
Using collaborative teaching and inquiry project-based learning to help primary school students develop information literacy and information skills

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Abstract

Information literacy and information technology (IT) skills have become increasingly important in today's knowledge society. However, many studies have shown that students across different educational levels from primary to postgraduate level actually lack crucial information literacy and IT skills, thus the need for an effective pedagogical approach that will develop these skills. This study investigated the effect of combining a collaborative teaching approach with inquiry project-based learning (PjBL) on the development of primary students' information literacy and IT skills. Students in a Hong Kong primary school completed two inquiry-based group projects. A collaborative teaching approach involving three teachers in different subject areas (General Studies, Chinese, and IT) and the school librarian was adopted in guiding students through the two projects. Results indicated the positive impact of collaborative teaching and inquiry PjBL on the development of students' information literacy and IT skills.

Acknowledgement

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1. Introduction

In today’s knowledge society, information literacy and information technology (IT) skills are crucial for effective functioning in society (American Association of School Libraries [AASL], 2007). As such, educators are being called upon to integrate the teaching of information literacy and IT skills into the regular curriculum (Kuhlthau, 2004; Scott & Sullivan, 2005). Before, students were usually taught these skills using the traditional didactic approach; however, the emergence of new pedagogical approaches has also influenced how teachers and librarians are imparting these skills to the students.

Inquiry-based learning (IBL), also known as enquiry-based learning (EBL), is a pedagogical approach that uses questioning to involve students actively in their own learning (Harada & Yoshina, 2004a). Recent studies have indicated that IBL is more effective in promoting learning outcomes such as deep thinking, the ability to apply knowledge, and reasoning skills when compared to the traditional didactic approach (Dochy, Segers, Van den Bossche, & Gijbels, 2003; Harada & Yoshina, 2004b; Hickey, Kindfield, Horwitz, & Christie, 1999; Hmelo-Silver, Duncan, & Chin, 2007; Hu, Kuh, & Li, 2008; Kuhlthau, Maniotes, & Caspari, 2007). One way to implement IBL in schools is through student group projects (Chu, 2009; Hmelo-Silver et al., 2007). Project-based learning (PjBL) involves an in-depth exploration of issues, themes, or problems without predefined answers (Harada, Kirio, & Yamamoto, 2008). PjBL has been shown to provide students with opportunities to engage in realistic and thought-provoking problem-based learning (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palinscar, 1991; David, 2008; Marx, Blumenfeld, Krajcik & Soloway, 1997; Thomas, 2000). A considerable amount of research conducted in different domains and with different outcome measures generally show support for the greater effectiveness of both IBL and PjBL over the traditional didactic approach (Guthrie, Wigfield, Barbosa, Perencevich, Taboada, & Davis, 2004; Hickey, Wolfe, & Kindfield, 2000; Hickey, Kindfield, Horwitz, & Christie, 1999; Hmelo-Silver et al., 2007; Langer, 2001; Lynch, Kuipers, Pyke, & Szesze, 2005; Wu & Tsai, 2005). The integration of PjBL and IBL could lead to a promising learning approach (Chu, 2009; Krajcik et al., 1998), and is referred to as inquiry PjBL in this article.

Figure 1 presents the framework for this study that examines the effectiveness of an inquiry PjBL approach in guiding students through their group projects and promoting learning in various domains (Chu, 2009). This framework was adopted from Kuhlthau et al.’s (2007) recommendation that two subject teachers and a school librarian collaborate in the implementation of inquiry PjBL. For this particular study, the focus was on the development of information literacy and IT skills among students and on the collaboration between the IT teacher and the school librarian.¹²

¹ This study is part of a larger project that involved a collaborative teaching approach, bringing together a team of three teachers with different specialties and the school librarian to equip students with knowledge and skills to support group project implementation in a Hong Kong primary school. Studies by the same team have used this framework, and it has been shown to foster improvement in
2. Problem statement
Despite the emphasis on the emerging importance of information literacy and IT skills (American Library Association, 2007), considerable research has shown that students across different educational levels from primary to postgraduate levels are generally lacking in competence in these areas. (Branch, 2003; Chu & Law, 2005; 2007; Lazonder, 2000; Pelgrum, 1999; Schacter, Chung, & Dorr, 1998). While research has shown the benefits of information literacy and IT skills for student learning (e.g. Chan-Lin, 2008), limited studies have been conducted on the pedagogical approaches that can be used effectively to promote their development (see Mokhtar, Majid, & Foo, 2008; Moore, 2001 for exceptions). Most of the studies that have investigated information literacy and IT skills in the context of PjBL have focused on how students use these skills as tools for doing their projects and not on examining these skills as learning outcomes. There appears to be a need therefore to develop an innovative instruction approach and examine how it may promote the learning of these skills among students.

Evidence supports the effectiveness of pedagogical approaches like inquiry PjBL and collaborative teaching in enhancing learning outcomes (e.g. Hmelo-Silver et al., 2007; Murata, 2002). However, few studies have examined the use of these strategies for students to gain competencies in information literacy and IT skills. Considering recent recommendations of collaborative teaching with the participation of the school
librarian to support the implementation of inquiry projects (Kuhlthau et al., 2007), this study combined collaborative teaching and inquiry PjBL, and examined its effects on primary students’ information literacy and IT skills. The findings of this study may serve as evidence to support a viable teaching strategy to cultivate these skills that students need in today’s society.

