Design a Digital Archive Value-added Model of Supporting Formal Instruction

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Abstract—The purpose of this study was to identify a way for applying big 6 information skill on digital book for supporting learning in the formal education. Digital learning projects show us fruitful opportunities of promoting learning. Those abundant research products should be used in a more efficient way to support our formal education. The standard based formal education provides a well defined foundation for teachers to develop learning experience for their students. Based upon both the content of digital book and guide line of educational standard, a big 6 learning activity design procedure was identified and verified.

Keywords—Big 6 information skill, Digital book, Learning activity development

I. INTRODUCTION

In this information world, digital technology provides people the power to save knowledge not only in the paper but also electronic form. The function and volume of digital book are growing rapidly.

Several information problem solving models exist for fostering learning and reinforcing the research, problem-solving, and knowledge processes. The Big Six information skills model (Big 6) is one that is primarily aimed at all range students. In the search for re-using fruitful digital books, appropriate procedure of learning activity design is important information for promoting digital knowledge products. Exploring digital book for knowledge supporting formal learning based upon Big 6 steps becomes a logical designing movement.

In the learning world, how to organize those fruitful digital books becomes a critical problem. Without resolving this problem, the abundant resource could not be appropriately used. Big 6 might be one of the solution to help learner finding organization of information.

II. THEORY FRAME

In this information age, knowledge construction is firmly rooted in digitizing products. Digitizing learning is highly depending on digitizing archiving. There is a need to identify ways of using all those growing digitizing archiving.

The purpose of this study was to identify a way for applying big 6 information skill on digital book for supporting learning in the formal education.

A. Information Problem Solving

Information problem solving is a concept that combines the skills needed to access and use information, and those needed to apply and solve an information problem [1].

In other words, whenever a student encounters a problem that requires information in order to be solved, she is encountering an information-based problem, also termed an information problem [3] Several researchers have examined behaviors and skills associated with information use [4-7]. From this rich empirical and rational-empirical [8] body of knowledge, three prominent models of the research process have been created. These include the search process model [3], the research process model [7], and Big 6 [9-10].

In an effort to better understand the research process or the information problem-solving process, Kuhlthau [3] examined the thoughts, feelings, and actions associated with various activities within this complex process. Her search process model details the changes that occur for searchers as they move from a generally unfocused to a focused state of mind while progressing from seeking relevant to pertinent information. This shift also describes feelings that ebb and flow between more negative emotions such as uncertainty, confusion, frustration, and doubt, to more positive emotions such as optimism, clarity, confidence and relief.

While Kuhlthau examined searchers as they sought information in a variety of situations, other authors focused on research paper writing in order to better understand the information search process. For example, Stripling and Pitts describe their model as a "thinking frame" [7] for research. This ten-step process emphasizes a thinking framework that can be adapted for any age level and any curricular subject.

The authors maintain that, unless they are instructed to do so, most students do not automatically think about research in an explicit manner. Therefore, by prescribing the method in which to write research papers, the authors hope to improve student thought about the research process. The ten steps of the search process model [7] are organized around the major activities performed in writing a coherent research paper: topic selection, planning the information search, locating and accessing materials, and creating a final product.
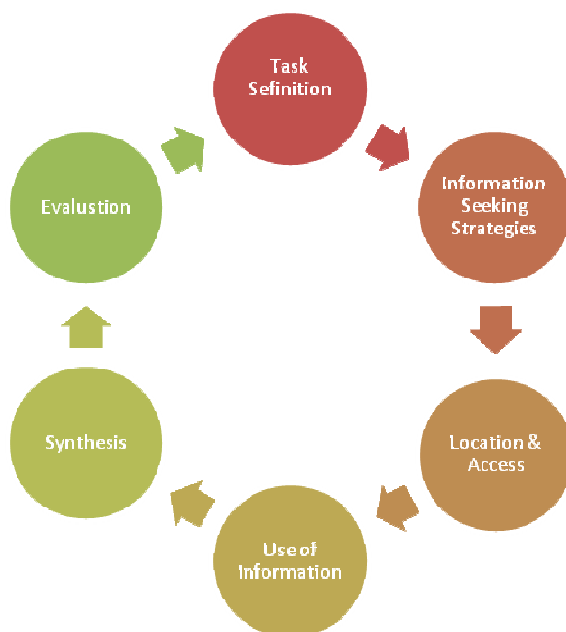
Figure 1 Big 6 sequential steps

Throughout the model, students have several reflection points that allow them to make judgments about their progress. In the figure 1, the Big 6 sequential steps are presented. The learners begin with the task definition. Following the flow, they would be through all six steps to get information for resolving a problem.

