Primary Four Students' Development of Research Skills through Inquiry-based Learning Projects

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Abstract: Researchers like Harada, Yoshina, Donham, Bishop, Kuhlthau and Oberg have pointed out benefits for students to move from rote to inquiry learning. However, "the norm in many classrooms remains teaching practice that results in rote learning and regurgitated facts". In Hong Kong, the government's Education Bureau recently put inquiry-based learning as the first emphasis under the new General Studies curriculum for primary schools with the objective of "creating more learning space by removing obsolete content, allowing more time for inquiry-based learning". Many schools are now attempting to incorporate this mode of learning into their curriculum. This study reports on two phases of IBL projects undertaken by 141 Primary Four students, each phase lasting for 2-3 months. The projects were led by General Studies teachers, and heavily supported by Chinese Language teachers, the Information Technology teacher and the School Librarian. Through analyzing the lesson plans, in-class exercises, homework assignments, written reports, presentations by students, and data collected through surveys/interviews, this paper will focus specifically on the role of the General Studies teachers in guiding students through the inquiry process. It will also analyze the students' development of research skills, the process of knowledge cultivation during the IBL, as well as students' and parents' perceptions of the projects.

Keywords: research skills, inquiry-based learning, General Studies, knowledge cultivation, information literacy.

1. Introduction

Harada and Yoshina (2004a, b), as well as Donham, Bishop, Kuhlthau and Oberg (2001) have shown the benefits of inquiry-based learning (IBL) for students, as compared to rote learning. However, "the norm in many classrooms remains teaching practice that results in

rote learning and regurgitated facts" (Harada and Yoshina, 2004b, p. 22). Harada and Yoshina might mainly be describing the situation in the U.S., but this is in fact a worldwide problem. Like many other parts of the world, rote learning is still the dominant way of teaching and learning in Hong Kong primary schools. In attempting to change this situation, the Education Bureau of the Hong Kong SAR (EDB) introduced IBL into the General Studies curriculum as a way to help students develop basic inquiry, investigative and problem-solving skills (Education Bureau, 2007).

This study reports two phases of IBL projects which were led by General Studies teachers, and heavily supported by the Chinese Language teachers, Information Technology (IT) teacher and the school librarian. Each phase had 141 primary four (P4) students working on a research project lasting for 2-3 months. Through students' self-directed learning and support from the different teachers, school librarian and parents (see Figure 1), their research skills were gradually developed.

Figure 1. A model of the influences on students' research skills development through IBL
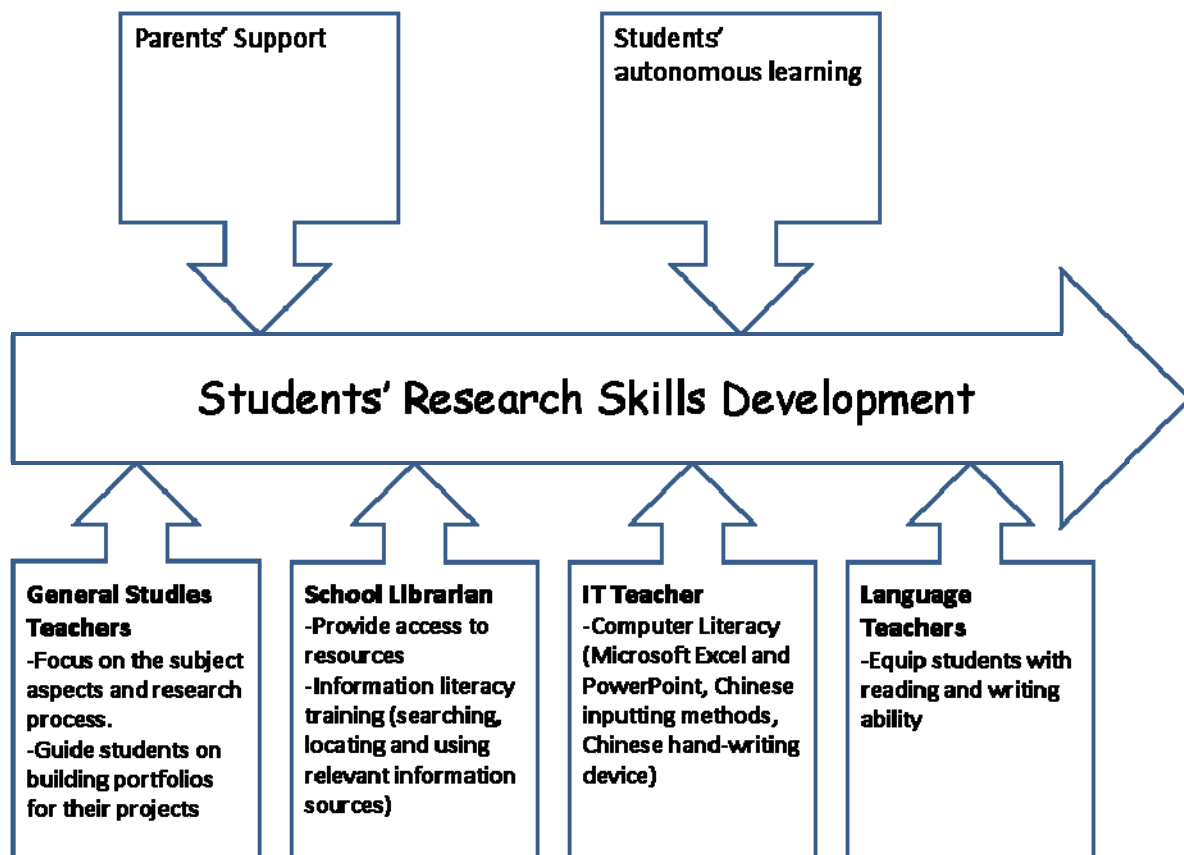
2. Literature Review

What is IBL? The EDB (2007) defines IBL as "a student-centered approach which helps students to integrate generic skills, knowledge and values in the learning of General Studies. In the inquiry process, students are active constructors of knowledge and the teacher is a facilitator of learning. Instead of the teacher giving the right answers, students have to raise questions, find their own answers and look for the necessary information. They are engaged in identifying problems, collecting information and solving the problems they encounter."

In the process of IBL, students are involved in cycles of questioning, investigation, verification, and generation of new questions (Harada & Yoshina, 2004a). It is also a kind of learning that "provokes deeper thinking and investigation and greater student motivation to learn" (Harada & Yoshina, 2004b, p. 22). Moreover, according to Dewey (1916), ideas and knowledge come only from a situation where learners must draw them out of experiences meaningful and significant to them. Similarly, Piaget's concept of autonomous learning (1973) requires children to discover relationships and ideas within the classroom through activities of interest to them.

L.S. Vygotsky emphasized the importance of opportunities for active exploration. He claimed that children learn new cognitive skills under the guidance of an adult (or a more skilled person) through a process called scaffolding. In the classroom, teachers can assist children's discovery by providing scaffolding with questions, demonstrations and explanations. In addition, the whole process has to be within the zone of proximal development of each child. In other words, the level of the assigned tasks has to be not too difficult for children to do alone, but they should be able to manage with guidance (Bee & Boyd, 2002; Vygotsky, 1987).

Seven steps are applicable to the implementation of an IBL approach at schools:
1. Students are provided with rich information sources (Alloway et al., 1997; Jakes, Pennington, & Knodle, 2002);
2. Students are equipped with information literacy skills (Alloway et al., 1997; Harada, 2002; Kuhlthau, 2003; Li, Lee, Kong, Henri, 2005);
3. A climate of inquiry is created in the classroom (Alloway et al., 1997; Hakkarainen, Lipponen, Jarvela, & Niemivirta, 1999);
4. Scaffolding support is provided to students in developing driving questions (Alloway et al., 1997; Harada and Yoshina, 2004a; Jakes et al., 2002; McKenzie, 1997);
5. Students go through an information seeking process (Harada, 2002; Kuhlthau, 2003);
6. Students develop their own research process (Harada, 2002; Kuhlthau, 2003);
7. Students learn to present their findings (Alloway et al., 1997; Jakes et al., 2002).

