file bookkeeping transparent. That is, once the flash is assigned as a virtual disk, all the pointers regarding file manipulation in programs are registered accordingly to this designated disk symbol number. Therefore, users are relaxed from varying assignments for the virtual disk while working on different machines so as to broaden the mobility and portability between hetero-machines. Therefore, once a user has located the materials via the search engine, which still needs to be operated in an environment equipped with internet access, the remaining procedures including authoring, publishing, and presentation can be done off-line. Figure 3 shows an authoring scenario by means of the portable PSP, where a user connects the web browser to http://localhost:8080 or http://127.0.0.1:8080 for locating desired materials.

A. Locating and searching curricular materials

The module provided by the portable authoring tool can either be downloaded from a syllabus provided by book publishers, or be filled in with semester themes and their constituent weekly units and lesson plans as required information, such as course, text book publisher, grade, is specified, as shown on Fig. 3. The portable authoring tool merely distinguishes two levels of curriculum available on the internet - theme and unit. A theme is a major curriculum, possibly covering a semester or a year of school and may integrate several subjects. A theme consists of multiple teaching units.
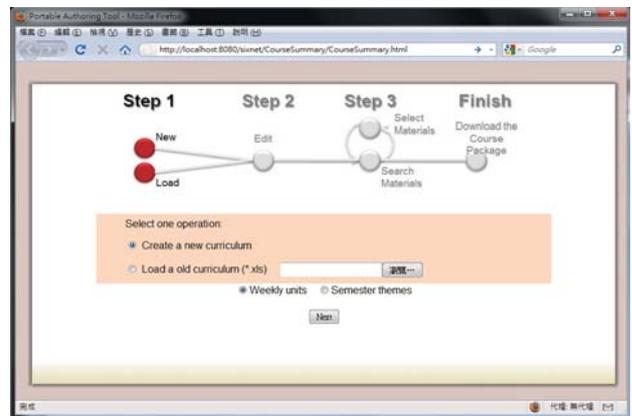

Fig. 2. The web-based application of portable authoring tool on localhost.

A weekly unit is part of a theme, typically one week of lessons for a single subject. A unit is described by its constituent daily lesson plans. The portable authoring tool provides a combination of query and browsing mechanisms to help users select curriculum of interest and to find resources accordingly. In technology, the portable authoring tool connect to PSP with a web service interface over internet. A user can start by specifying that he/she wants a curriculum for which course, text book publisher, grades and so on. Then a list of themes that meet the specification is shown on the web browser. Meanwhile, units that make up the curriculum for that theme
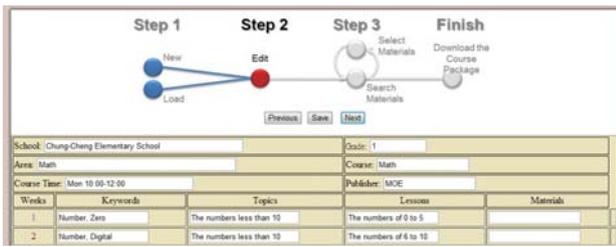
Fig. 3. Edit the keywords for each weekly schedule (fill in the textbook syllabus according to the Publisher automatically).
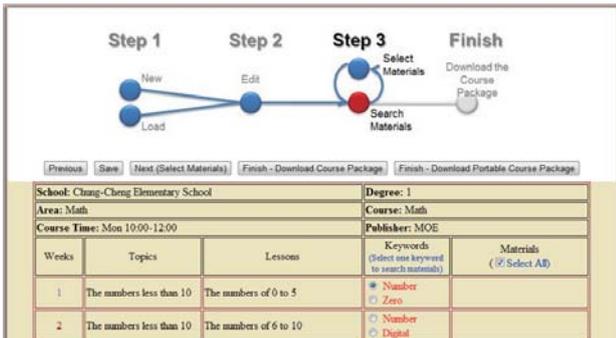

Fig. 4. Select one keyword for searching materials.

Fig. 5. Select the suitable materials.

Fig. 6. Search and select the suitable material.

are listed aside. These contents, keywords, themes, units, nonetheless have to be conceptualized respecting aspects of metaMetadata, pedagogy, and so on, in TWLOM.

