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## **BUILDING INFORMATION LITERACY THROUGH PROJECT WORK: A CASE STUDY IN SINGAPORE**

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**Abstract.** In this paper, we described a study carried out to investigate whether the incorporation of information literacy standards explicitly in the learner outcomes of Project Work helped students build and achieve a high level of information literacy. In this study, the students self-assessed their acquisition and development of the information literacy competencies through the use of a five-scale Likert survey. Their reflections of the research experience were also analyzed. In addition, the teachers rated their students' achievement levels through the use of a rubric. Findings revealed that students attained a relatively good level of competency, extracted relevant information, synthesized the main ideas to construct new knowledge and seemed to concur with teachers' perceptions of the students' abilities to access, evaluate and use information more effectively.

### **Introduction**

The 21st century challenges educators to prepare students to cope with complex and unforeseeable changes. Education must provide them with the attitudes, knowledge and skills they require as active members of an information society. This shift in paradigm has been the driving force behind Singapore education till today, aiming to nurture students into active learners with critical thinking skills while developing a creative and critical thinking culture because learning how to learn is fundamental to economic and personal success in the information age (Doyle, 1994).

The Thinking School Learning Nation movement was supplemented with the expansion of information literacy, defined as "the ability to access, evaluate and use information from a variety of sources" (Doyle, 1992, p. 2). Expected learner outcomes and skills are identified. Guidelines are integrated into the existing school curriculum.

Critical appraisal of the teaching and learning processes was carried out by the Ministry of Education to review the school curriculum in the light of future economic, technological and social needs of Singapore. It was recommended that all students be provided with the experience of self-directed learning which could take the form of Project Work (PW). This interdisciplinary, project-based approach to teaching and learning views students as enquirers, and teachers as architects, of the process where they "apply creative and critical thinking skills", "improve communication skills", "foster collaborative learning skills" and "develop self-directed inquiry and life-long learning skills" (Ministry of Education, 1999, p. I-1). Through implementing PW, students are expected to achieve the learning outcomes in the following domains as shown in Table 1:

### **Information Literacy and Measurements**

#### ***Defining Information Literacy***

A majority of the definitions of information literacy are actually descriptions of the skills required to be information literate (Bruce, 1997), namely as "the ability to access, evaluate and use information from a variety of sources" (Doyle, 1992, p. 2). On the other hand, Kuhlthau (1993), insisting on processes [or the process] rather than attributes, holds that information literacy is a way of learning, not a discrete set of skills.

Information literacy has been frequently confused with other terms such as library skills, computer literacy, IT literacy, information skills and learning to learn with authors having sought to emphasize

the differences between these terms (Snively and Cooper, 1997; etc.). Today, information literacy is best envisioned as a broader concept that encompasses all of the other forms of literacy.

**Table 1. Domains and learning outcomes for Project Work**

| Domains               | Learning outcomes  |
|-----------------------|--|
| Knowledge application | Students will acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. |
| Communication         | Students will acquire the skills to communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms.                                 |
| Collaboration         | Students will acquire collaboration skills through working in a team to achieve common goals.  |
| Independent learning  | Students will learn on their own, reflect on their learning and take appropriate actions to improve it.  |

### ***Measurements of Information Literacy***

Traditional measures of information literacy assessment focus primarily on student learning outcomes, but student learning outcomes are not the only important arena of assessment. However, it is still critical to establish the standards with which to measure information literacy competencies as the students carry out their PW, if it is to be used as the vehicle to promote information literacy. “Students will find the expected competencies useful because they provide students with a framework to gain control over how they interact with information in their environment. It will help to sensitize them to the need to develop a meta-cognitive approach to learning, making them conscious of the explicit actions required for gathering, analyzing, and using information” (Association of College and Research Libraries, p. 6)

It is equally important to measure and document personal experiences that directly contribute to the development of information literate individuals, such as specific indicators that capture the quality of the learning environment, the learner’s self-assessment of skills and instruction/learning satisfaction ratings. The most common approach of assessing students’ information literacy or information skills is by means of questionnaires or multiple-choice tests (Greer, Weston, & Alm, 1991; etc.). They are useful for testing large numbers of people and are quick to administer and analyze (Astin, 1993).