Big 6 [10] is a six-step process that provides support in the activities required to solve information-based problems: task definition, information seeking strategies, location and access, use of information, synthesis, and evaluation.

presented to them. They must also identify the types of information needed in order to solve the problem. They must have a clear hypothesis, a specific question, and a clear understanding of what is needed in order to answer that question.

In the figure 2, sub-skills of task definition are presented. They are defining the problem and identifying information needed.
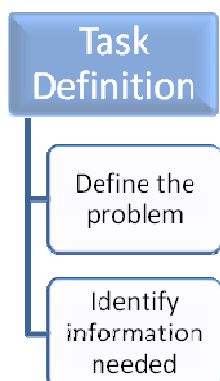

Figure 2 Sub-skills of Task Definition

Each of the six steps has two sub-skills. Task definition requires students to identify the exact information problem

Figure 3 Sub-skills of Information Seeking Strategies

In the figure 3, sub-skills of information seeking strategies are presented. They are determining rage of sources and evaluating and prioritizing source.

Both Kuhlthau [3] and Stripling and Pitts [7] examined the

search process from the point of view of the searchers. Others have examined the search process and found that a more generalized view of the information problem-solving process was warranted. By formulating a model that can be used by students to guide their thinking and research activities and by teachers to guide their planning and implementation of classroom instructional activities, Eisenberg and Berkowitz [10] provided school library media specialists, students, and classroom teachers with a model that could be used in a variety of settings for a variety of activities.
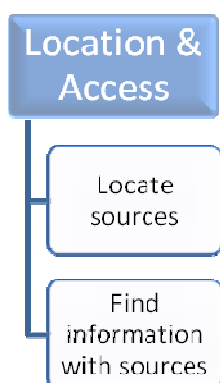

Figure 4 Sub-skills of Location & Access

The information seeking strategies stage requires students first to identify all the possible sources of information, and then to evaluate each source to determine which are best for them to use. For instance, while one possible source of information about the weather. A more feasible and higher quality source would be a detailed Web site (http://www.cwb.gov.tw/eng/index.htm) created by Central Weather Bureau, based on the weather exploration expeditions.

Figure 5 Sub-skills of Information Use

The next two steps, location and access and use of information, are comprised of traditional bibliographic skills.

In the figure 4, sub-skills of location and access are presented. They are locating sources and finding information with sources.

In the figure5, sub-skills of use of information are presented.

They are engaging the information and extracting information.

Students must not only find individual resources such as books, magazines, reference materials, and Web sites, but also find the information within each source through the use of tables of contents, indexes, and other resource-specific tools. Next, they must engage each source (read, view or listen) and extract specific information from it through the application of note taking, highlighting, and summarizing.
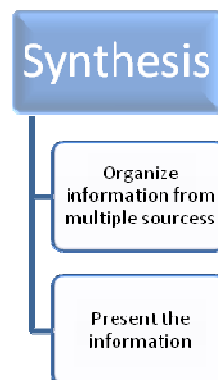

Figure 6 Sub-skills of Synthesis

In the figure 6, sub-skills of synthesis are presented. They are organizing information from multiple sources and presenting the information. .

Figure 7 Sub-skills of Evaluation

Synthesis requires students to make a decision, create a product, or formulate an answer. Synthesis is linked to task definition in that students are expected to answer the specific question they created when initially engaging in the problem-solving process. Finally, evaluation requires students to evaluate not only their final product (whether it is a decision, paper, etc.), but also to evaluate how well they performed the

information problem-solving task.

In the figure7, sub-skills of evaluation are presented. They are producing and processing.