Owens, Hester, and Teale (2002) reported on the use of technology to support IBL programs for 7-15 year old urban students. They suggested that technology enhances cognition, particularly in the areas of reading and writing. Furthermore, access to technology makes schools seem more 'real world', and students are able to push the boundaries of their traditional school curriculum. Wu and Hsieh (2006) investigated how sixth graders develop inquiry skills of constructing explanations in an IBL environment. They designed a set of IBL activities that develop students' ability to construct explanation. The results showed that the students' inquiry skills were significantly improved after participating in the IBL activities. Bilal (2001) studied 17 grade 7 students, who were required to use Yahooligan to locate information for an assigned research task. She found the students had difficulty in completing the task because they lacked adequate research skills.

Although Harada and Yoshina (2004a) and Kuhlthau (1994, 1997, 2003) studied how school librarians and teachers can work together in guiding students' inquiry learning, there is still a lack of literature on how different subject teachers and the school librarian can work together in equipping students with inquiry learning and skills. This is especially true in the non-English speaking world. Besides, little discussion exists on the specific role of General Studies teachers in this collaborative teaching approach. Another gap in the literature relates to how students' research skills are developed through the process of IBL. This study, involving three subject teachers and the school librarian in supporting students' IBL's activities, attempts to address these gaps in the literature.

3. Research Methods

This case study examined 141 P4 students from a local Hong Kong primary school. The design involved two phases, each having an IBL project assigned by the General Studies teachers, which the students were to complete with support from their Chinese Language teachers, IT teacher and school librarian.

3.1 Research questions

The main research questions for this study are:

- What are the roles of a General Studies teacher in an IBL project?

- How do the support from teaching staff[1] and parents influence students' development of research skills through IBL projects?

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[1] Teaching staff includes teachers in General Studies, Chinese Language, and IT, as well as the school librarian.

- What is the process of students' knowledge cultivation in an IBL project?

- How well do students develop their research skills through IBL projects?

3.2 Sampling

The sample contained four classes of P4 students, with each class having 30-40 students, 27 parents, 10 teaching staff and the principal.

3.3 Evaluation

We analyzed the following areas to answer our research questions:

3.3.1 Lesson plans, in-class exercises and homework

The lesson plans provides a framework for the content of each lesson. Students were required to complete in-class assignments and homework, in order to learn different skills required for completing their group work. The in-class tasks helped students practise the necessary skills for completing their research, whereas the homework helped students accumulate related information for their project.

3.3.2 Students' written reports and presentations

Students worked on their projects in groups of six. At the end of each group project, students were required to submit a written report and do a presentation. The main theme of the group work in phase 1 was "The Earth", while in phase 2 it was "History of Hong Kong and mainland China". With guidance from the General Studies teachers, students were encouraged to choose a specific topic of interest to them under the general themes. The General Studies teachers evaluated students on their written reports and presentation for each project. Students also did self and peer evaluations for each project (Appendix 3).

3.3.3 Surveys and interviews

The students were surveyed (Appendix 1) and parents were interviewed via telephone. Teaching staff and the principal were also interviewed in person and/or telephone.[2]

4.   Findings and analysis

This section will briefly discuss the effectiveness of the IBL approach taken for this study in helping students to improve various skills and abilities. It will focus on an examination of the development of primary 4 students' research skills. General Studies teachers' roles in guiding students through the inquiry process and the process of students' knowledge cultivation in IBL projects will be investigated. Finally, it will compare General Studies teachers' evaluation on students' IBL projects (and also students' self and peer evaluation) this year with that from last year.

4.1 Effectiveness of the three teacher[3] and librarian collaborative approach in inquiry-learning

All students[4] were surveyed on their thoughts about their IBL project. In addition, 27 parents[5] and 10 teaching staff[6] were interviewed with similar questions given to the students. A General Studies teacher said, "This project has pulled different subjects teachers together. We saw this project as a joint effort between teachers in helping students become self-learners." One of the students commented that, "The collaboration between the teachers and the librarian was very helpful, since they all worked together to help us learn how to look for relevant information, input Chinese, and use PowerPoint."

Table 1 shows how IBL projects are effective in offering students an enjoyable and challenging learning experience while enhancing their knowledge and skills through close collaboration of the teaching staff and parental support.

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[2] Both parents and teaching staff were interviewed using similar questions as those given to the students. Three General Studies teachers were further interviewed with questions in Appendix 2, focusing on the extent of various research skills students learned from the IBL projects.

[3] Three teachers: General Studies teacher, Chinese Language teacher and IT teacher.

[4] Students were surveyed shortly after phase 1.

[5] Parents were interviewed via telephone around the same time as the students' survey.

[6] Teacher staff (4 General Studies , 4 Chinese, 1 IT teachers and 1 librarian) were interviewed shortly after phase 2.

Table 1. Perceptions of teaching staff, parents and students on the inquiry-based project

Interview/Survey Questions	Teaching staff	Parents	Students
1. Enjoyment of doing the project[a]	3.9	4.0	3.8
2. Level of difficulty of the project[b]	3.0	3.5	3.3
3. Parental support[c]	n/a*	2.4	2.7
4. Information literacy[c]	*4.0*	*3.7*	*3.6*
5. Reading interest[c]	*3.7*	*3.1*	*3.5*
6. Reading ability[c]	*3.9*	*3.3*	*3.5*
7. Writing ability[c]	*3.7*	*3.2*	*3.5*
8. Computer literacy[c]	*3.8*	*3.4*	*3.3*
9. Knowledge of the research topic[c]	*4.2*	*3.6*	*3.9*
10. Communication skills[c]	*3.8*	*3.4*	*3.7*
11. Research skills[c]	*3.6*	*n/a**￼*	*3.5*
12. Overall support from school[c]	3.9	3.7	3.7

Notes:
[a] The respondents were answering according to a scale of 1-5, with 1 as 'not enjoying' and 5 as 'enjoying very much';
[b] The respondents were answering according to a scale of 1-5, with 1 as 'very difficult' and 5 as 'very easy';
[c] The respondents were answering according to a scale of 1-5, with 1 as 'the lowest' and 5 as 'the highest'.
* Teaching staff's views were not sought because parental support was not observable by the teaching staff.
** Parents' views were not sought since they were asked to take a rather passive role in this project so they may not know their children's development in this area.

Table 1 indicates that students had a high degree of enjoyment (3.9 out of 5, with 5 as "very much so" for teaching staff; 4.0 out of 5 for parents; and 3.8 out of 5 for students) in accomplishing the inquiry-based project. It also indicates that the difficulty level of the students' projects was appropriate – not too easy and not too difficult (3.0 out of 5, with 5 as "very easy" for teaching staff; 3.5 out of 5 for parents; 3.3 out of 5 for students). The italicized portion of Table 1 shows the level of perceived improvement in eight areas of student abilities. All scores were over 3, which shows there was a reasonably high level of improvement achieved in all eight areas, according to the parents, students and teaching staff.[7]

One General Studies teacher commented that "It was expected that students would use PowerPoint for their presentation, but the use of drama, videos or other means to do their presentation were beyond our expectations. They have learned to use drama or videos to convey their message showing their improvement in creativity and cooperation."