### **The Study**

#### ***Motivation and Aim***

There is general consensus that the objectives of PW are being met and that students have benefited from it. Nonetheless, little is known about the effect of PW in developing information literate students. Only broad references are made to information literacy outcomes, lacking the richer definition and understanding of those concepts that can be found in documents addressing information literacy.

Moreover, sample project tasks provided in the resource package emphasize developing students’ information literacy competencies while omitting explicit references to the learner outcomes in the *Information Literacy Guidelines* (Ministry of Education, 1997), an obvious shortcoming in PW. An assumption is made by the Curriculum Planning and Development Institute of Singapore that schools integrate the information literacy framework into the various subject-specific curriculum and students naturally acquire the information literacy skills while doing PW.

However, this assumption construes naively that information literacy is an automatic outcome. But this link cannot be taken for granted. The reason for the uncertainty of students acquiring the attributes of an information literate person is due generally to teachers’ lacking the awareness of the learner outcomes in the *Information Literacy Guidelines* (Ministry of Education, 1999, p.I-1). Subsequently, they are unable to teach towards these desired outcomes. Therefore, it is necessary to ensure that these outcomes are disseminated to teachers and implemented by overtly enshrining them in the PW strategic document to ensure that attainment of information literacy competencies is not left to chance but be consciously measured and evaluated. Ultimately, greater coherence of desired results, key performances, and teaching and learning experiences lead to the attainment of information literacy.

The aim of our study, therefore, was to investigate the perceptions of students and teachers regarding effectiveness of information literacy in PW as integrated into the Research Studies (RS) curriculum.

### ***Participants and Setting***

A group of 293 Secondary Two students from Raffles Girls' School (Secondary) participated in this study assessing the RS curriculum, an extended version of PW where students were introduced to the Big6 information problem-solving model and taught research skills and knowledge to equip them to accomplish a project in groups smoothly. In addition, it was based on the philosophy for students to engage in independent self-directed learning and be empowered in the learning process. More importantly, development of information literacy skills was explicitly stated as one of the main aims of RS.

A developmental approach towards assessment was clearly adopted. The students' progress was carefully tracked by their teachers using rubrics to assess the research skills and knowledge with feedback given as part of formative assessment to help the students become aware of any gaps that exist between their desired goal and their current knowledge, understanding or skill, and hence, guided them through taking necessary actions to attain their goals. In addition, students were further encouraged to regularly reflect on their performance and contribution to the project, and the lessons to be learnt from working on the project. Dewey (1933) affirms that action and reflection are necessary elements for learning to take place.

### ***Survey***

A questionnaire of 57 items was developed using the indicators from the information literacy standards adopted from that of *Information Power: Building Partnership for Learning* (American Association of School Libraries, 1998) to study the students' assessment of their own information literacy competencies upon completion of their project: ability in the research process and the creation of the products and/or artifacts; personal growth through the process; working with others; and achievement of standards as described in the rubrics. A total of 70 projects were evaluated in this study. Self-assessment questionnaires are the most popular suggestion for a diagnostic test, which is also the most common method mentioned in relevant literature. The advantages of this method are the quick and easy nature of the tasks for both respondents and distributors, which concur with the literature (Astin, 1993).

In each category of the questionnaire, the survey questions served as modes of measurement of information literacy and these parts, when pieced together, form and construct the picture of an information literate person. The deliberate 'messing up' of these questions was to better facilitate the self-assessment process in the students as the categories chosen mapped their research experience. In addition, the assessment would be a more reliable indicator of the development of information literacy because the students would be more spontaneous in rating themselves rather than to give a conscious-bias response.