3. Literature review

3.1. Inquiry project-based learning

Hong Kong’s Education Bureau (2002) defined inquiry learning 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 their learning. Instead of having the teacher give the right answers, the students have to raise questions, find their own answers, and look for necessary information. They are engaged in identifying problems, collecting information, and solving the problems they encounter. A specific example of how inquiry-based learning can be applied in the classroom setting is through the use of group projects (Krajcik et al., 1998). Projects can capture students’ interests, provoke serious thinking, and enable students to apply their knowledge in a problem-solving context (David, 2008). Harada, Kirio, and Yamamoto (2008) claimed that PjBL involves in-depth exploration of issues, themes, or problems without predefined answers. It facilitates the development of ownership by giving students the chance to select topics that are personally relevant and by giving them a sense of responsibility to take charge of their own learning (Alloway et al., 1996).

A considerable amount of research conducted in different domains and with different outcome measures generally show support for the effectiveness of inquiry learning and PjBL over the traditional didactic approach (Guthrie et al., 2004; Hickey, Wolfe, & Kindfield, 2000; Hickey, Kindfield; Horwitz, & Christie, 1999; Hmelo-Silver et al. 2007; Langer, 2001; Lynch, Kuipers, Pyke, & Szesze, 2005; Wu & Tsai, 2005). In a comprehensive review of research on PjBL, Thomas (2000) found support for the argument that this approach is more effective in enhancing student learning when compared to traditional instruction. He further claimed that it is effective for teaching problem-solving and decision-making skills. Examples of studies include a project by Boaler (2002), which compared the mathematics skills of students in two secondary British schools. One of the schools used project based learning, while the other used traditional instruction. After three years, students in the project-based learning school outperformed the students from the traditional instruction school in terms of mathematics skills, as well as in conceptual and applied knowledge. In addition, more students from the project based learning school passed the national exam. In another study conducted by the Cognition and Technology Group at Vanderbilt University (1992), a software program called The Adventures of Jasper Woodbury was developed. This was a series of video-based adventure simulations that enabled inquiry PjBL. This software provides a structure for students to work collaboratively on simulated real-world problems that require the application of mathematical reasoning. Students who used this software scored higher in solving word problems and in planning skills than those who did not.
3.2. Collaborative teaching

Previous studies have shown the importance of collaborative teaching practices in improving instruction and student learning (Frana, 1998; John-Steiner, 1992; Murata, 2002; Oldfather & Thomas, 1998; Schwab Learning, 2003; Thousand, Villa, & Nevin, 2006). For example, Thousand et al. (2006) argued that when teachers collaborate on their planning and teaching, they are better able to meet the needs of students with diverse backgrounds. A recent development in collaborative teaching is the acknowledgment of the librarian’s role in the modern school setting (Kuhlthau et al., 2007). Teacher-librarian collaboration has been the focus of a considerable number of studies, as school librarianship has gained more active involvement in student learning (Warmkessel & McCade, 1997; Konzal, 2001; Mokhtar & Majid, 2006; Chu, Chow, Tse & Kuhlthau, 2008; Montiel-Overall, 2008). Despite the literature supporting teacher-librarian collaboration, the role of school librarians as an education partner seems to have gained little acceptance from teachers worldwide (Doskatsch, 2003; McCarthy, 2002). This is especially true in the Asian setting (Mokhtar & Majid, 2006). Mokhtar and Majid (2006) examined the collaborative relationship between teachers and school librarians in Singapore primary and secondary schools. The level of collaboration was found to be very low, and teachers had yet to regard the school librarian as an education partner. Teachers with more teaching experience were also observed to be more likely to engage in collaboration with librarians. Furthermore, primary school teachers tended to collaborate with librarians more because they organized more academic activities than secondary school teachers. Full-time qualified librarians were also the key to promoting collaboration with teachers, as they had adequate time and the necessary knowledge to be valuable assets in education.

The inclusion of librarians in collaborative teaching has the potential to improve student learning (Donham, Bishop, Kuhlthau, & Oberg, 2001; Kuhlthau et al., 2007). School library programs, which are centers of inquiry-based learning, can enhance student achievement (Alberta Learning, 2004). Borgman, Hirsh and Walter (1995, pp. 663-664) began their study on children’s information seeking behavior with the idea that a “library-centered school curriculum would be an appropriate model for true discovery learning.” Harada and Yoshina (2004) and Kuhlthau (1994, 1997, 2003) studied how school librarians and teachers worked together in guiding students’ inquiry learning, while Kafai and Bates (1997) discussed the important role of school library staff in information literacy instruction for both teachers and students. In line with this, Kuhlthau et al. (2007) recommended having a flexible three-member core team consisting of two subject teachers and a librarian for the implementation of inquiry projects. She claimed that this arrangement would be effective in harnessing the domain knowledge of the subject teachers and also the information literacy skills of the librarian, thus promoting a more authentic inquiry experience for the students.