4.2 Students' improvement in research skills

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[7] A detailed discussion on how has this IBL approach led to an improvement of students' various skills and abilities is available at Chu, Tang, Chow, & Tse (2007).
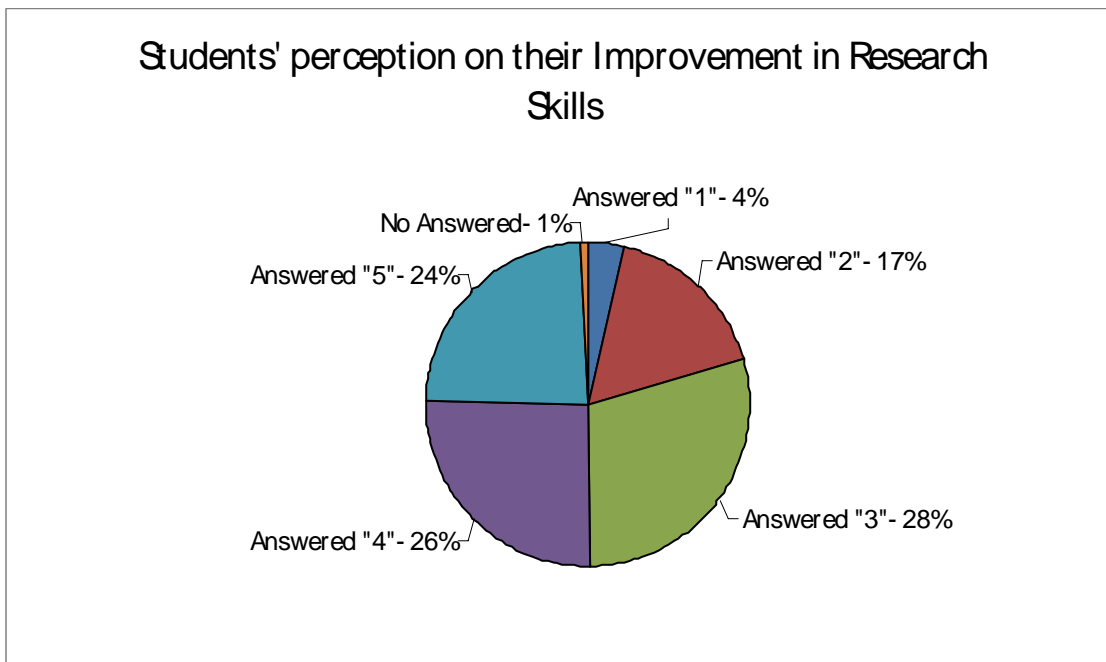
Students' improvement in research skills is closely related to their knowledge of research topic, which is the area of greatest improvement (Table 1), as perceived by students, parents, and teaching staff (3.6 out of 5 for parents; 3.9 out of 5 for students; and 4.2 out of 5 for teachers). Parent 18 said her child now "knows how to ask questions precisely, and to critique his own opinion".

This section will first compare students' and teaching staff's perceptions on students' improvement in research skills, and then discuss two factors influencing this improvement—parental and teaching staff support.

### 4.2.1 Students' and teaching staff's perceptions on students' improvement in research skills

According to Table 1, both students and teaching staff felt that the students' research skills were greatly improved (3.5 out of 5 for students and 3.6 out of 5 for teaching staff), although they exhibited a degree of difference (Chart 1a and Chart 1b). Out of 141 students, 78% responded with a 3 or above—implying they had improved in their research skills through the IBL project—whereas 91% of the teaching staff chose 3 or above. In other words, nearly all teaching staff felt that students had great improvement in the research skills. It is also interesting to note that about one-quarter (24%) of the students selected "5" to show that they have learned a lot in research skills, while none of the teachers were so exuberant.

Chart 1a. Distribution of students' perception of their improvement in research skills

Note: Scale 1-5, "1" is lowest, "5" is highest

Chart 1b. Distribution of teaching staff's perception of students' improvement in research skills
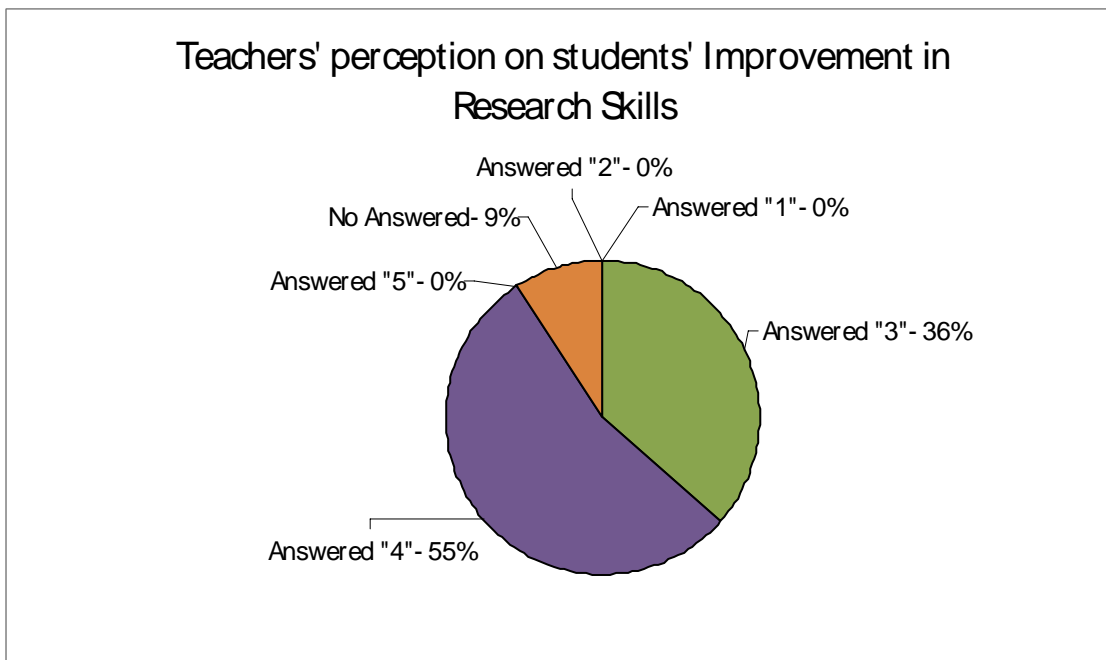
Note: Scale 1-5, "1" is lowest, "5" is highest

4.2.2 Influence of parental and teaching staff support on students' development of research skills

Figure 1 in the Introduction section shows how the collaboration of the teaching staff, with the appropriate support from parents, can help students' development in their research skills. This section provides more details on the support from the teaching staff and parents in facilitating students' learning in the IBL projects.

4.2.2.1 Parental support

IBL promotes students' self-directed learning. Therefore, parental support should be kept at a mimimum level whenever possible. Before the start of the IBL projects, parents were asked to offer help to their children only when absolutely necessary. Table 1 shows that both students and parents thought a low level of parental support was offered to students for the projects (2.7 out of 5 for students; and 2.41 out of 5 for parents). This suggests that the students have indeed learnt to work on their own, instead of relying heavily on parental assistance, which is the norm in the completion of homework for the majority of Hong Kong students.

4.2.2.2 Teaching staff support

This study promotes a collaborative approach of three kinds of subject teachers (General Studies, Chinese Language, and IT) and the school librarian in supporting students on their inquiry-based group projects. Table 1 has shown that the overall support from the school (mainly provided through the collaborative effort of the teachers and the librarian) was perceived to be high by students, parents, and teaching staff with scores of 3.7, 3.7, and 3.9 respectively.

Chart 2 provides details of the help students received from different kinds of teachers and the librarian for their projects. Both students and teaching staff felt that the support from all four teaching staff was very helpful in equipping students with the knowledge and skills needed in completing their group projects. There are small differences, however, between the perceptions of students and teaching staff. The students valued the help received from their Chinese teachers (in terms of the effectiveness of the in-class assignments and weekly research journals in improving their reading and writing abilities) slightly more than that received from others. The teaching staff though, thought the help students obtained from the school librarian to be the most valuable (in terms of equipping students with information literacy skills needed for the project) when compared to the help received in other areas.