After evaluating, it is possible to carry out learners' meta-thinking. Meta-cognition has been described as thinking about thinking. More specific definitions include references to knowledge and control of factors that affect learning, such as knowledge of self, the task at hand, and the strategies to be employed [12-13]. In order to perform meta-cognitively, learners must be aware of their own cognitive activities, and be able to control and monitor those activities.

Evaluating cognitive activities in students is mystified by the hidden nature of cognition. It is difficult to see whether a student is engaging in meta-cognitive behaviors. Therefore, researchers have operationally defined meta-cognition in terms of various behaviors that can be observed in students.

This study considered learners to be exhibiting meta-cognitive activity when they verbally indicated that they did not understand a task or were not given enough information to complete a task. Other researchers considered an ability to alter strategy use based on an awareness of task and personal characteristics as well as the "process of reflecting on, or monitoring the effectiveness of, the search process and then refining the process when necessary"[14]. Several techniques have also been used to ascertain meta-cognitive awareness in study participants including think-aloud protocols [14] and journaling activities [15, 16].

A number of research studies have been conducted with regard to meta-cognition. A major issue in relation to meta-cognitive strategy instruction is that many students use a strategy when required, but fail to use it when the requirement is removed. This suggests that a model other than direct instruction would be beneficial to students.

Teachers and designers can develop and support strong meta-cognitive skills in students by incorporating the use of meta-cognitive scaffolds [12] into the curriculum. Scaffolding has been defined as a support structure for learners engaged in activities just beyond their independent abilities [12].

Research indicates that the different uses of scaffolds in various learning situations have impacted student achievement and attitudes [8,13]. In addition, the school library community has recognized the need for students to possess strong meta-cognitive skills [10]. Studies suggest that information-seeking behaviors yield more positive results when the students performing them possess strong meta-cognitive skills[16].

The link between meta-cognitive skills and the use of scaffolds has also been explored [16]. One common assumption associated with the design, development, and implementation of student-centered learning environments (particularly environments that are technology-enhanced) is that "learners must take more responsibility for monitoring, and reflecting upon, the learning process" [16]. Further, student effectiveness within student-centered environments is attributed to an ability to monitor thoughts and actions; locating, selecting, organizing, integrating, and using relevant information to generate products; and evaluating the efficiency and effectiveness of personal approaches during open-ended learning.

Harada [16] suggests that information-seeking behaviors yield more positive results when students possess strong meta-cognitive skills. Recommendations for scaffolding meta-cognitive development in students have been identified. Students can be taught to generate questions, make conscious choices concerning information for problem solutions, evaluate information in relation to multiple criteria, summarize information, and keep a thinking log or diary. Teachers can provide specific support and scaffolding for desired meta-cognitive skills by labeling student behaviors as meta-cognitive behaviors, modeling specific meta-cognitive activities (e.g. self-questioning, reflection, strategy revision), providing opportunities for feedback to the students, and by adopting a specific learning or studying model for use within the classroom.

As noted previously, Big 6 defines information problem solving in terms of a research process. This study defines meta-cognition as the ability to plan, implement, and evaluate strategic approaches to learning and problem solving is supported by the six steps of Big 6.

Learners who engage in task definition and information-seeking strategies are formulating a plan in order to complete an assignment or solve a problem. Engaging in location and access, use of information, and synthesis is the implementation of that plan. Evaluating the process and product resulting from the synthesis activity is the final step.

Big 6 may serve as an effective meta-cognitive scaffold for a variety of reasons. Within the task-definition stage, students are generating questions and making conscious choices regarding relevant information. There also exists an element of analysis and evaluation in this stage to make links between required information and the questions generated by students. The information-seeking strategies stage requires that students make evaluative and conscious decisions about which specific information sources to use for a problem.

Location and access is a part of the implementation process, yet consists mainly of seeking and finding types of behaviors. Students must determine only whether a particular source contains information that they might need not the value or use of that information. However, once students engage the use of the information step, they employ a variety of summarizing skills in the form of note taking, highlighting, paraphrasing, and other methods of engaging and extracting specific information from each resource.

