Electronic Portfolio Architecture Based on Knowledge Support in Senior Project Design

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***Abstract*—ePortfolios based on the practice in self-assessment, and self-reflection and self-regulation are viewed as important tools in facilitating and supporting learner-centered environment at higher education. This study explains how an electronic portfolio system was designed and used as a useful repository for learning products in China. This paper aims to provide this evidence how to properly judge students abilities, and how to convert project profiles into information useful for institutional level self-assessment, are our key concerns here. Moreover, while designing, students often spend lots of time/resource solving previously solved problems. According to issues thus said, this thesis explains how an electronic portfolio system was designed and used as an alternative assessment method to help teachers assess the students, monitor their progress, provide feedback and develop students' self-reflecting and project management capability. The system also employed knowledge retrieval and relational index technology to provide knowledge and decision support, making it possible for students to tap easily on the knowledge established previously. The experimental results demonstrate that the system improves the overall quality of senior project design course in high education institutions.**

***Index Terms*—ePortfolios, project design, knowledge Support**

I. Introduction

Senior project design plays an essential role in engineering curriculum and instruction. Much criticism exists concerning a lack of focus on the knowledge and skills acquired in earlier course work, while incorporating engineering standards and realistic constraints. Many of these critics say that current educational infrastructures are incapable in preparing future scientists and engineers to solve the complex and multidisciplinary problems this society will face within personalized learning. Students must be trained to prepare for engineering practice through the curriculum culminating in a major design experience to meet these challenges by incorporating a combination of learning paradigms to solve real-world, multidisciplinary, multifaceted problems based on the practices of collaboration, self-assessment, self-reflection, self-regulation. However, much effort needs to be done in advance before getting the most out of senior project design. The most essential task is assessment. When large scale designing works and longer learning duration are concerned, traditional assessment tools such as examinations or performance appraisal may not be as effective as they evaluate students' learning outcomes only at certain time intervals [1]. Among the twelve assessments proposed by Prus, J. *et al*, the use of portfolio is most suitable for longitude assessment. As the Internet becomes more popular, many teachers today use course management system to collect learning data. However the commonly used course management systems support only passive learning model and genuine courses model. Schools start to use electronic Portfolios (ePortfolios) as alternative assessment method, which also promotes active learning. Furthermore, while starting the course, students tend to spend much time on choosing advisors, exploring project possibilities, and forming topics. Thus comes in the need of knowledge supporting system, and students could use their time more effectively on creative thinking, thus improving the overall quality of senior project design.

Electronic Portfolios (ePortfolios) is growing process by research that is either in the practice of the engagement within personalized learning, or in the framework of reflective procedure [2]-[3]. In fact, electronic portfolios have been used to document student work to demonstrate ePortfolios learning [4]. Unlike paper-based portfolios, ePortfolioss allow information to be stored, accessed, updated, and presented in various electronic formats to record students achievements.

This paper aims to provide this evidence the system also employed knowledge retrieval and relational index technology to provide knowledge and decision support, making it possible for students to tap easily on the knowledge established previously. The experimental results demonstrate that the system improves the overall quality of senior project design course in high education institutions.

II. Related Work

A. Senior Project Design

The course in participating university is three semesters long, with the goal of designing and implementing an IT application. During the process students perform system analysis, setting goals, master required tools, and finally set out to implementation and

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evaluation stages. Plan proposals, oral presentations concerning mid-stage progresses, finalized technical reports or experimental results, and actual system in any stage of designing serve as accord for advisors to assess and to monitor students' learning process. Senior project design is concluded with a final interview, where oral presentation and system demonstrations are made. In CS programs, senior project design as a whole drills and trains the students' design/implementation skills, communication, project management, problem solving methodology, as well as software engineering practices.