Chart 2. Students' and teaching staff's perception on the helpfulness of various teaching staff in supporting the students' projects
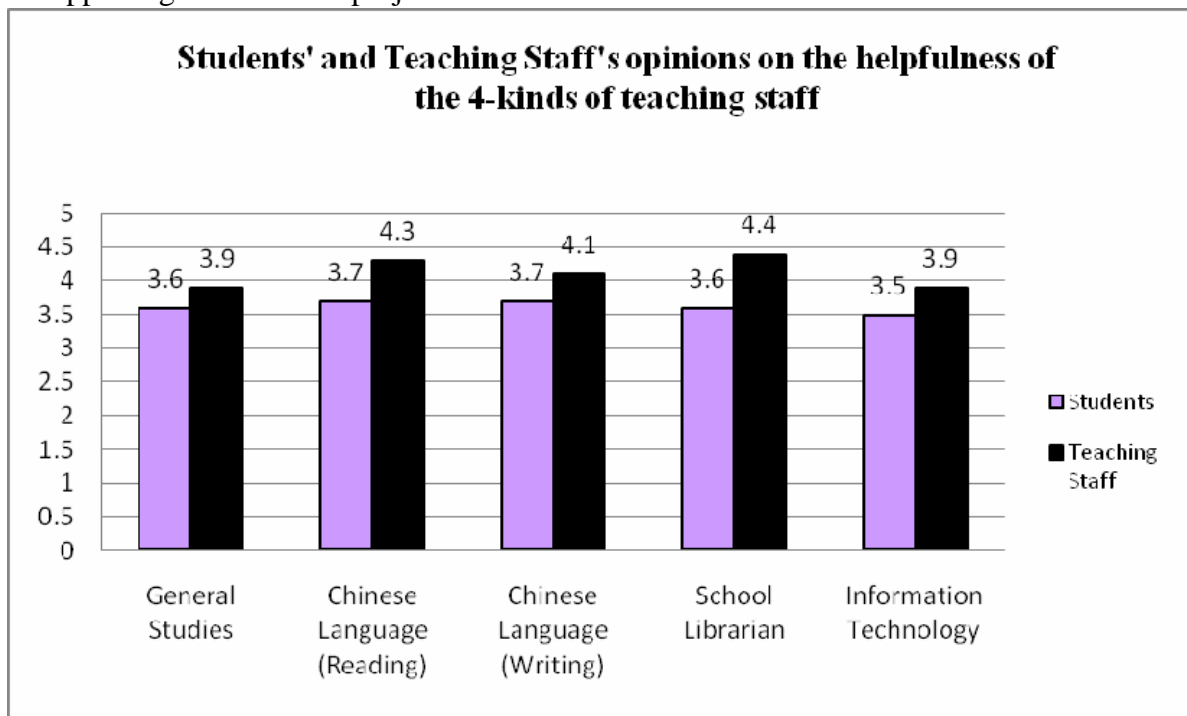
Note: Scales from 1 to 5; "1" is "not at all"; "5" is "very much so"

4.3 Role of the General Studies teachers

The General Studies teachers' primary role is to support students in the inquiry learning projects. In the words of the school principal, "The role of General Studies teachers in implementing the inquiry learning project is to serve as a guide to the students." This view is also reflected by the General Studies teachers, one of whom stated that General Studies teachers "were the facilitators in the lessons", while another said "the students play a leading role while the teacher assists them".

Table 2 shows the role of General Studies teachers in guiding students through the inquiry process.

Table 2. Role of the General Studies teachers

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1. Led the students through the inquiry-based projects each week in two lessons, totaling 1.5 hours:
   a. One class for teaching students research skills (e.g. brainstorming, formulating questions and organizing data).
   b. Another class for group discussion about the group portfolio and presentation design[8].
2. Assigned in-class exercises and homework to students to consolidate their research skills and knowledge.
3. Seek help from other teaching staff if necessary. For example, they seek help from Chinese teachers when students have the need to write introductions and summaries for their project.
4. Provided advice and guidance especially when students encountered problems that they cannot solve on their own during the project.
5. Regularly checked on students' progress in doing their project.

**4.4 Students' knowledge cultivation in the IBL projects**

At the end of each inquiry-based project, General Studies teachers found that students' knowledge on their research topic was greatly enhanced. The process the students went through to increase their knowledge is illustrated in Figure 2.

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[8] PowerPoint, video, skit, or other means in doing their presentation.

4.4.1 A model of students' knowledge cultivation process

Figure 2 shows that the skills and knowledge that are involved in IBL can be grouped into four stages: topic formation, data collection and evaluation, findings and analysis, and presentation and reporting. As mentioned by Kuhlthau (2004), collaboration is an important activity for students to work through their research work. This study found that it is essential for students to work collaboratively in all phases of their knowledge cultivation process.

Figure 2. The process of knowledge cultivation through the IBL project
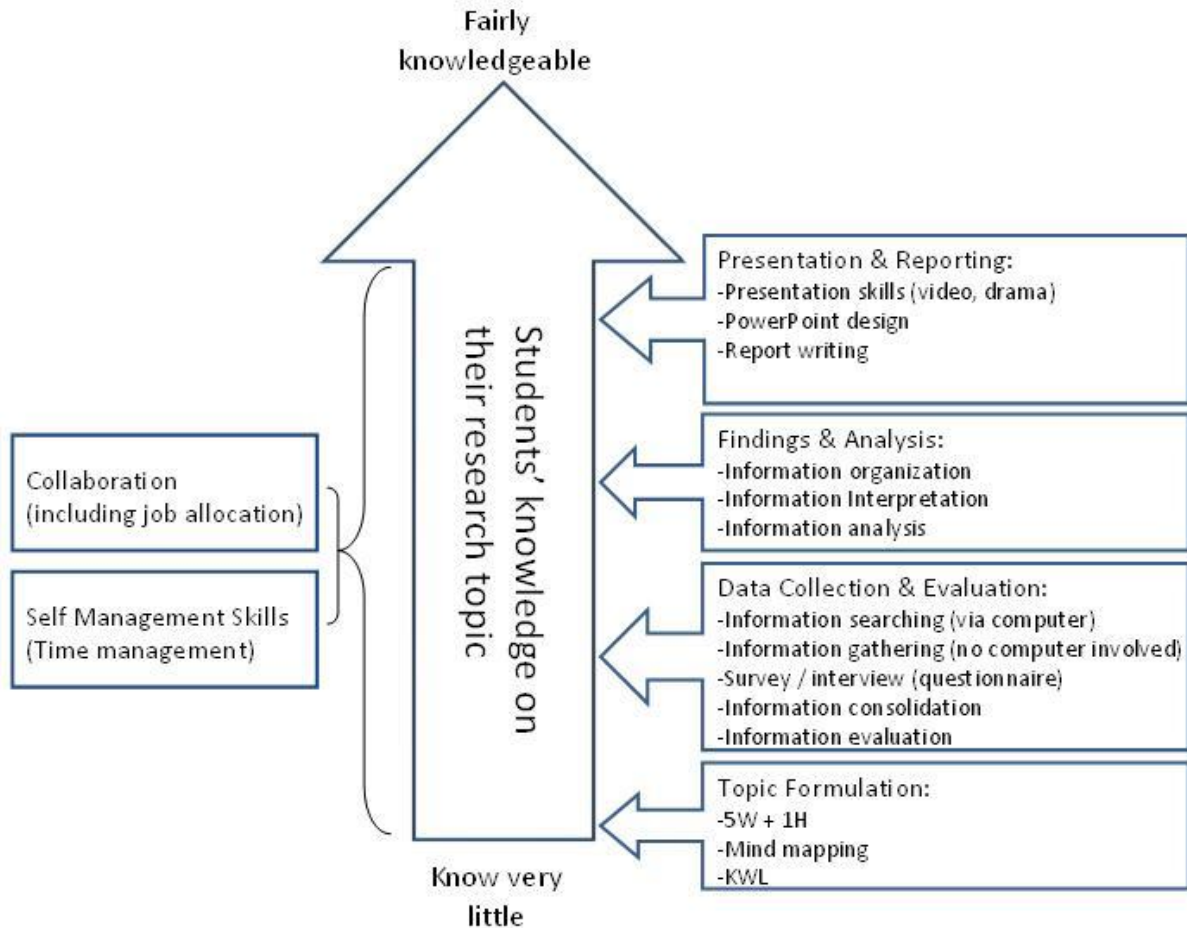
General Studies teachers were asked to rate students' research related knowledge or skills before and after the General Studies group projects (Appendix 2). Chart 3 describes the General Studies teachers' ratings in the questionnaire. It shows that students gained significant improvement in their knowledge and skills after the group projects in the view of these teachers.