The synthesis stage involves the use of summarizing techniques, as well as additional analysis and evaluation of information in relation to the questions generated in the task definition stage. Finally, students must not only evaluate whether their product meets the criteria initially set forth, but they must also evaluate the process they took in order to finish the project and make decisions about their strengths and weaknesses of their problem-solving strategies.
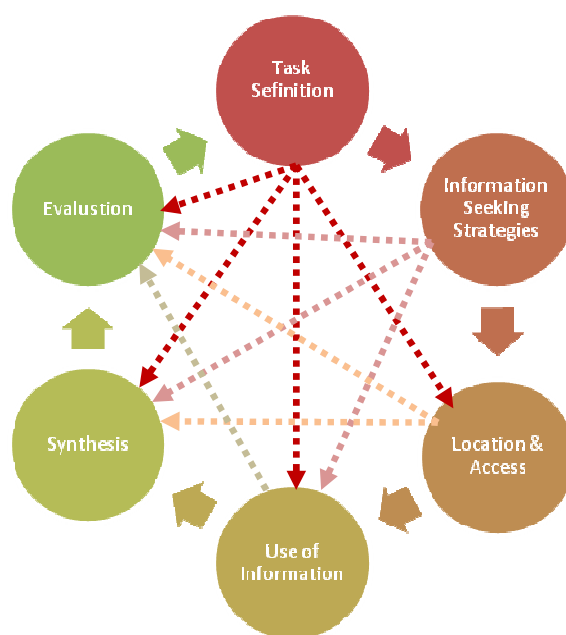
Figure 8 Non-linear flows of Big 6 Information Skill

B. Taiwan e-Learning and Digital Archives Program

Under the "National Digital Archives Program" initiated in 2002, various kinds of archives kept in Academia Sinica, the National Palace Museum, National Taiwan University, and many other public and private cultural institutions in Taiwan have been digitized. In 2003, the "National Science and Technology Program for e-Learning" was launched. These two national programs have successfully integrated development of various fields in science, technology, humanities and economy. Through the implementation of these programs, experts in different fields were brought together to exchange ideas and to consider how to create, organize and disseminate knowledge. The results of digitization have not only increased accessibility to these knowledge resources for scholars, but also allowed the general public to transcend barriers of time and space in appreciating and utilizing knowledge, thereby creating more fun and happiness in their lives.

This cultural endeavor requires an across-the-board thinking and the participation of specialists from various fields. Beginning on January 1, 2008 the two aforementioned programs were integrated into the "Taiwan e-Learning and Digital Archives Program." It is hoped that with further efforts from interdisciplinary experts, more forward-looking thinking and execution capability will be brought to bear.

With the achievements of the "Taiwan e-Learning and Digital Archives Program" you can feast your eyes on the treasures of five thousand years of Chinese civilization and also take a peep at Taiwan's ecology and history. You can feel the amazing industrial power when contents of domain knowledge and science and technology combine. You can also appreciate the creativity of young people as they utilize knowledge, culture and technology, and personally experience the learning revolution that information technology development has brought forth.

It is hoped through the efforts today the cultural heritage and knowledge been locked away in academic institutions in the past can be brought to light and be made available and accessible to more people.

C. Digital Education & e-Learning Project

The objective of the Digital Education and e-Learning Project is to expand the application of e-learning in formal education and lifelong learning so that talent and human resources can be effectively nurtured and utilized, raising the quality and skill level of Taiwan's human resources. A complete e-learning application chain from primary and junior high, to high schools (including vocational high schools) colleges and to continuing education is planned. It includes four sub-projects: Digital Education and e-Learning Project of the Ministry of Education, National-wide Labor Education Learning Network, Sub-plan of e-Learning for Public Servants, and e-Learning for Art and Culture Project. The missions are as follows:

1) Integrating the e-learning resources with the results of TELDAP, encouraging and assisting primary and junior high school teachers to use archive resources, transforming them into Grade 1-9 Curriculum framework learning objects and courses, and promoting the use of information technology in teaching.

2) Providing e-learning materials for senior high schools and vocational schools in 22 subjects, and increasing the use of information technology in teaching.

3) Developing high quality models for e-learning courses for general education in colleges and universities, introducing the developed model and results to college and university e-learning implementation and application, and encouraging colleges and universities to adopt e-learning in training.