B. Electronic Portfolio

Much has been written about portfolios and ePortfolios in teacher education [6]-[17] and relating to higher education beyond teacher education [18]-[20]. Portfolios were introduced in the field of education as an instructional tool in the 1970s [22]. An electronic portfolio, also known as an ePortfolios or digital portfolio, by and large, is an all-encompassing term used to refer to an electronic space for learners to store their work and share with others and instructors. It frequently includes the use of blog, web-based materials and hypermedia. Specifically, ePortfolios, the accessible network space to exhibit students' achievement, can be assessed by themselves, other students, and teachers. Examining content through developing portfolio is a common use to ensure students accountability from teachers. Several studies reported that portfolio has distinct advantages. Ashelman *et al*. [23]-[26] noted the use of portfolio is a kind of tools to assess student learning. Barron et al. [27]-[28] further pointed out that reflective feedback, personalized development, self-assessment process arising the implementation in ePortfolios provides students support in learning. For example, eportfolios can be designed to be used with instructional plans increase learners to solve problems by themselves, reflect their merits and drawbacks in the process of completing assignments and enhance concepts to realistic problems [29]-[31]. Since stated ePortfolios has the potential to enhance learning and practice assessment, the process of student learning is the center of assessment in ePortfolios. Such as authentic task, contextual feedback, and student responsibility pertained to the rubric of ePortfolios involves the effectiveness of assessment [32]. With the increased use of ePortfolios, a comprehensive range of functions has been identified. The key learning elements to meet such as assessment, presentation, learning, personal development, collaboration, and ongoing working documents through ePortfolios. In a word, self-regulation learning, self-reflection, self-assessment, collaboration and the students' performing outcome is illustrated as well as the core of authentic task, contextual feedback, and student responsibility [33]-[36].

C. Knowledge Retrieval

The ability to integrate and apply the specialized knowledge by organization members is fundamental to a firm to create and sustain a competitive advantage. In order to better understand the importance of the term knowledge, it would be better for us to cross into the world of computational intelligence and to take a look at the hierarchy of knowledge. As shown in Fig. 1, at the bottom is data, which is filtered from noise. Processed data is referred to as information, indicating or measuring how much we know from the underlying data. Information used by agents to solve a problem will be referred to as knowledge. Information can be accessed, but knowledge can only be possessed by an agent. It should be noted that the retrieving of data and that of knowledge are quite different, but also share some common concerns. A good understanding of these similarities will enhance the chance of integration of information systems, since these pieces of knowledge has a great impact on decision making. Following sections introduce the basics of information retrieval and Web mining. While retrieving information, unstructured data such as documents are concerned. IR(Information Retrieval) has drawn much attention recently due to the Internet's popularity.

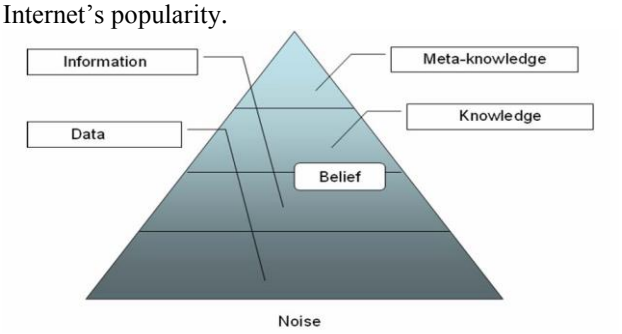

Figure 1. Hierarchy of abstraction, revised from Giarratano and riley 1998.

III. System Architecture

A. System Design

The concept of portfolios system is explained in the learning process could be surmised into collection, selection, reflection, projection, and presentation (see Fig. 2). The process such as knowledge modeling, knowledge storage, and knowledge query compose in knowledge engineering process would build those elements of institutional self-assessment and legacy archived reports in the eportfolios system (see Fig. 3)

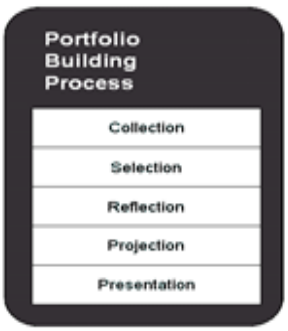

Figure 2. Portfolios building process

When conducting project, there is eportfolio, which represents the collective knowledge concerning from past, ready to offer help. When in the collection and stage, in-service teachers would like to have a look on faculty pasts in order to understand their research expertise. In