Chart 3. General Studies teachers' evaluation on students' research skills before and after the IBL projects.

Comparison of students' knowledge or skills before and after the General Studies Group Projects
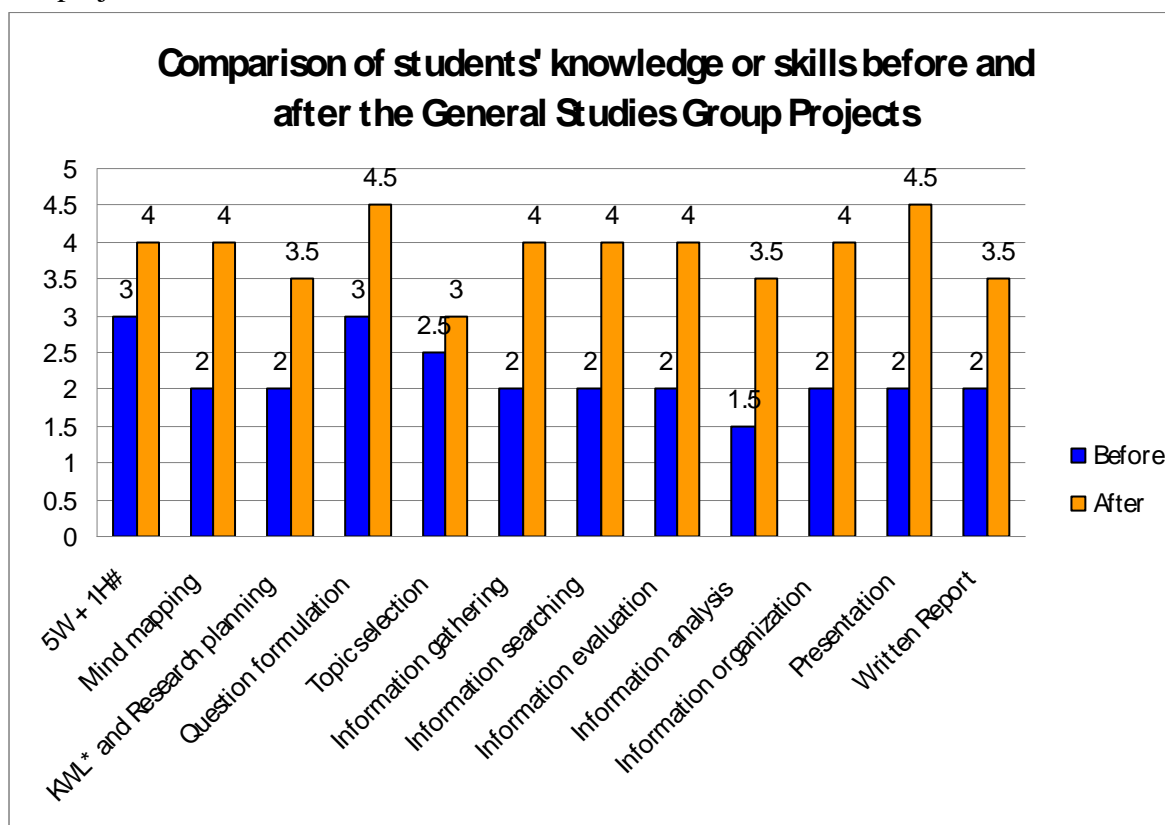
Note: Scale from 1 to 5; "1" is "very little"; "5" is "very much"

The presentation skills was rated the highest and was also the greatest improvement (2 out of 5 before the project; 4.5 out of 5 after the project). General Studies teachers described that students' had improvement in all the aspects, but they showed great interests in the presentation. These teachers were also very impressed by the students' creative presentation such as staging a drama.

Besides, General Studies teachers thought students had great improvement in the skills of collecting and analyzing information. Students on average got improvement of 2 points for each skill of information gathering, searching, evaluation, analysis, and organization. These teachers commented that students tried various techniques in finding information, e.g., designing questionnaire, searching relevant sources from the Internet and WisesNews, and

also finding information from newspapers and books. And they used various methods to process the information after the in-class exercises.

4.4.2 A 4-step process of students' knowledge cultivation

General Studies teachers equipped students with various basic skills and guided them to complete their research work for the projects. These teachers commented that students gained apparent improvement in research skills and in their knowledge of the selected topic after the group projects. Figure 2 shows how students' knowledge was built through the learning in the different stages of the projects. And the process of students' knowledge cultivation involves 4 major steps.

4.4.2.1 Step 1: Topic Formulation

During the stage of topic exploration and formulation in the first three lessons, General Studies teachers guided the students' thinking mainly by three methods - "5W+1H[9]", "mind map", and "KWL[10]". Students went through the process of brainstorming, discussions, and finally decided on a feasible topic. Compared with students last year, General Studies teachers gave 18.79% - 40.00% higher average points to "question formation" for students this year (Appendix 4). This shows that students had learnt to formulate their research topics in a systematic way.

4.4.2.2 Step 2: Data Collection and evaluation

After the formulation of the project topic, students started to collect related information. To facilitate students in collecting relevant information, the School Librarian helped the students by providing them access to relevant resources, and by equipping them with skills in searching, locating and using of various information sources. Students also completed two substantial information literacy assignments to reinforce the learning at their information literacy sessions.

In General Studies teachers' evaluation, students this year gained 21.38% - 44.52% of increase in their average points in related evaluation criteria (including information gathering and searching, and information evaluation) when compared with students last year (Appendix 4). It shows an improvement of students' abilities in data collection and evaluation.

General Studies teachers indicated that students learned to use more methods of data collection. They were able to, for example, search the Internet and WisesNew, conducted a survey, and obtained information from museums and libraries. They also acquired more

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[9] 5W+1H: Who? Why? What? Where? When? How?
[10] KWL: What I KNOW; What I WANT to know; What I LEARNED

advanced information search skills, such as using Boolean operators in their search. School Librarian commented that students were able to use different keywords for searching. Even though they encountered problems sometimes, they were, at least, willing to try searching.

4.4.2.3 Step 3: Findings and Analysis

Collected data have to be organized and analyzed to make it meaningful. Chinese teachers taught students some reading techniques to help them understand and evaluate the information collected. General Studies teachers awarded 60.00% and 28.00% higher average points in arithmetic ability and data analysis respectively to students this year, as compared with students last year (Appendix 4). It suggested improvement of students' knowledge in information organization and analysis through the IBL project.