3.3. Information literacy, IT skills, and inquiry project-based learning

“Information Literacy encompasses knowledge of one's information concerns and needs, and the ability to identify, locate, evaluate, organize and effectively create, use
and communicate information to address issues or problems at hand” (US National Commission on Library and Information Science, 2003). An important component of information literacy is IT skills, which involve the ability to use different tools in a computer system (AASL, 2007). Previous studies have shown that information literacy and IT skills are important components of inquiry PjBL (Chan Lin, 2008; Jonassen & Reeves, 1996; Owens, Hester, & Teale, 2002). Inquiry PjBL requires students to carry out an in-depth exploration of particular issues, themes, or problems (Harada et al., 2008). In this regard, information literacy is crucial since it helps learners become “critical users of information and creative producers of knowledge” (Bowler et al., 2001, p. 205). Owens et al. (2002) likewise emphasized the importance of IT skills in inquiry PjBL, in that they allow students to organize and edit their projects easily. At a higher level, IT skills empower students to communicate with experts in different places, access information from a vast array of resources, and create multimedia presentations with high quality (Owens et al., 2002).

Numerous studies have recognized the importance of technology to student learning (Cognition and Technology Group at Vanderbilt, 1992; Lee & Kim, 2005; Owens, Hester, & Teale, 2002), but there is also evidence indicating that students may not have the necessary information literacy and IT skills to utilize the technology effectively (Julien & Barker, 2009; Salovaara, 2005; van Aalst, Fung). For example, Bowler et al. (2001) provided a review of research in this area and found that a lot of students lacked basic IT skills. Borgman et al. (1995) found that elementary school children did not possess the necessary keyboard, spelling, or vocabulary knowledge to effectively search library catalogs. In addition, Bilal (2001) found that when grade school students were required to use Yahoo! to find certain information, they had difficulty in completing the task. Even teachers found it difficult to incorporate technology use in the classroom (Wallace, Kupperman, Krajcik, & Solloway, 2000). Thus, it appears that technical illiteracy hampers effective student learning (Bowler et al., 2001).

4. Research questions
Based on the literature gap identified above, this study sets to examine the following research questions:
1. To what extent does collaborative teaching with inquiry PjBL help students develop their information literacy and IT skills?
2. How important did the students perceive the information literacy and IT skills they learned in completing their inquiry PjBL?
3. To what extent does the improvement in information literacy and IT skills vary across student academic ability and gender?
4. What are the different roles played by the school librarian and the IT teacher in terms of the support they provided to equip students with the relevant information literacy and IT skills?

5. Procedures
This study applied a mixed methods research design, employing both quantitative and qualitative methods to answer the research questions. The use of both methods in combination is expected to generate a better understanding of the research problem (Creswell, 2008).

5.1. Instructional Design
In the years preceding this intervention, General Studies (GS) projects had been implemented under the direction of the GS teacher only. In response to the observations concerning students’ IT and information literacy needs mentioned in the introduction, the first author of this article and the school principal provided guidance and leadership in bringing the teachers and the school librarian in this study to work together to guide the P4 students on projects that involved information research from printed and Internet sources. The instructional design was based on the models and guidelines created by Harada and Yoshina (2004a, 2004b) and Kuhlthau (1997, 2003, 1994), and was conducted over a period of 6 months.

The study consisted of two phases. Phase 1 lasted for 10 weeks, while Phase 2 lasted for 9 weeks. Students worked in groups of 5-6 and were free to choose any topic based on the theme for each phase. The number of members for each group was determined by the teachers to equally distribute students in the class. The main theme for Phase 1 was “The Earth”, while the theme for Phase 2 was “The History of Hong Kong or China.” Students worked in the same groups for both phases. At the culmination of each phase, each group prepared a written report and presented it in front of the class. In order to enhance the students’ skills in searching for different kinds of information, the school librarian arranged 6 library lessons, each lasting 50 minutes. The first three sessions were given during the beginning stages of Phase 1, while the last three sessions were given during the beginning stages of Phase 2. The goal was to make the students familiar with the Internet and with online searching. The IT teacher, on the other hand, was responsible for equipping students with relevant IT skills such as using PowerPoint. During the IT classes, students also learned the use of the Chinese handwriting device, Chinese inputting methods, and other relevant IT skills for information search. The IT teacher conducted 10 sessions to teach these different skills, which were spread out across the two phases. Students also received support from the Chinese Language and General Studies teachers in the course of their projects. The medium of instruction during the whole study was Chinese.

5.2. Participants
This study involved three groups of participants: (a) students, (b) their parents, and (c) the teaching staff. One primary school in Hong Kong served as the site for this project. All four classes of Primary 4\(^2\) (P4) students in the selected school participated in the study.\(^3\) The school did not group its students according to their academic standing, and

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\(^2\) In the HKSAR education system, Primary 4 corresponds to Grade 4 in the US system.