4) Training of teachers at various levels to help them apply the results of TELDAP in teaching, and promoting the development of e-learning in formal education and lifelong learning in Taiwan.

5) Combining existing digital contents and platforms to develop lifelong learning materials for labor and a test database for skill certification examinations, and thus stimulating diversified e-learning by people who are on the job or seeking employment.

6) Combining related resources to create a first-rate learning environment, improving the effectiveness of civil servant e-learning and gradually increasing the proportion of e-learning to at least 20% of civil servants' study time each year.

7) Promoting an art and culture learning portal and e-learning material database of art and culture, and establishing websites and communities of national culture, art and creativity learning information.

III. METHODOLOGY

A feasible analysis method was applied to conduct this study. The methodology would be illustrated according to the research problem, research procedure and research tools.

A. Research problem

The purpose of this study was to identify a model of designing big 6 learning activities based upon using a public access digital book. In the other word, it was intended to find a systematic process of re-use digital book for formal education.

Big 6 was chosen to examine as a general, non-subject-specific, meta-cognitive scaffold for students to use when solving information-based problems.

Big 6 was chosen for study for two reasons. First, while there is a strong body of anecdotal research that highlights recommendations for practice and successes resulting from implementation of Big 6 (e.g., Jansen and Culpepper 1996; Eisenberg 1997, 1999; Eisenberg and Berkowitz 1998) the literature does not report a strong empirical study of the model. Second, the complex nature of the information search process coupled with the influence of meta-cognitive skills provides an intriguing arena to explore in a detailed manner. In this light, the key question in this study was, how does Big 6 support meta-cognitive strategies and knowledge management in teaching plans?

B. Research procedure

There were two phases in this study. In the first phase, a proposed model for developing digital book based big 6 learning activities was designed. In the second phase, an instructional plan was developed and implemented according to the model.

The first phase was conducted during August 2010 and the second phase was conducted from September 2010 to January 2011.

C. Research tools

For the feasibility evaluation, a technology feasibility questionnaire of instruction plan design model was created. In the questionnaire, there are 10 items in likert scale format. Those factors are listed as follows.

1) In terms of input
2) In terms of Processes
3) In terms of Output
4) In terms of Fields
5) In term of Program

D. Participants and Setting

There were 20 elementary teachers and 156 fifth grade students participated in the study. None of the students had been identified as being gifted or possessing a learning disability.

The study was conducted in a primary school. The enrollment in the school was approximately one thousand students with a student to teacher ratio of 30:1.

A moodle instruction management system was used in this study. Students spent four weeks to familiar with the moodle learning environment. The wiki learning activity module was set for learners to collect and edit information during big 6 procedures.

The digital book used for this study was "Remembrance of a City through the Lens – Experience the Changes of Kaohsiung from Old Photos (1945-1970)". The content of this digital book are listed as follows.

1) Kaohsiung under the Cold War
2) The Construction in Kaohsiung
3) The Industry in Kaohsiung
4) The Entertainment in Kaohsiung
5) The Politics in Kaohsiung
6) The Sports in Kaohsiung

This digital book could be downloading from URL of http://163.32.121.50/index.jsp?Lprg=maga&code=T0000079. Those 165 pictures were picket out from the whole Kaohsiung city museum collections for the digital book. Those pictures were collated, analyzed, compared to the current status, and been interpretations for the view of city growing and changing. The overall content consists of Kaohsiung under the Cold War, the construction in Kaohsiung, industry in Kaohsiung, Kaohsiung entertainment, politics and sports in Kaohsiung in

Kaohsiung, 6 major themes. The theme will be to serve the reader to understand what was the background.

The time period of this digital book is from 1945 to 1970 as the narrative timeline.

IV. FINDINGS

In this study, energy use was illustrated according to theory of big 6 information skill learning, the model structure, and feasibility evaluation.

The achieve project prepared fruitful digital learning materials.

As noted previously, Big 6 defines information problem solving in terms of a research process. It could be a guided structure for learners to organize information. Learners could inquiry digital book based upon Big 6 steps to learn. Students who engage in task definition and information-seeking strategies are formulating a plan in order to complete an assignment or solve a problem. Engaging in location and access, use of information, and synthesis is the implementation of that plan. Evaluating the process and product resulting from the synthesis activity is the final step.