4.4.2.4 Step 4: Presentation and Reporting

The last step was to write a report and do a presentation on the findings of the project. Information Technology teacher taught students computer literacy skills for presentation, and Chinese Language teachers guided students in writing reports. As compared with students last year, average points of students this year were increased by 34.62% and 26.06% in communication skills and IT literacy respectively (Appendix 4). It revealed students' improvement in the presentation skills and computer literacy.

General Studies teachers said that students enthused in the part of presentation. Many student groups designed their presentations in a non-traditional way and showed creativity in their presentations. Apart from PowerPoint slides, some students presented with video clips or even song singing. General Studies teachers were impressed that students were able to present their knowledge of the topic and related information. For example, General Studies Teacher H said that "There was a student who could tell his group mates the whole story regarding certain history events".

Most students were not able to use Chinese typing in their written reports because of their lack of time in learning Chinese inputting method, as reported by the Information Technology teacher. However, the quality of written reports was not affected by the low level of skill in Chinese inputting method. Students managed to present their ideas and enhanced them by using different colors and nice drawing.

4.5 General Studies teachers' evaluation on students' performance in IBL projects

General studies teachers evaluated on students' performance in IBL projects using criteria listed in Appendix 4. The scores of the primary 4 students this year (2007) were compared with primary 4 students last year (2006). The evaluation criteria used by the General Studies teachers can be consolidated into 8 areas and they are compared by the histogram in Chart 4.

Chart 4. General Studies teachers' evaluation on students' performance in IBL projects
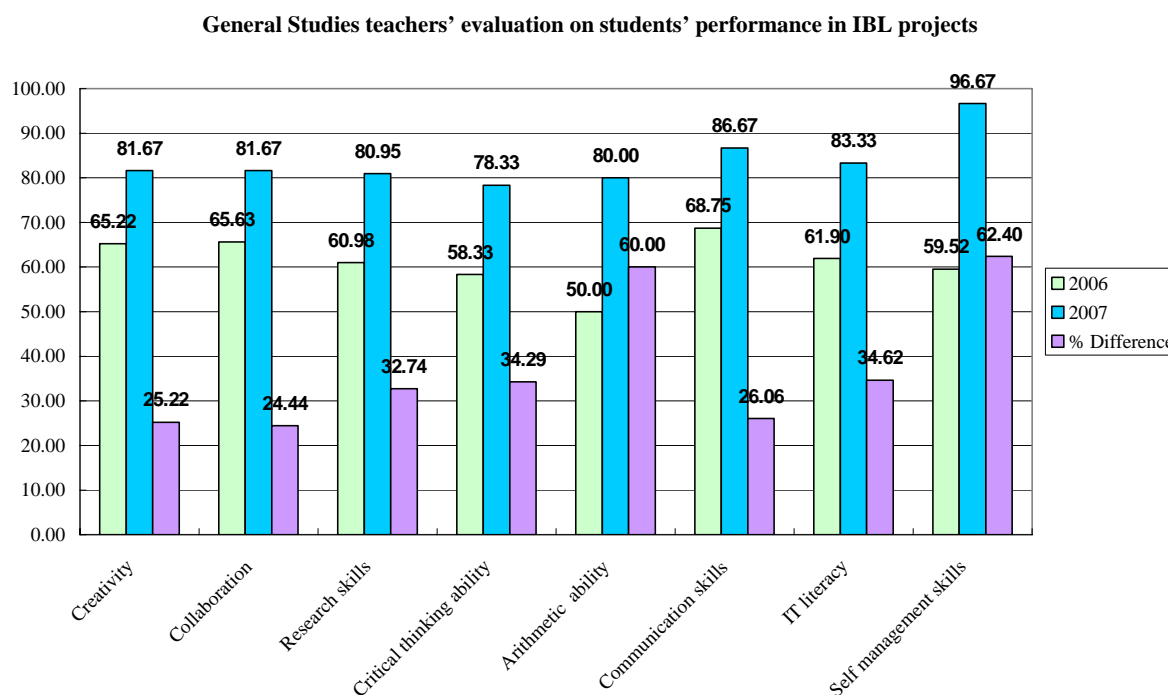
General Studies teachers' evaluation on students' performance in IBL projects

Chart 4[11] shows that students this year (2007) performed better than students last year for similar General Studies projects. Students this year on average scored higher in all evaluation criteria when compared to students last year. On average, students this year scored 37.47% higher average points across all criteria. Students' greatest improvement was in self management skills and it was followed by arithmetic ability.

Students also improved 32.72% in research skills (Chart 4). This shows that the collaborative approach of 3 kinds of teachers and the librarian in providing students support in inquiry learning projects is highly effectively in advancing students in all learning pointers set commonly for group project based learning.

Besides the support from the three teachers and the librarian, it is also important for parents not to intervene too early into their students' autonomous learning. Otherwise, the

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[11] All figures for both years were derived from the best project(s) in each of the four Primary 4 classes. For the year 2006, the sample size is 4; whereas for the year 2007, the sample size is five because one class has 2 best projects with identical grade.

projects would be parents' projects instead of students' projects. It is reasonable to assume that parents did not offer significantly more help than parents in the previous year. First, parents in general behave similarly from year to year. Besides, parents this year was asked to help their children as less as possible.

4.6 Students' self evaluation and peer evaluation regarding the IBL projects

Students evaluated their own performance and also their most admirable group mate with six criteria. Chart 5 and 6 compares the average self and peer evaluation scores of students in 2006 ($N_1 = 24$) and 2007 ($N_2 = 23$).

Chart 5. Students' peer evaluation on the IBL projects

Average peer evaluation scores using six criteria
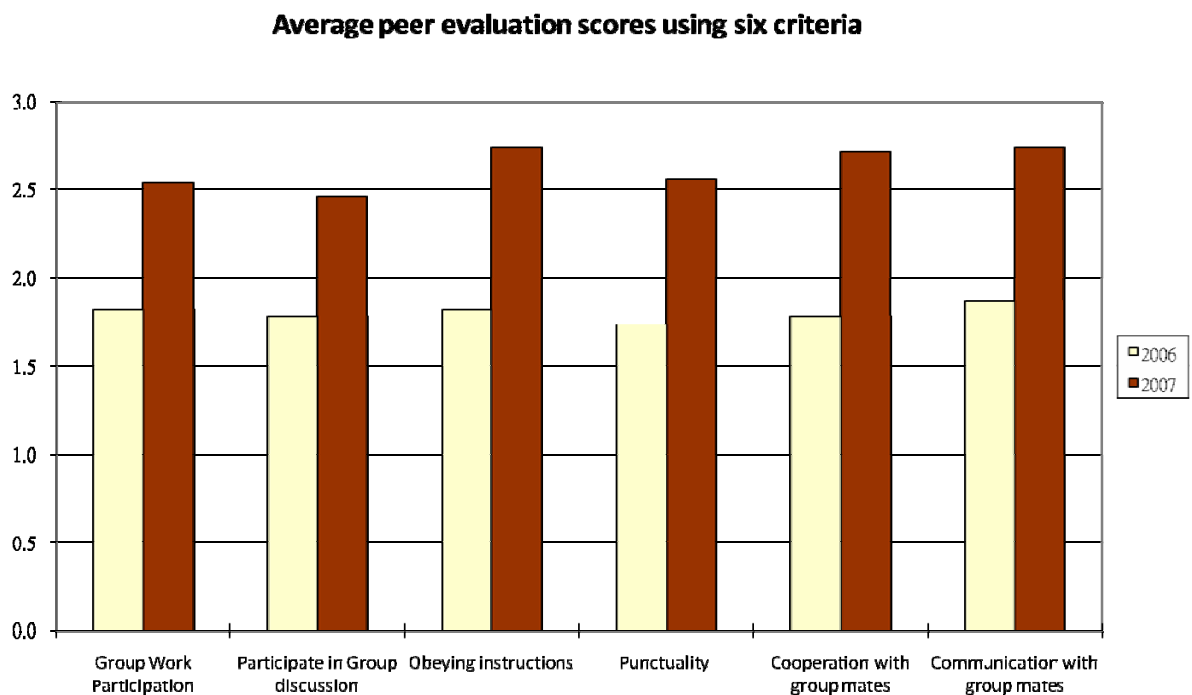
Note: Scale is from 1-3 points.