\(^3\) P4 students were chosen through convenience sampling. In addition, Hong Kong students begin to have group work during their P4, thus we wanted to see how inquiry PjBL can facilitate the development of information literacy and IT skills and vice-versa.
thus each class was made up of students with varied academic abilities. The mean number of students per class was 36. Class A had 37 students (20 males, 17 females), class B had 35 students (20 males, 15 females), class C had 36 students (19 males, 17 females), and class D had 35 students (17 males, 18 females). This constituted a total of 143 participating students (76 males, 67 females). Aside from the students, the teaching staff were also interviewed. Although 11 teaching staff were involved in the project (4 General Studies teachers, 4 Chinese teachers, 1 school librarian, 1 IT teacher, and 1 curriculum development officer), in this paper we will only focus on the IT teacher and the school librarian. In addition, we included 27 parents (10 in Section A, 7 in Section B, 4 in Section C, and 6 in Section D) who consented to be interviewed. Telephone interviews were conducted with the parents.

5.3. Data collection
Different data collection methods were employed in the study. Self-report questionnaires were administered to all the students who participated in the study. Focused group discussions with selected groups of students were also conducted, together with telephone interviews with parents and face-to-face interviews with both the school librarian and the IT teacher.

The self-report questionnaires were administered by the teachers to the P4 students after their inquiry PBL. Students were asked to assess their level of information literacy and IT skills before and after the intervention. The questionnaire was divided into 2 main parts. The first part aimed to assess students’ (1) perceived level of familiarity with various information literacy skills before and after the intervention, and (2) perceived level of familiarity with different IT skills before and after the intervention. The second part of the questionnaire asked students about their perceived importance of the components of information literacy and IT skills in completing the projects. For the first part of the questionnaire, two dimensions of information literacy skills were examined. The first dimension was concerned with the perceived level of familiarity with the use of various information sources/services like the school library, school library’s OPAC (online public access catalogue), public library, public library’s OPAC, Wisenews, links via school’s website, Yahoo!, Google, and other sources. The second dimension of information literacy was perceived level of familiarity with various types of information search knowledge/skills, which included the use of Boolean operators, Dewey classification system, reference books, newspapers, and keyword search. IT skills, on the other hand, were assessed using items that focused on student’s perceived level of familiarity with various software packages like PowerPoint, Excel, and two Chinese writing software (Canjie input method and Jiu Fang input method). This part of the questionnaire was anchored on a 5-point scale where “1” referred to “not familiar” and “5” referred to “very familiar.” The second part of the questionnaire asked students how important they perceived the various information literacy and IT skills were for the completion of their inquiry projects. This part of the questionnaire was anchored on a 5-point scale where 1 referred to “not important” and 5 referred to “very important.” (See Appendix B for the questionnaire given to the students after the inquiry PjBL). This questionnaire was based on previous research investigating the development of information literacy and
IT skills among postgraduate students, and was later modified to make it more appropriate for primary school students (see Chu & Law, 2005; 2007).

To examine the roles of the school librarian and the IT teacher, face-to-face interviews were carried out concerning the support they had offered to students in order to equip them with the relevant information literacy and IT skills. Telephone interviews with 27 parents who had given their consent to participate in the study, and focused group discussions with students were also conducted to determine their perceptions of the inquiry PjBL. The parents who were interviewed turned out to be well-distributed across the 4 classes of students.

5.4. Data analyses
The data from questionnaires comparing the self-perceived level of familiarity with various information literacy and IT skills before and after the intervention were analyzed using dependent samples t-tests. Linear regression was used to analyze the effects of gender and year level on change in information literacy and IT skills. SPSS 16.0 was used for all the statistical analyses. The semi-structured interviews with the parents and students were summarized through sequential analysis. Axial coding was done by using NVivo 7.0, where themes were identified and clustered.

6. Results
6.1. Development of information literacy and IT skills
To investigate how students developed in terms of their information literacy and IT skills (research question 1), the researchers looked at the (a) teachers’, parents’, and students’ overall perceptions of improvement in information literacy and IT skills, (b) students’ perceived level of familiarity with the various information sources before and after the inquiry PjBL, (c) students’ perceived information search knowledge and skills before and after the inquiry PjBL, and (d) students’ perceived IT skills and knowledge before and after the inquiry PjBL.

6.1.1. Teacher, parent, and student perceptions of improvement in information literacy and IT skills
Teachers, parents, and students assessed the students’ information literacy and IT skills in relation to the implementation of PjBL. The survey showed that the three groups perceived that the collaborative teaching and inquiry PjBL approach helped students improve their information literacy and IT skills, with scores above the midpoint of three (See Figure 2). Interviews with teachers and parents supported these quantitative findings. For example, the IT teacher said, “Most students managed to accomplish the standards of PowerPoint skills that I set for them. They were able to insert pictures, add hyperlinks and edit words in PowerPoint.” One parent also viewed the improvement in information literacy and IT skills as helping her child become “exposed to more reading materials when searching for information—no longer limited to textbooks.”
Figure 2. Teachers’, parents’ & students’ perception of student improvement in information literacy and IT skills via collaborative teaching and inquiry PjBL

6.1.2. Students’ perceived familiarity with various information sources before and after the inquiry PjBL

Dependent t-tests were used to compare the ratings of the students’ familiarity with various information sources and services before and after the inquiry PjBL. Results showed that students reported greater familiarity with the information sources and services after the inquiry PjBL compared to their familiarity with these sources before the project (p < .001) (See Table 1).