selection stage, when choosing development tools and platform, the choices from past projects could certainly help them make better decision. In the reflection stage, where endless problems are encountered, past experience on solution could save their valuable time. During the process, in-service teachers also put their learning data in a portfolio folder, thus constructing their own personal learning portfolio. In the presentation stage, the student portfolio will be made public along with their final product for summative assessment. Through the in-service teachers portfolio, the grading committee could have an easy understanding of each participating students' contribution to the project, thus have more authentic information for assessment. After the projects are finished and graded, thus considered done, in-service teachers' portfolios will undergo some categorizing and indexing process, and then be merged into the program portfolio to provide help for next generation in-service teachers. The learning function is presented in the form of an electronic portfolio system, with learning and managing functions, and serves as a way to promote interaction between team members and advisors, as well as constructing in-service teachers' personal learning record. Learning data, representing valuable personal experience, stored in portfolio database, are also to be modeled and classified by the knowledge management system for future reusability (Fig. 4).

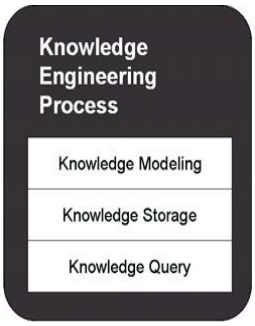

Figure 3. Knowledge engineering process

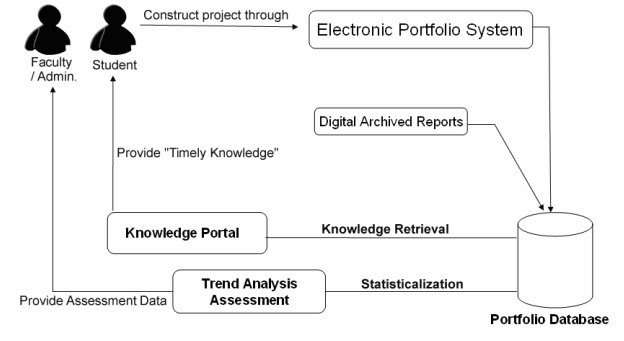

Figure 4. System architecture

In addition, the portfolio database is analyzed, generating information useful for both institutional-leveled assessments as well as providing newbie students as references. Furthermore, knowledge support system classifies objects in portfolio database, stores user preferences, and provides knowledge in the forms of either fully concluded project report, or related discussion from portfolio system, according to users' individual interests (see Fig. 3). Thus, it was proposed portfolio learning process which is composed of in-service teachers project design, and portfolio building processes; in-service teachers build their own learning portfolio in the process of conducting project design, collecting learning evidences.

B. Portfolio System

This section shows the usage of the portfolio system, and it is more a principal guideline, and most electronic portfolio software today are built with the idea of using with general courses. While the courses often have their own teaching and learning website, the contents of the courses are to be built on these sites or software, and then imported to the portfolio system. Content for a departmental ePortfolio system will need to be developed and harvested elsewhere, then imported into the ePortfolio system. This means content will be duplicated within the ePortfolio system, which might not be integrated with a common institutional authentication system. However, because it can avoid the need to be integrated into the institutional infrastructure, the departmental ePortfolio system can be deployed rapidly. The diagram below suggests how the single ePortfolio system might be deployed on a campus. As shown in Fig. 5 we have divided the portfolio system into three components, content manger, project manager, and discussion forum, which will be further detailed.

Figure 5. Portfolio system architecture

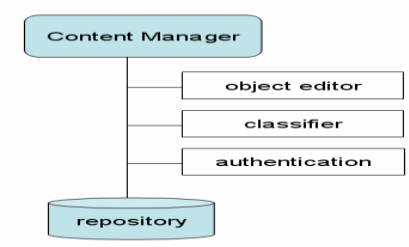

Figure 6. Content manager

Content Manger is the space manager, the holding repository of the portfolio system. Including in it is the basic ability to insert, change, edit, rename, or erase of an item, as well as an authentication system that give access control to portfolio objects. Objects within a portfolio will contain following data: owner(s) information, activity information, rubric information, actual products, and comments/reflections. While these data are essential for portfolio purposes, they are not required at once when objects are input (see Fig. 6). The classifier looks at input objects' file type, title, indexing term, and other

information, then marks the input objects with keyword for knowledge retrieval purpose. Contents' accessibility state could either be public, private, or conditional; an authentication mechanism is in place to enforce these privacy policies (see Fig. 7).