According to Chart 6, the evaluation scores of the most admirable students in 2007 increased by an average of 1.2 (45.59%) across the six criteria, as compared with students in 2006. This aligns with the earlier findings that students overall improved a lot in various skills that are related to doing a group project. The two most improved areas of the most admirable students were cooperation with group mates and obeying instructions.

Chart 6. Students' self evaluation on the IBL projects

Average self evaluation scores using six criteria
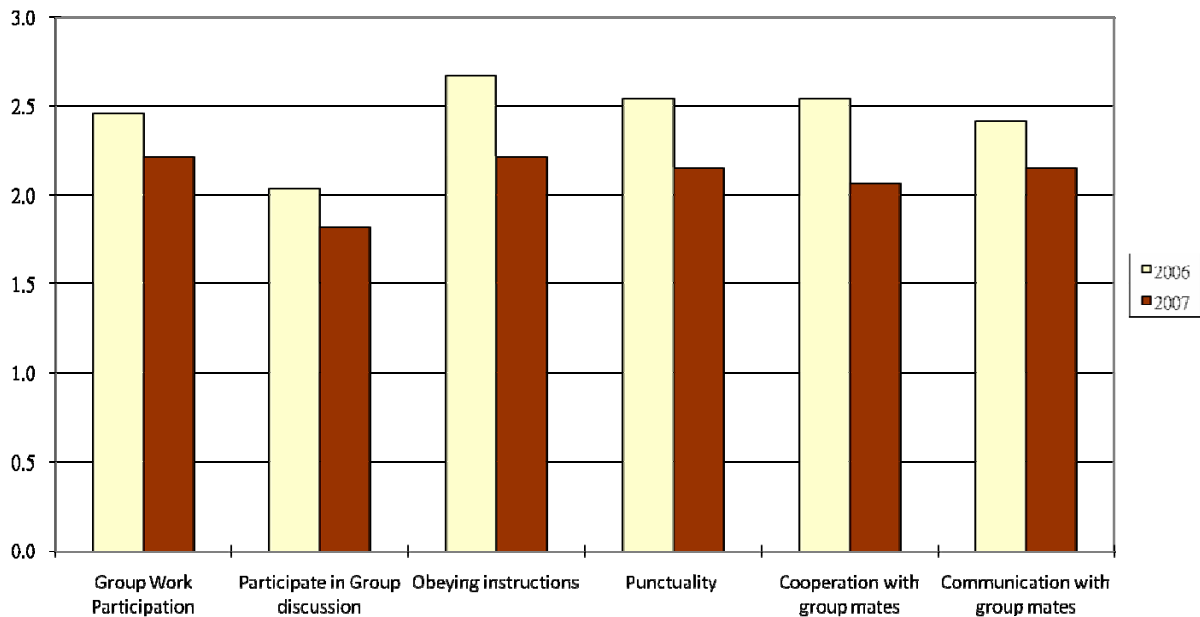
Chart 6 shows that the students in 2006 class ranked themselves higher than the students in 2007 class. The General Studies panel teacher said that it might due to an increased level of difficulties of the projects and a higher demand on the use of computers in 2007. However, since the sample size is not large enough so no conclusive explanation can be made.

Table 3 shows students' major suggestions for areas for improvement for their most admirable group members. As compared with 2006, it is worth noting that more students tried to write down their opinions on areas that other members could improve on (75% in 2007 and 67% in 2006), and that students gave more similar comments. For example, in 2007, punctuality (25%) and cooperation with group mates (17%) were mentioned, while information collection (17%) is the only comment that was more commonly mentioned in 2006. These are also the aspects mentioned most frequently (more than 50% of the students). The increase in the number of students giving written comments could be related to students' improvement in writing abilities after the IBL project. Besides, it is interesting to find that when students were asked to suggest additional reasons why he or she is the most admirable to oneself, students elected personality traits such as conscientious and more active.

Table 3. Students' major opinions on areas that their most admirable group member can improve on.

Aspects	No. of students' comments in 2006	No. of students' comments in 2007	Total no. of students' comments
Punctuality	1	6	7
Information collection	4	1	5
Cooperation with group mates	1	4	5
Active involvement in group work	1	2	3
Active participation in group discussion	2	1	3
Communication with group mates	1	1	2

Table 4 lists students' main comments on areas that they themselves can improve on. As compared with 2006, it is worth noting that more students tried to write down their opinions on areas they can improve on (85% in 2007 and 58% in 2006), which could be caused by students' increased writing abilities.

Table 4. Students' major opinions on areas that they themselves can improve on.

Aspects	No. of students' comments in 2006	No. of students' comments in 2007	Total no. of students' comments
Active participation in group discussion	4	3	7
Cooperation with group mates	1	4	5
Communication with group mates	1	3	4
Punctuality	1	2	3
Work Harder	1	1	2
Presentation (of report)	1	1	2
Information collection	1	1	2

Among all the opinions listed in Table 4, active participation in group discussion (21%), cooperation with group mates (15%) and communication with group members (13%) were more commonly mentioned, suggesting that more group-based activities could be arranged to familiarize students with group work, so as to increase their confidence and efficiency when working in groups. Besides, students in 2007 elaborated more on self-evaluation and reflection upon the completion of the research study. This includes how hard working they were, how they could use better approach in the research study (e.g. delegate tasks in a better way), and what they learnt from it (e.g. improved communication skills and interpersonal skills).

5.   Conclusion

The above study showed that the collaborative approach that involves three kinds of teachers and the school librarian in equipping students with knowledge and skills they need to conduct IBL projects works effectively. And students' various basic skills were greatly enhanced in the process. To foster students' development in research skills, our findings suggested that General Studies teachers should take on a supporting role as a facilitator, advisor, and a guide in the students' inquiry learning process. To promote students' autonomous learning through the projects, parents need to help their children as less as possible.

This article also created a model of students' knowledge cultivation process in which students' knowledge on their research topics was built up gradually through learning and practicing in four steps – topic formulation, data collection, findings and analysis, and presentation and reporting. And it is important for students to work collaboratively throughout the entire process.

The most striking finding in this study is that primary 4 students this year achieved a much higher quality in the General Studies projects when compared to students of last year – an increase of about 40% higher points were given by the General Studies teachers this year. Students' peer evaluation suggested the same with an increase of 46% higher points given for their most admirable students this year as compared to last year. This again reflects that the 4-teaching staff approach in guiding students through IBL projects is indeed an excellent way of supporting students with what they need for the projects.

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8. Appendices

Appendix 1: Inquiry based learning at Canossa: questionnaire for all P4 students[12]

Class: _____

Name: _____

Please answer the following questions based on your experiences from Phase I of the project.

1. What topic is your group working on for the inquiry learning project?

   _____

2. Do you enjoy working on the inquiry learning project?

Not at all				Very much so
1	2	3	4	5

3. How difficult did you find the inquiry learning project?

Very difficult				Very easy
1	2	3	4	5

4. How helpful do you find the assignments from General Studies in equipping you to do the inquiry based learning project?

Not at all				Very much so
1	2	3	4	5

5. Do you find the in-class assignments from Chinese Studies helpful in improving your ability in reading comprehension?

Not at all				Very much so
1	2	3	4	5

6. Do you find the in-class assignments and the weekly research journals from Chinese Studies helpful in improving your writing skills?