Big 6 may serve as an effective meta-cognitive scaffold for a variety of reasons. Within the task-definition stage, students are generating questions and making conscious choices regarding relevant information. There also exists an element of analysis and evaluation in this stage to make links between required information and the questions generated by students. The information-seeking strategies stage requires that students make evaluative and conscious decisions about which specific information sources to use for a problem.

Location and access is a part of the implementation process, yet consists mainly of seeking and finding types of behaviors. Students must determine only whether a particular source contains information that they might need, not the value or use of that information.

V. CONCLUSIONS

As previous research found, value of information technology could not only stand along but also integrated[11]. The purpose of this study was to identify a way for applying big 6 information skill on digital book for supporting learning in the formal education. Digital learning projects show us fruitful opportunities of promoting learning. Those abundant research products should be used in a more efficient way to support our formal education. The standard based formal education provides a well defined foundation for teachers to develop learning experience for their students. Based upon both the content of digital book and guide line of educational standard, a big 6 learning activity design procedure was identified and verified..
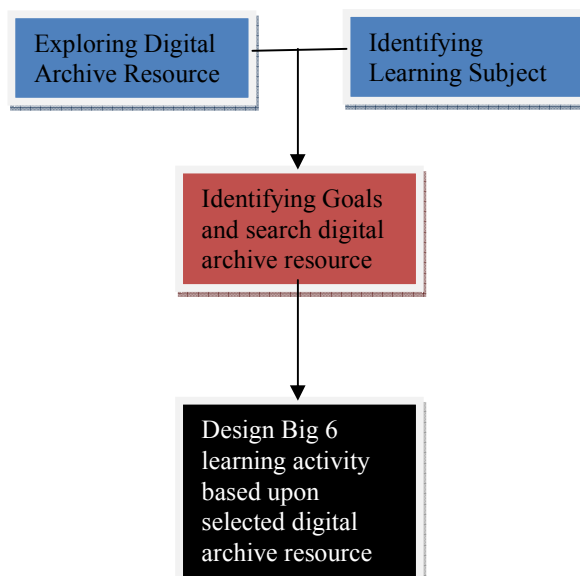

Figure 1 The First Stage of big 6 digital book learning activity
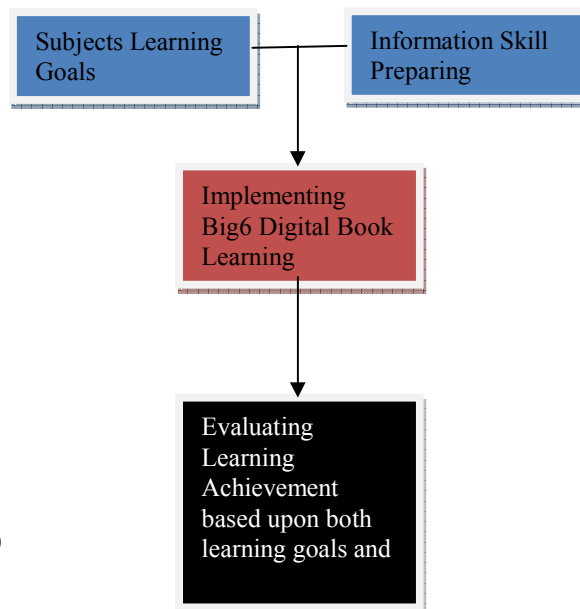
According to the model, there are two stages of each implementation. Those are:
1. Preparation stage
2. Formal instruction stage

In the preparation stage, there are three steps for constructing action plan. The first step is doing the exploring digital archive resource and identifying learning subject.

The second step is conducting both digital achieve searching and instructional goal pointing. And then, educational goals would be the target for designing Big 6 learning activity.

In the second stage, Big 6 digital book learning activity would be implemented based upon selected learning goals and information skill preparing activity.

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Learners would play as an independent thinking unit to exploring digital book for learning. The first step is to implement Big 6 digital book learning according to the learning activity design. The second step is to evaluate the achievement of learners.

For the further research on this topic, it is suggested that conducting big 6 learning activity is necessary for collecting reliable data in order to verify the whole model [17-19].

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