The first person singular was intentionally used, to obtain each respondent's perception of her own subjective experiences in RS, rather than perceptions of the experiences of the others (Taylor & Fraser, 1991). This agrees with the basic principle of the constructivist education of placing students in the centre of the instruction process and the willingness to understand the student's personal point of view. The Likert-style survey was based on a five-point scale; with '5' representing 'strongly agree' and '1' being 'strongly disagree'.

### **Results and Analysis**

The reflections written by the students form the core data for textual narrative analysis. Extractions from the written reflections provided evidence of learning experiences highlighting information literacy. The data demonstrated that students were functioning at the cognitive level with reference to information literacy and thus exhibited clearly that students were practicing information problem solving. Furthermore, the data was analyzed for the function of and ways to strengthen the learning experiences for the students.

We report our results and analysis of students' and teachers' feedback and performance under the following sub-sections:

- I. Students' self-assessment of their abilities to access, evaluate and use information; and
- II. Teachers' impressions of students' abilities to access, evaluate and use information.

### ***I. Students' Self-Assessment: Access, Evaluation and Use of Information***

Students' self-assessments of their abilities in accessing, evaluating and using information were analyzed and categorized with selected qualitative feedback inserted as follows:

1. Having the ability to define the purpose of research problem  
37.4% of the students mentioned that they were able to define the purpose of their research problem, with 44.0% of them claimed they achieved a manageable focus of the problem.
2. Being confident of setting clear and realistic goals and objectives  
Compared to 51.6% of the students who were unsure of their levels of competency of this skill, 41.2% was confident in their abilities to set clear and realistic goals and objectives for their projects. This was reflected in working within time constraints:  

"... we realized that our thesis statement was far too extensive, and that we absolutely have to narrow it down since we only have a short span of time for our research."

(Student A)
3. Ability to apply appropriate research methodology  
48.5% of the students was confident of their abilities to apply the appropriate research methodology in their projects, and Student B, for example, understood that effective research meant asking the right questions:  

"During Research Studies (RS) discussions, we learnt that our RS proposal had many loopholes in it and was rather vague. We had to go more in depth into our subject matter and be more precise and accurate in our responses. We had to pin point one specific problem or issue we were researching on and not to research blindly, leading to superficial results."

(Student B)
4. Being able to identify a variety of information sources  
66% of the students felt that they had identified a variety of types and formats of potential sources for information. Some students, however, like Student C found identifying a variety of potential sources of information a challenge:  

"Gathering background information was not as easy as many of the sources we looked at were irrelevant to our study ... we should expand our range of resources to other sources as well as philosophical books, previous similar studies conducted, or articles."

(Student C)
5. Having the ability to define and execute a realistic plan and set schedule  
16.6% of the students agreed that they had defined and executed a realistic overall plan and timeline to acquire the needed information to complete their projects, well over half of them felt that they had learnt from their research and achieved their research goals and objectives. Student D, for example, planned a feasible project in the given timeframe:  

"We learnt about the importance of a timeline and how it could guide our research process. The timeline enabled us to set targets which had to be reached within a certain time frame. That made us more organized and prepared in that sense."

(Student D)
6. Confident in having the ability to examine and compare information  
55.8% of the students were confident in their abilities to examine and compare information from various sources in order to select information that was applicable to their research problem or questions, there was only agreement from 46.6% of the students that they could determine whether the new knowledge had an impact on the individual's value system and took steps to reconcile the differences. Only 43.5% of the students felt that their product displayed sufficient depth of analysis and thought. Student E, for example, evaluated the information critically:  

"[This knowledge] will constantly remind me to think before I act and to view matters in different perspectives to get a full picture. I recognized that many issues should not only be viewed on the surface but require an in-depth study."

(Student E)
7. Being able to communicate effectively

63.5% of the students felt that they had in their products communicated effectively in a style and format that supported the purposes of the intended audience, in terms of language and selection of information sources as well as in creating new meaning in the conclusion with new information and ideas gathered. Student F, for example, highlighted the importance of communicating different points of view.