The portable authoring tool helps users locate relevant curricular materials by transmitting information on themes and units stored on a designated form, as shown on Fig. 4. Along with the PSP ontology search engine, indexing summaries of curriculum and resources, based on theme, unit, and keyword, are produced and can be selected for download, as shown on Fig. 5. These summary records reference curricula and resources that have been posted to internet nodes on the servers storing various curricular materials packages with TWLOM v2.0. In addition, the internet address information needed for download and a record containing a description of the item are also provided on the summary so users can decide whether or not it is of interest, as shown on Fig. 6. Resources are also cross-referenced under ontology trees so that many different resources related to a given one can be retrieved.

B. Adapting to local needs

Following the outcome of search and selection by educators, links between materials and curricular units/theme hence are established. The empirical establishment can be profoundly analyzed as a solid ground for advances service design. For example, Figure 7 shows the arrangement of selected materials on the internet (marked in blue) according to the theme and unit in the second weeks. The red column is the keyword-indexing recommended by PSP from a built-in ontological structure. The arrangement of selections can be made in term of week(s) and theme(s) throughout the overall semester by

means of the curriculum authoring subsystem. After completing the full contents for a course, the user then can pack the edition (also called a design) into a package compatible with the format of "the backup zip of a course of Moodle[1]". This is called course package in this project and includes the major attributes of the authored course and links to referenced materials from the internet. Therefore, this package can be imported to a Moodle platform. Alternatively, the authors can upload the completed work to a presentation container, referred to as the curriculum presentation subsystem.

With the ontological keyword-indexing recommendation system, with the more frequently and longer use of PSP service, the hit rate will be higher, and the ontological association and the hits of searched materials can also be more accurate. Nevertheless, it still can be expected that discrepancies on individual designs can be observed, even though the association

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[1]Moodle is a Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). It is a Free web application that educators can use to create effective online learning sites. (http://moodle.org/)
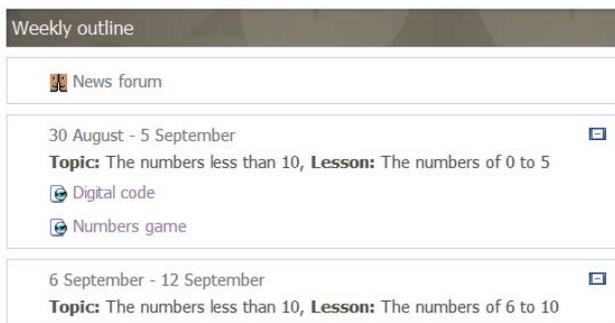
Fig. 7. An example of design shown on the presentation container based on the platform of Moodle.

Fig. 8. The flow chart of course authoring.

between keyword-indexing and resources is subjective.

C. Organizing resources into lesson plans

Although most resources found are located on distributed sites across the internet, but structured summaries (indexes) of these fitted and tailored materials according to the educators' pedagogical concepts should be maintained on the educators' personal space maintained in the portable authoring tool. Therefore, upon the completion of the edition, a presentation container is provided not only for the author's own teaching practice in class or sharing with peers, but also to fulfill the requirements of TWMOE that e-learning and on-line instruction should be some portion of schooling for K-9 education. The container, an example of which is shown in Fig. 8, is derived from the template of a Moodle platform, which is an open-source package so the government can avoid any commercial conflicts in promotion of PSP and the portable authoring tool.

V. SUMMARY OF PROCEDURE AUTHORING PROCEDURE

The development of the curriculum portable authoring tool based on PSP aims to work under public licensed web applications and open source coding. The procedure is briefly summarized as follows:

- *Step 1*: users can either download semester themes and their constituent weekly units and lesson plans from syllabus, provided by book publishers, into a curricular planning form and revise the form, or even use an on-line blank form. The former method is for general users but the latter one is more suitable for the users with more active attitudes to design and creativity.
- *Step 2*: Users decide the style of presentation for their editions based on the index of either "theme" or "weekly".
- *Step 3*: In addition to theme and unit, the PSP ontology search engine can generate, and index summaries of curricula and resources based on a keyword. Therefore users can type in keywords to relate with themes or units of interest subjectively. Based on the findings, PSP establishes this association to the related ontology tree along with the hit rate thereafter.
- *Step 4*: A user can connect to and browse the interesting and seemingly appropriate materials for each theme/unit
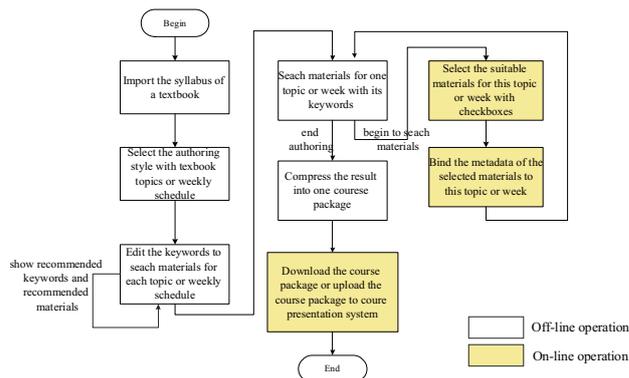
after the PSP ontology search engine has finished search on the dispersed servers.
- *Step 5*: If materials hit the search targets, a simple click on the checkbox by the side of the index list completes all procedures of bookkeeping, including selecting, locating the materials and establishing the associations in background processes.
- *Step 6*: Once the edition is finished by repeating the preceding steps, the portable authoring tool can pack the edition (also called a design) into a Moodle package, by users' options, either for on-line Moodel presentation container or for off-line portable authoring tool. The one for the off-line portable authoring tool downloads all materials listed on the curriculum, i.g., as shown in Fig. 9, via the associated URLs.

VI. EXAMPLES ON PRACTICING

Figure 10 shows the discrepancy presenting on the presentation container between two educators who both used the authoring tool. The figures show up lesson plans on two beginning weeks of the same course. The versatile design styles can be observed, though the arrangements of both are structured on a "weekly" basis.

The plan in Fig. 10(a) is more documentary-oriented than that in Fig. 10(b), so readings might be emphasized in the class practice. In contrast, the other lesson plan adopts multimedia, such as video, pictures, and flash, to assist teaching practice on the same theme. This example shows how the diversity of creativity still exists according to an educator's innovative concepts, even using the same tools provided by the portable authoring tool.

VII. DISCUSSION AND CONCLUSION

The conceptual architecture of the portable authoring tool embodies five principles: 1) Most resources are located at distributed sites across the internet, but elaborated structured summaries (indexes) of selected sites are maintained on educators' personal space and maintained in local computers by means of portable tools. 2) The search process is supported through a multi-layered combination (theme, unit, keywords)

(a) Case I

(b) Case II

Fig. 9. The different Styles in presentation of a course authored by both teachers.

of queries accelerated by an ontology indexing structure that helps educators explore much more easily what is available. 3) Adaptation of tools and resources has benefited educators and students through the constructed curriculum. 4) Resources can be organized deliberately into designed curriculum units to provide effective and interactive learning environments. 5) Internet features have been brought to be a medium for sharing curriculum ideas, practice experiences, and lesson plans. Based on these principles, the system to assist educators in developing curriculum for pedagogical reform has been designed and prototyped.

Future refinement of all aspects of the system by working further with classroom educators and curriculum developers would be conducted on the next stage of the project. While the approach of portable authoring tool appeals to educators who have participated in its design, its implementation must still be at tuned to classroom realities. The distribution of resources and indexes prototyped in the portable authoring tool has attractive advantages. Because the actual multimedia resources (text, pictures, video, spreadsheets, Flash animations) are distributed across the internet, there is no limit to the quantity or size of these resources and no need for educators to have large computers. Resources, as long as they are under the packing

standard of TWLOM v2.0, can be posted on network servers maintained by TMOE-funded projects, regional pedagogical organizations, textbook manufacturers, and other agencies.

Meanwhile, before educators are willing and able to use the portable authoring tool efficiently, there must be rich and useful indexed resources available on the network, with comprehensive suggested lesson plans. Therefore, cooperation among TMOE-funded curriculum development efforts, textbook publishers, and teacher organizations is initiated currently. The prospective is to establish a critical mass of curricula on the internet accessible by the portable authoring tool so as that the internet can begin to be an effective medium for sharing curricula and a catalyst for creative curricular practice.

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