Table 1
Mean values and significance levels for the dependent t-tests on students’ familiarity with various information sources before and after the intervention

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean before intervention</th>
<th>Mean after the intervention</th>
<th>t statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of the school library</td>
<td>3.94 (SD = 1.07)</td>
<td>4.49 (SD = 0.77)</td>
<td>-8.370</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>School library’s online catalog</td>
<td>2.82 (SD = 1.24)</td>
<td>3.71 (SD = 1.13)</td>
<td>-10.99</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>The use of public libraries</td>
<td>4.15 (SD = 1.12)</td>
<td>4.55 (SD = 0.78)</td>
<td>-6.51</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Public libraries’ online catalog</td>
<td>3.26 (SD = 1.38)</td>
<td>4.01 (SD = 1.02)</td>
<td>-8.42</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>WiseNews</td>
<td>1.76 (SD = 1.16)</td>
<td>4.01 (SD = 1.02)</td>
<td>-20.48</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Google</td>
<td>2.97 (SD = 1.31)</td>
<td>4.05 (SD = 1.05)</td>
<td>-10.99</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Yahoo</td>
<td>4.46 (SD = 0.89)</td>
<td>4.79 (SD = 0.52)</td>
<td>-5.85</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>School/library suggested websites</td>
<td>3.23 (SD =1.48)</td>
<td>3.78 (SD = 1.36)</td>
<td>-7.21</td>
<td>P &lt; .001</td>
</tr>
</tbody>
</table>

Note: The three parties were answering the question “Does the inquiry PjBL help students improve in their information literacy and IT skills?” The scale was 1-5, with 1 as ‘low improvement’ and 5 as ‘high improvement.’
Note. N = 143

Of the different information sources and services (use of the school library, use of school library’s online catalog, etc.), students were most unfamiliar with using Wisenews and the school’s OPAC (See Figure 3). Students were more familiar with using the school library facilities, public library facilities, and Yahoo!. Students’ familiarity with Yahoo! was greater than that of Google (4.5 compared to 3.2), which might be explained by Yahoo!’s more child-friendly services such as “Yahoo! Kids” (http://kids.yahoo.com/) that Google does not offer. Since students did not have free access to the WiseNews database in school in the past, and because it is not a freely accessible database available on the Web, students’ familiarity with WiseNews was substantially lower than all of the other information sources and services prior to the inquiry PjBL. However, the biggest improvement was also seen in this domain. This big improvement in familiarity with WiseNews was supported by our interview data. Some students became so comfortable with using it that one of them “used it for leisure reading and for doing homework in the Scouting Movement.” Another student used it for reading topics of interest to himself, which were not really required in school. Figure 3 summarizes the students’ responses about their perceived familiarity with the various information sources and services before and after the inquiry PjBL.

Figure 3. Students’ familiarity with information sources & services before and after the projects.

6.1.3. Students’ perceived information search knowledge and skills before and after inquiry PjBL

Figure 4 shows how the students perceived their level of information search...
knowledge and skills both before and after the inquiry PjBL project. Students perceived an overall improvement in the different information search knowledge and skills components. Before the inquiry PjBL, students perceived themselves as particularly weak in using the Dewey classification system and the three Boolean operators. After the inquiry PjBL, the greatest gains were reported to be in the use of the Boolean operators (‘and’, ‘or’, ‘not’). Table 2 presents the results of the dependent sample t-tests, which show that students perceived themselves more knowledgeable in the various information search knowledge and skills after the inquiry PjBL (p < .001).

![Figure 4. Students’ perceived information searching knowledge and skills.](image)

**Table 2**

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean before intervention</th>
<th>Mean after the intervention</th>
<th>t statistic</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dewey classification system</td>
<td>2.53 (SD=1.23)</td>
<td>3.64 (SD=1.14)</td>
<td>-11.54</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Reference books</td>
<td>3.13 (SD=1.18)</td>
<td>4.04 (SD=0.88)</td>
<td>-12.17</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Newspapers</td>
<td>3.57 (SD=1.15)</td>
<td>4.41 (SD=0.83)</td>
<td>-8.98</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Keywords</td>
<td>3.32 (SD=1.40)</td>
<td>4.30 (SD=0.88)</td>
<td>-10.00</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Boolean operator “and”</td>
<td>2.62 (SD=1.43)</td>
<td>4.25 (SD=0.87)</td>
<td>-13.96</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Boolean operator “or”</td>
<td>2.65 (SD=1.42)</td>
<td>4.20 (SD=0.92)</td>
<td>-13.50</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Boolean operator “not”</td>
<td>2.61 (SD=1.44)</td>
<td>4.18 (SD=0.96)</td>
<td>-13.76</td>
<td>P &lt; .001</td>
</tr>
</tbody>
</table>

Note. N = 143

6.1.4. Students’ perceived IT knowledge/skills before and after inquiry PjBL

Figure 5 shows students’ IT knowledge/skills before and after the inquiry PjBL. Students regarded their IT skills in using Chinese inputting methods like Jiu Fang and
Simplified Cangjie as weak before the project. In Jiu Fang, only the numeric keypads are used to input Chinese characters into the computer, while in Simplified Cangjie, Chinese characters are inputted using the qwerty keyboard. After the project, students perceived an improvement in all aspects of their IT skills and knowledge. Students perceived that they had gained the most in ‘making PowerPoint presentations’ (improvement of 1.28 points), ‘using Jiu Fang method’ (improvement of 1.22) and ‘making Excel spreadsheet’ (improvement of 1.16). Students perceived that they had gained the least improvements with ‘Writing Pad’, which was probably due to their high familiarity with it even before the intervention. Table 3 shows the dependent samples t-tests, which indicate that there was a statistically significant improvement in the students’ perceived familiarity with the different IT knowledge/skills after the inquiry PjBL (p < .001).