"[Furthermore,] I now hold much better enquiry skills. In which the way I probe and ask questions has changed ... no longer ask questions from my point of view but instead, with the use of the [Paul's] Wheel of Reasoning [critical thinking model], I now can enquire from many points of view."  
(Student F)

8. Having the ability to synthesize appropriate information

56.1% of the students agreed that their products displayed their abilities to effectively synthesize appropriate information and new understandings through critical thinking and problem solving. Likewise, 49% of the students agreed that their products would contribute an original idea to an existing body of knowledge. Only 40.1% of the students felt that their products, and/or approaches to problem solving were original. Student G, for example, commented that her awareness of organizing and integrating information to apply to decision making has heightened:

"The learning and process of this project ... open new fields of thought and encouraged flexibility in thinking and analysis ... it strengthened my brainstorming abilities [fluency]"  
(Student G)

9. Having sharpened critical thinking skills

In general, 78% of the students agreed that they actively assessed the quality of their information seeking process and products. For example, Student H learnt to sharpen her critical thinking skills:

"Our mentor reminded us to bear in mind the rubrics, and to work on the interview questions first before jumping straight into the interview."  
(Student H)

10. Being able to overcome problems encountered

50.0% of the students agreed that they were able to overcome problems encountered during the course of the research and suggested improvements. Student I learnt to deal with obstacles:

"... we faced several rejections from intended surveyees and interviewees ... this project has really taught me how to deal with unexpected turns. It also made me a more versatile person, in coming up with solutions to counter these unexpected rejections."  
(Student I)

11. Being aware of ethical behaviour

69.5% of the students agreed that they acknowledged the use of information sources and communicating their products, for example, by following bibliographic form and citing all information sources used. For example, Student J acknowledged the need to cite sources used in their projects using the American Psychological Association A style:

"... learned how to use the APA format in our bibliography and use footnoting when quoting from a certain source of article."  
(Student J)

12. Encouraged to participate effectively in groups

70% of the students agreed that they collaborated well with others, from their peers to their teachers. 67% of the students felt positively about working in groups and that they were able to achieve more by working with others. While 78% of the students felt that they had put in their fair share of work, 47.4% of them felt that the distribution of workload among group members was fair. 81.4% of them acknowledged that they discussed ideas with others in the group, listened well and responded respectfully to the points of view of the team members. Student K, for example, commented on the benefits of collaboration:

" ... contribute ideas readily and give constructive criticism to each other's comments. Sharing our ideas has allowed us to express our feelings about the RS project."  
(Student K)

## **II. Teachers' Assessment: Students' Access, Evaluation and Use of Information**

Here, we analyzed teachers' impressions of students' abilities to access, evaluate and use information as follows:

### **A. Defining the problem and identifying the information need**

64.2% of the projects were awarded ratings of "Proficient" and "Excellent" in the area of task definition, namely, defining the problem and identifying the information need. Typical feedback given by teachers could be seen in comments such as:

"The group was able to clearly define the research question and suggest how to go about exploring the issues. Goals were adequately identified and the means of achieving them discussed. Better management of their time would have ensured that more substantial changes could have been made to their report after submission of the first draft. Ideas brought up during information gathering could also have been discussed in more depth."

### **B. Mapping students' knowledge and time management abilities**

55% of the projects were awarded ratings of "Proficient" and "Excellent" in terms of the students' knowledge mapping and time management abilities. Typical feedback given included:

"There was a tendency to seek information to verify or defend personal views. They needed to be constantly prompted and reminded of the need to seek answers rather than to defend existing views. Their tasks were clearly delineated, bearing in mind this purpose."

### **C. Being resourceful**

However, for the resourcefulness of the students, only 44.0% of the projects were awarded ratings of "Proficient" and above, in terms of generating alternative ways of approaching tasks and analyzing how the alternatives affected those tasks and adapting where necessary. Comments written by the teachers to guide students in improving their skills and knowledge in this area included:

"Breath and depth of research was lacking, and limited to a few (mostly anecdotal) sources on Singapore's education system."