Not at all				Very much so
1	2	3	4	5

7. How helpful do you find the teaching/guidance from the school librarian in equipping you with the information literacy skills needed to find and evaluate relevant sources for your project?

Not at all				Very much so
1	2	3	4	5

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[12] Some parts of the questionnaire not related to this paper are omitted.

8. How helpful do you find the teaching/guidance from the IT teacher in equipping you with IT skills (keyboarding, the use of PowerPoint, etc.) you need for your project?

Not at all				Very much so
1	2	3	4	5

9. Do you find the overall support from school sufficient in equipping you with the knowledge and skills to tackle the project? (e.g., broad loan from public library and the joint class activities regarding this project)

Not at all				Very much so
1	2	3	4	5

10. How much help did your parents offer when you were working on your project?

None				A lot
1	2	3	4	5

11. Does the project help you improve in the following aspects?

Aspect	None				A lot
	1	2	3	4	5
Ability in finding information (e.g., can find relevant articles/books more easily)					
Interest in reading (e.g., read more books/articles)					
Reading ability (e.g., read faster, can identify the main points in articles more quickly)					
Writing ability (e.g., can write with a wider base of vocabulary)					
Computer related skills (e.g., PowerPoint, Chinese word processing)					
Knowledge about the research topic					
Communication skills with other students					
Presentation skills (Verbal)					
Research skills (e.g., ability to ask questions)					

Appendix 2: Inquiry based learning at Canossa: questionnaire for teachers (General Studies)

Class: _____

Name: _____

Please answer the following questions based on your experiences from both Phase I and II of the inquiry based learning project.

1. When compared to the way you teach General Studies before the inquiry based learning project, do you see any change in your role as the General Studies teacher in guiding your students through the projects?

   Yes / No

   If yes, how has your role been changed?

2. If "yes" for question 1, how essential do you see this change in your role on students' learning in the projects?

Not essential at all				Very essential
1	2	3	4	5

   Please explain?

3. Compared to the P4 students last year, did your students this year perform better in the General Studies group projects?

Not at all				Very much so
1	2	3	4	5

   Why?

4. Compared to the P4 students last year, did you assign higher grades for the General Studies group projects?

Not at all				Very much so
1	2	3	4	5

   Why?

The following questions are related to the **in-class exercises** that you assigned for your students to prepare them for the General Studies group projects.

5. What did the students do in the in-class exercises that were related to the General Studies group projects?

6. How well did your students perform in the in-class exercises for the group projects?

Very poorly				Very well
1	2	3	4	5

7. How helpful do you find the in-class exercises in equipping your students for the General Studies group projects?

Not helpful at all				Very helpful
1	2	3	4	5

The following questions are related to the **homework** that you assigned for your students to prepare them for the General Studies group projects.

8. What did the students do in the homework that was related to the General Studies group projects?

9. How well did your students perform in the homework for the group projects?

Very poorly				Very well
1	2	3	4	5

10. How helpful do you find the homework in equipping your students for the General Studies group projects?

Not helpful at all				Very helpful
1	2	3	4	5

The following questions are related to the **research skills development** through the General Studies group projects.

11. Did the General Studies group projects help your students improve their research skill development?

Not at all				Very much so
1	2	3	4	5

12. Please rate the students' research related knowledge/skill in the following aspects before and after the General Studies group projects.

Aspect	BEFORE the projects					AFTER the projects				
	Very Little				Very Much	Very Little				Very Much
	1	2	3	4	5	1	2	3	4	5
5W + 1H#										
Mind mapping										
KWL* and Research planning										
Question formulation (asking)										
Topic selection										
Info gathering (no computer is involved)										
Info searching (via computer)										
Information evaluation										
Information analysis										
Info organization										
Presentation										
Written Report										

5W + 1H: Who? Why? What? Where? When? How?
* KWL: What I KNOW; What I WANT to Know; What I LEARNED

Appendix 3: Students' self and peer evaluation on the inquiry learning group project

(A) Students' self evaluation

Topic: _____   Name: _____

Class: _____   Group: _____   Date: _____

Through the group project, I can:

1. Actively participate in the group work   ☺ ☺ ☺
2. Actively participate in group discussion   ☺ ☺ ☺
3. Obeying instructions to do the project   ☺ ☺ ☺
4. Complete the project on time   ☺ ☺ ☺
5. Cooperate with my group mates   ☺ ☺ ☺
6. Communicate well with my group mates   ☺ ☺ ☺

7. Others: _____

_____

8. Areas could be improved: _____

_____

_____

(B) Students' peer evaluation

Topic: _____   Name: _____

Class: _____   Group: _____   Date: _____

In Group _____, I most admire _____, because in this group project, s/he can:

1. Actively participate in the group work   ☺ ☺ ☺
2. Actively participate in group discussion   ☺ ☺ ☺
3. Obeying instructions to do the project   ☺ ☺ ☺
4. Complete the project on time   ☺ ☺ ☺
5. Cooperate with my group mates   ☺ ☺ ☺
6. Communicate well with my group mates   ☺ ☺ ☺

7. Others: _____

8. Areas could be improved: _____

_____

☺ Average   ☺ ☺ Satisfactory   ☺ ☺ ☺ Very satisfactory

Appendix 4: General Studies teachers' evaluation on students' performance in IBL projects

Teachers' evaluation criteria			Average Points* in year 2007	Average Percentage in year 2007	Average Points in year 2006	Average Percentage in year 2006	Average Points Difference between 2007 and 2006	Percentage difference
Creativity	Question formulation	Creativity	2.45	81.67%	2.06	68.67%	0.39	18.79%
		Research value	2.50	83.33%	2.06	68.67%	0.44	21.21%
		Feasibility	2.40	80.00%	1.71	57.00%	0.69	40.00%
Collaborative Skills	Research planning	Job allocation	2.30	76.67%	1.88	62.67%	0.43	22.67%
Research Skills	Information gathering and searching	Information source	2.60	86.67%	2.00	66.67%	0.60	30.00%
		Information quality	2.20	73.33%	1.81	60.33%	0.39	21.38%
	Questionnaire	Questionnaire design	2.25	75.00%	1.83	61.00%	0.42	22.73%
		Sampling (Target)	2.13	71.00%	1.58	52.67%	0.54	34.21%
Collaboration, Communication, and Problem solving Ability	Collaboration	Collaboration (Cooperation)	2.60	86.6%	2.06	68.67%	0.54	26.06%
Research Skills	Information organization	Information classification	2.80	93.33%	1.94	64.67%	0.86	44.52%
		Information consolidation	2.50	83.33%	1.75	58.33%	0.75	42.86%
Critical Thinking Skills	Information analysis	Information interpretation	2.40	80.00%	1.88	62.67%	0.53	28.00%
		Information evaluation	2.30	76.67%	1.63	54.33%	0.68	41.54%
Arithmetic Ability	Information analysis	Data analysis	2.40	80.00%	1.50	50.00%	0.90	60.00%
Communication Skills	Expression	Presentation skills	2.60	86.7%	2.06	68.67%	0.54	26.06%
IT Literacy	IT Literacy	IT Literacy	2.50	83.33%	1.86	62.00%	0.64	34.62%
Self Management Skills	Time Management	Adheres to Assignment Timeline	2.90	96.67%	1.79	59.67%	1.11	62.40%

*Based on a scale of 1-3, with 1 as the 'lowest' and 3 as the 'highest', General Studies teachers assigned a grade for each of the elements in the table above in regards of students' written reports for their group projects. The figures for both years were derived from the best project(s) in each of the four Primary 4 classes. For the year 2006, sample size is 4; whereas the sample size is five for the year 2007 because one class has two projects with the highest and an identical grade.