Figure 5. Pre and post inquiry project familiarity with IT knowledge/skills.

Table 3
Dependent t tests on students’ familiarity with various IT knowledge and skills before and after the intervention

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean before intervention</th>
<th>Mean after the intervention</th>
<th>t statistic</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jiu Fang input method</td>
<td>2.46 (SD=1.42)</td>
<td>3.68 (SD=1.26)</td>
<td>-12.70</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Cangjie input method</td>
<td>2.63 (SD=1.40)</td>
<td>3.51 (SD=1.31)</td>
<td>-10.35</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Writing pad</td>
<td>4.58 (SD=0.81)</td>
<td>4.81 (SD=0.62)</td>
<td>-4.50</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Powerpoint</td>
<td>3.27 (SD=1.39)</td>
<td>4.44 (SD=0.87)</td>
<td>-11.05</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td>Excel</td>
<td>3.01 (SD=1.41)</td>
<td>4.28 (SD=0.96)</td>
<td>-11.99</td>
<td>P &lt; .001</td>
</tr>
</tbody>
</table>

Note. N = 143.

6.2. The importance of information literacy and IT skills for completing the projects
Students were surveyed on (a) their perceived importance of various information literacy and IT skills for completing the projects.
sources/services for completing their projects, (b) their perceived importance of information search knowledge/skills for completing their projects, and (c) their perceived importance of IT knowledge and skills to the completion of inquiry-based learning projects.

6.2.1. Students’ perceived importance of various information sources/services for completing the projects

Students answered a survey on their perceived importance of various information sources or services for the completion of their projects, and their ratings are summarized in Figure 6. Almost all the information sources were perceived by students as generally important as evidenced by the above 3.5 ratings given to all the information sources above. The most important source of information was Yahoo! followed by the use of the public library and the school library. Although searching on the web was the most convenient means of obtaining information, the more traditional forms of information seeking such as using the school library and using the public library still appeared to be important.

![Students' perceived importance of various information resource/services](image)

**Figure 6.** Students’ perceived importance of information resources and services

6.2.2. Students’ perceived importance of information search-related knowledge/skills

Students were also asked how important they thought the different types of information search knowledge or skills were in completing their projects, and their answers are summarized in Figure 7. Students perceived ‘keyword search’ to be the most important, followed by the use of the three Boolean operators. These findings are consistent with previous research indicating that knowing how to use the right keywords and being able to use Boolean operators properly are crucial to obtaining more accurate information (Bezanilla, 1992; Chu & Law, 2007; Lancaster et al., 1994; Tillotson, 1995). It also suggests that students considered information searches...
through electronic resources such as search engines and databases more important than searches in printed resources such as newspapers and reference books. This is not surprising since recent research has shown that children, nowadays, use computers at an early age (Calvert, Rideout, Woolard, Barr, & Strouse, 2005).

![Figure 7. Students’ perceived importance of information searching related knowledge/skills](image)

**6.2.3. Students’ perceived importance of IT knowledge and skills for completing the projects**

IT skills were important for students in searching for information related to their projects, as well as for preparing for their final project reports and presentations (Chu, 2009). For example, Chinese input programs were important as they enabled students to use databases and search engines. IT skills such as using PowerPoint and Excel enabled students to create effective presentations for their projects. Students generally thought IT skills were important to them as evidenced by ratings that were all above the midpoint of the scale. The most important areas perceived were the use of Microsoft Office—PowerPoint and Excel (See Figure 8).

Although students improved more in the Jiu Fang inputting method than in Simplified Cangjie (See Figure 5), they tended to see Simplified Cangjie as more important than Jiu Fang (4.1 vs. 3.9 /5). This may be due to the fact that Simplified Cangjie is offered as a free bundle in Microsoft Windows, while Jiu Fang is only available at school. Before the inquiry PjBL, some students might have had some experience with Simplified Cangjie at home, whereas they started to learn Jiu Fang only during their projects. With its availability at home, Simplified Cangjie may well be perceived by the users as more important. This finding shows that as far as teaching IT skills is concerned, there might be some disparity between what tools are perceived by
students as important and what tools teachers actually teach at school. Nevertheless, the students generally considered the IT knowledge and skills they learned during the inquiry PjBL to be important for the completion of their projects. Scores ranged from 3.9-4.5 on a 5-point scale.