### **D. Evaluating information**

58.7% of the projects were awarded ratings of "Proficient" and "Excellent" in the students' performance in evaluating information critically and competently through the exhibition of information processing, reasoning, critical thinking and logical deduction skills. The positive comments given included:

"... group critically analyzed the pros and cons of each of the three proposed experimental design and the procedures to justify their final choice."

### **E. Synthesising and organising information**

61.5% of the projects were awarded ratings of "Proficient" and "Excellent" for the students' abilities to synthesize and organize information in a logical manner, transiting smoothly between ideas. Similarly, the same grading was awarded for originality and presentation of projects. However, for creative thinking exhibited by the students, only 43.1% of the projects were awarded ratings of "Proficient" and above in the course of the project.

### **F. Being able to reflect**

68% of the projects were awarded ratings of "Proficient" and "Excellent" for the students' abilities to reflect and their attitude towards the research process, namely, task commitment, effort and perseverance and pride in work. Feedback from teachers, for example, shows that students gave more thought into the management of the project:

"... demonstrated a healthy and sustained interest in the project and in getting things moving forward. A thoughtful and hard worker, she steadily improved in her contribution to the group by helping them think through many of the issues and challenges thrown up by the project."

### **G. Collaborating with others**

83.7% of the projects were awarded ratings of "Proficient" and "Excellent" in the area of collaboration where the students' contributions, responsibility, accountability and cooperation with teammates were assessed. Good feedback given included:

"Quick with interesting ideas, she consistently and actively contributed information, opinions and skills. She valued others' views and feedback,

seeking to improve quality of tasks. She was committed to team's goals and inspired others to work collaboratively."

## **Discussion**

Upon completion of their RS projects, at least 50% of the students felt a sense of achievement and that they had learnt new skills through the process. Only 20.1% of them agreed that they were able to apply the skills learnt from the Skills Build-up sessions.

The importance of giving students information skills to develop individual learning skills had led to the recognition that learning "how to learn" was more important than learning a given subject matter. The learning process is guided and mediated authentic activities where learners construct the meanings and develop the needed knowledge and skills with support (Lave & Wenger, 1991). PW comprises teaching and learning where learners are viewed as enquirers and teachers as architects of the process.

Educational practice has significantly shifted from a content-based education to an outcomes-based education on their skills and understanding. An Australian School Library Association paper (2001) notes the emergence of curriculum statements in the various states and territories that emphasize the processes of learning and information literacy, including 'independent, integrated resources-based and technology-based inquiry learning' and collaborative project-based learning. By harnessing the information literacy standards in assessing the performance outcomes in PW, information literacy can be expanded and built.

## **Research Process**

Generally, there was agreement between the students' self-assessment of their information literacy competencies and the teachers' assessment of their levels of competencies through the achievement of learner outcomes. Students tended to exhibit information sources and information evaluation conceptions, rather than knowledge/information creation conceptions of information literacy.

Both teachers and the students themselves were generally confident in the students' ability to identify and locate a variety of types and formats of potential sources for information while relying on online sources.

The students were able to examine and compare information from various sources, expressed explicitly in many instances of their reflection. However, they can synthesize main ideas to construct new concepts in the research process. Students can become competent, independent users and evaluators of information. Hence, it is critical that teachers model the skill for the students to practise and emulate. Students should receive some instructions on how to recognize quality information (Caruso, 1997).

There was a difference between teachers' and students' assessments of level of competency in the outcome of retrieving information effectively and efficiently. The students recognized that they experienced difficulties exploring information for a focus and eventually narrowing their topic of interest of research. This is understandable, considering that this has been the first time these students embarked on such a 'big scale' research project. In addition, this might partly be because students were more familiar dealing with situations where the nature of the problem was carefully defined by the teacher, and also where clear guidelines were given for the answer. Kuhlthau (1993) and Burdick (1996, 1997) have also indicated similar problems and numbers of students having difficulties in the focus stage. Obviously, the focus stages are crucial in the success of the research process.

Although the opportunity for deep learning was there in PW, it often did not occur because of the tendency in project-based approaches to get caught up in the action without appropriate reflection (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991). In such cases, the "doing" of an activity takes precedent over "doing with understanding."