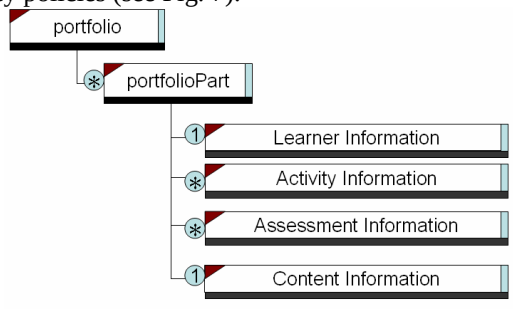

Figure 7. A portfolio object

IV. System Prototype

The scope of our implementation is exactly as proposed earlier, with an electronic portfolio management system for constructing learning records, which is named the *Senior Project Design Portfolio* (SPDP), and a knowledge support system for knowledge retrieval, which is named the *Corpus*. Both were realized in ASP.NET applications in a Web Server with Microsoft Internet Information Service and .NET Framework, in combination with MySQL database system. All sub-applications are presented in active web pages; enabling users to access the system from any place without the need to install any client software. The whole system is constructed under MyIECS, the departmental Web portal, thus taking advantage of its authentication system.

A. Portfolio System

As shown in Fig. 8, teachers can design or edit rubric for different tasks for summative assessment purpose. That is, when a grade is given, the rubric data will also be attached so that the student might know the merit of the grading. While portfolio objects can be graded according to rubric, it can also be formatively assessed, and comments from either peers or teachers are then attached. The implementation of an ePortfolio system for a single large course such as senior project itself is meaningless without the support or portability of other supporting groups, such as school campus enterprise system. Departmental policy and teaching style are also important for the portfolio system.

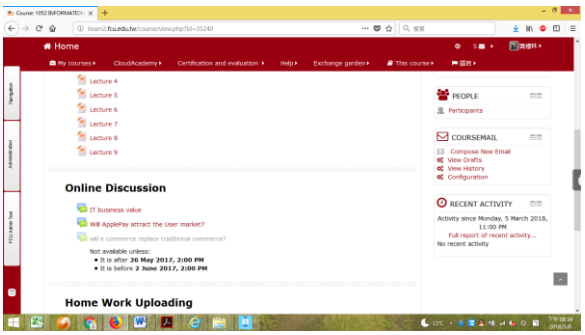

Figure 8. Rubric setting

B. Knowledge Support System

This study examined what the effects those in-service teachers in ePortfolios environment are the knowledge portal is built under courseserching03 framework, thus uses its identification and authentication system. Shown in Fig. 9, is the intro page of the portal, basic search function is very simple, just type in the search term and click submit, the responding page will be generated. The courseserching03 is provided by electronic portfolio objects. From 1999 to now, every senior project design is concluded in a product and a digital formed written report in PDF file format. Project products sometimes were either long lost or in non-digital or non-archival forms, however the written reports were kept. We arranged these digital files, attached keywords and other attributes that are required of portfolio objects to them according to their contents, and then imported these 350 objects into the portfolio system while creating assessment criteria for rubrics, the teacher must also choose which "program learning outcome" this criteria will map to.

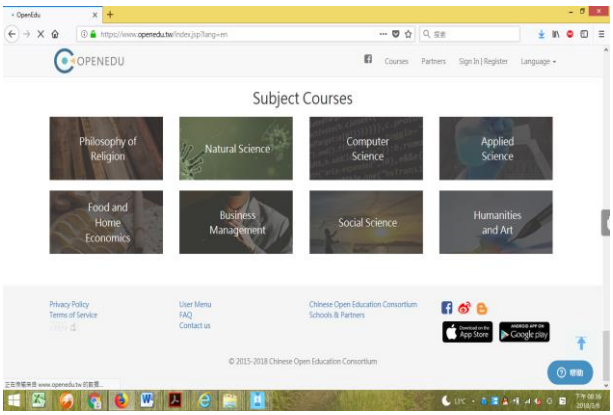

Figure 9. Coursesearching 03

Acknowledgment

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