Figure 8. Students’ perceived importance of IT knowledge/skills

6.3. Effectiveness of inquiry PjBL across different academic abilities and gender
To determine whether academic ability and gender influenced the perceived improvement in information literacy and IT skills (research question 3), gender and grades of the students were entered into a regression model as predictors. Academic ability was determined by obtaining the students’ general averages from the school. The criterion variable - perceived improvement in information literacy and IT skills - was obtained by adding the standardized improvement scores (Z scores based on mean and standard deviation) for the information literacy and IT skills questions in the survey. This index is referred to as overall improvement in information literacy and IT skills. Results showed that gender did not significantly predict overall improvement in information literacy and IT skills, whereas grades significantly predicted such improvement. Students with higher academic abilities seem to have made improvements in information literacy and IT skills significantly more than those students with lower academic abilities (See Table 4 for the regression results).
Table 4
Regression result for gender and grade as predictors of improvement in information literacy

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-5.961</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.184</td>
<td>.406</td>
<td>.040</td>
</tr>
<tr>
<td>Grade</td>
<td>.068</td>
<td>.023</td>
<td>.254</td>
</tr>
</tbody>
</table>

Note: $R^2 = .091$

6.4. Roles of the school librarian and IT teacher
In order to understand the collaborative process more deeply, the librarian and the IT teacher were interviewed about the roles they played in this project. Although the major initiative in organizing the inquiry PjBL was undertaken by the first author, all the 11 teaching staff were also involved in designing the content and the process of the intervention. In this article, the roles of the school librarian and IT teacher are the subject of interest because the focus was on the improvement of information literacy and IT skills of the students. Their roles were defined in terms of the support and guidance they offered to the students and how they collaborated with each other and with the other subject teachers. Their responses are summarized in Table 5. During the information literacy and library sessions, students were equipped with the basic skills for using various electronic sources. According to the school librarian, the provision of relevant materials to students, as well as training in using the materials effectively increased student motivation and interest in conducting their own inquiry PjBL. The librarian also tried to cultivate a positive attitude towards the use of the Internet among the students and cautioned against indecent Web materials and Internet addiction or overuse.

The IT teacher, on the other hand, set up the WiseNews database and taught students various IT skills like using PowerPoint, Excel, and Chinese input methods. He contributed to the development of their self-directed learning. He commented that students had become better at creating PowerPoint slides for effective presentation by the end of their projects.

The librarian and IT teacher coordinated with the other teachers. For example, the librarian said, “I would find out from the Chinese Studies teachers what topics they needed me to cover, and I would organize a class that involved students…so that they could master the relevant skills…this also complemented the General Studies (GS) teachers’ teaching. Basically, the classes that I conducted were based on the needs of GS, IT and Chinese Studies teachers.” The librarian directly worked with the GS teachers. She said, “I helped GS teachers in terms of borrowing some books for their students. Apart from that, I also helped them to search for some relevant websites, did some newspaper-cutting on the topics that they were doing for their reference, and I also searched some relevant information for the students and created some reference folders for them.” The IT teacher, on the other hand, commented that to facilitate collaboration, he gave special attention to “the division of labor” among the different teachers.
This showed that the librarian and the IT teacher had different roles to play in the inquiry PjBL. They did not function independently, but worked as a team, collaborating with the other subject teachers during the inquiry PjBL.

Table 5

<table>
<thead>
<tr>
<th>Librarian</th>
<th>IT Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘As an information provider’; provided relevant books (a block loan of 200 books from public libraries), information folders (containing newspaper clips) and related webpage links</td>
<td>Set up user accounts for students to access the WiseNews database, which contains news sources from Hong Kong, mainland China, Taiwan, and other parts of the world.</td>
</tr>
<tr>
<td>Held information literacy classes to provide training for students in the use of various printed sources (e.g., reference books), information searching skills (e.g., Boolean operations), the school and public library catalogs, and the WiseNews database</td>
<td>Taught various IT related skills, including Microsoft PowerPoint and Excel, and Chinese input methods (e.g., Simplified Cangjie)</td>
</tr>
<tr>
<td>Assessed students’ effectiveness in using various information sources and development of information searching skills.</td>
<td></td>
</tr>
</tbody>
</table>

7. Discussion

This research investigated how a combination of inquiry PjBL and collaborative teaching can serve as an effective means of improving primary school students’ information literacy and IT skills. Results showed that the intervention led to a perceived general improvement in the information literacy and IT skills of the students as they did their projects in the GS course. Students’ perceived level of familiarity after the intervention compared to that before the intervention was significantly higher for all the dimensions of information literacy and IT skills that were examined in the study. The present findings contribute evidence to the growing literature supporting the effectiveness of inquiry PjBL (Blumenfeld et al., 1991; Derry et al., 2006; Harada & Yoshina, 2004a, 2004b, Hmelo-Silver et al. 2007; Krajcik et al., 1998; Schmidt, Loyens, van Gog, & Paas, 2007) and collaborative teaching approaches (Harada & Yoshina, 2004; John-Steiner et al., 1998; Rockman, 2003) in promoting positive student outcomes. An additional contribution is that this study also highlights the effectiveness of combining these two approaches, i.e., inquiry PjBL and collaborative teaching. Few studies have previously investigated how they can be combined to promote optimal outcomes for students, with most studies focusing exclusively on inquiry learning (e.g. Sproken-Smith et al., 2010) or collaborative teaching (e.g. Thousand, Villa, & Nevin, 2006) (See Harada & Yoshina, 2004 and Kuhlthau et al., 2007 for an exception). In addition, this study shows the potential of inquiry PjBL in promoting information literacy and IT skills, thus building on previous studies that have shown its positive impact in other domains like natural science (e.g. Harland, 2002; Krajcik et al., 1998), social science (e.g. Derry et al., 2006; Sproken-Smith et al., 2008), business (e.g. Capon & Kuhn, 2004), medicine (e.g. Hughes, Ventura, & Dando, 2004), and mathematics (e.g. Cognition and
Technology Group at Vanderbilt, 1992).