## **Discussion Skills**

A lack of discussion skills to facilitate and manage small groups could possibly explain why only a comparatively low proportion of students felt that they were able to help their groups stay focused and be on task. In PW, students learned through inquiry and thus, needed to be able to discuss ideas and issues with each other. However, not all students were able to discuss comfortably with their peers and, because of this, were not able to participate fully. It seemed that students often had difficulties as discussion facilitators and participants. For some of them, this is a new role and they may never devel-

oped skills in these areas. As Kim, Parks and Beckerman (1996) discovered, “some small-group discussion facilitators were unclear about what they were expected to do” (p. 175).

### **Skills Build-up**

52.4% of the students was unsure of their levels of competency in the various information literacy skills despite the encouraging ratings that their teachers had assessed them in. This correlates with the low percentage of students (20.1%) who felt that they were able to apply the research skills learnt from the Skills Build-up sessions. Students are more likely to remember the information and use it properly when skills are taught as they needed. Students only embark on the projects when all instructions were conveyed and completed. Due to the lack of urgency, students’ attitude towards the learning of research skills were not as committed as they would be if they had needed the skills to carry out a task then. Merrill (1995) echoes that instruction needs to be transmitted at the time when students need the research skills.

This low number might also be due to students’ differing entry levels of information literacy competencies. It may then be advisable to carry out differentiated instruction to better meet the needs of the students. A diagnostic assessment can be used for channeling the students to attend the appropriate level of skills build-up session, hence closing the gaps between incoming students’ current information literacy skills and the skills that have been identified that they need in order to complete their research projects. Skills Build-up sessions can also be better designed to meet students’ needs because training is no longer based on assumption but evidence (Miller, Imrie, & Cox, 1998).

PW is an excellent tool for ensuring that students have become information literate before they graduate from secondary school because it requires practice in organized research, synthesizing materials and presenting it clearly and effectively. According to Loertscher and Woolls (1998), to be information literate, students need both a basic understanding of the research process itself and the ability to develop their own internalized strategies for finding, evaluating and using information.

Students learn from their entire ongoing experience (Caine and Caine, 1991). In many ways, content is inseparable from context. Projects are a means of an excellent vehicle for helping students to understand the interconnectedness that the subject area content knowledge should be the goal of educators. It creates student-centered learning environments where inquiry is the norm, problem-solving becomes the focus, and thinking critically is part of the process. Such learning environments require information literacy competencies. Hence, information literacy skills are presented and developed when the curriculum of PW is taught and executed, making it a robust, holistic information literacy programme.

PW clearly requires careful planning of instructional activities that serve to direct learners to understanding the research process. Scaffolding student learning to maintain structured thought throughout projects inspires students to learn beyond the task because they know how to sustain their own learning. Due to the close relationship between scaffolding and modeling learning behaviour, students learn how to pursue their own interests and passions.

The significance of information literacy education lies in its potential to encourage deep learning, and in its potential to develop independent, self-directed, lifelong learners. Without information literacy, people are condemned to the lack of information, dependence upon others for access to knowledge and information, and even to acute levels of information anxiety (Wurman, 2001).

### **Conclusion**

In this paper, we described a study carried out to investigate whether the incorporation of information literacy standards explicitly in the learner outcomes of Project Work helped students build and achieve a high level of information literacy. Findings revealed that students attained a relatively good level of competency, extracted relevant information, synthesized the main ideas to construct new knowledge and seemed to concur with teachers’ perceptions of the students’ abilities to access, evaluate and use information more effectively.

It is recommended that a second study be conducted with this same group of students in their second year of PW as a comparison to determine whether the level of achievement is significantly enhanced. Data, on the other hand, can be collected through interviews, which could reveal more in-depth information as it can then be extended to some of the themes requiring some coverage, which warrant some explanation from the interviewer that would be impossible with a questionnaire.

Future work includes extending the study to more secondary schools in Singapore.

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