Inquiry PjBL was shown to be an effective means of promoting information literacy and IT skills. This builds on the findings of previous research showing that information literacy and IT skills cannot be learned through one-time training such as tutorials or workshops (Mokhtar et al., 2008). Information literacy and IT skills need to be reinforced over a longer period of time with proper scaffolding and guidance from the teacher. Asselin (2005) noted that teachers perceived lack of time to teach information literacy and IT skills as a barrier. Inquiry PjBL which is conducted over a relatively longer time period may be a better alternative to the short-term workshops and tutorials that have been commonly used to teach information literacy and IT skills. There is an increasing need for these competencies in today’s information society, but students of different educational levels have been found to lack them (Branch, 2001; Chu & Law, 2008; Lorenzen, 2001), thus highlighting the need for an effective teaching approach.

The results showing that students considered the information literacy and IT skills they learned as important for completing their inquiry-based projects are in line with the findings of previous studies showing the importance of technology in completing school work (Bowler et al., 2001). The importance of information literacy and IT skills goes beyond the academic domain. Experts have claimed that these competencies have become “a prerequisite for participation in society and the workforce” (U.S. 21st Century Workforce Commission, 2000).

In this study, academic ability influenced the perceived improvement in information literacy and IT skills. In inquiry PjBL, students are expected to take charge of their own learning by posing their own questions and by trying to develop an in-depth understanding of a particular topic. Our findings imply that inquiry PjBL may require a higher degree of motivation and self-regulation from students for it to be effective. Research has shown that motivation is closely linked to engagement with schoolwork (Ames & Archer, 1988; Fredericks, Blumenfeld, & Paris, 2008). Inquiry-based learning places a heavier burden on individual students’ motivation and on their capacity to take charge of their own learning (Owston, 1997; Santiago & Okey, 1992). Students with higher grades are presumed to have a higher motivation and a higher level of self-regulation (Pintrich, 2003). Thus, it may be possible that students with higher grades in this study made greater improvements in information literacy and IT skills than those with lower grades due to their higher motivational and self-regulation level. This is consistent with research done in educational psychology claiming that self-regulation promotes learning (Schunk & Ertmer, 2000). It appears that educators may need to pay more careful attention to the participation of students with lower academic abilities in inquiry PjBL programs. Investigations of group learning have shown that it is most effective when students of different academic abilities work together and when peer interaction emphasizes cooperation rather than competition (Epsten, 1989; Schunk, 2009). Such situations may benefit students of lower academic ability. The present study did not take into account the distribution of students with different academic abilities among the groups. The dynamics of the
group learning process might have influenced the learning outcomes, but such a proposition requires further research.

Interviews showed that the IT teacher and the librarian played different roles in helping the students complete their inquiry PjBL. The collaboration between the school librarian and the IT teacher allowed the students to benefit from the expertise of each teacher. This finding supports the claims of previous research on the benefits of collaborative teaching (Thousand et al., 2006) in general, and teacher-librarian collaborations in particular (Kuhlthau et al., 2007; Mokhtar et al., 2008). Collaborative teaching has been seen as an important part of inquiry-based learning since it involves taking advantage of the expertise of the teaching staff (Kuhlthau et al., 2007). This allows each teacher to offer his or her unique expertise to meet the specific needs of the students. Teacher-librarian collaborations enable students to access the domain knowledge of the subject teachers and the information literacy skills of the librarian. The present study highlighted the crucial role of the librarian in implementing the inquiry PjBL. In the traditional school setting, librarians are not really visible in the school context, and their roles in teaching students are often overlooked and undervalued (Hartzell, 2002). This problem is more severe in the Asian context where there is still a lack of effective programs that tap the expertise of school librarians in teaching information literacy and IT skills (Mokhtar & Majid, 2006). The present study showed the importance of involving both the librarian and the IT teacher in inquiry PjBL to facilitate the promotion of student learning outcomes.

In sum, this study indicates the overall effectiveness of combining inquiry PjBL with collaborative teaching in promoting information literacy and IT skills among primary school students. In addition, aside from learning these skills, students also found these skills crucial in improving their project work. This study also highlights the important roles that librarians and IT teachers play in student learning.

8. Limitations & areas for further research

The study relied mostly on subjective perceptions since self-report questionnaires were used to assess the effects of inquiry PjBL and collaborative teaching. Future research could include more objective measures of information literacy and IT skills before and after the intervention. It would also be useful to have a comparison with students learning information literacy and IT skills through a traditional approach to contextualize the current research. In addition, future cross-cultural studies could be conducted to assess the effectiveness of the approach undertaken in this study among students from different countries.

9. Conclusion

The findings of this study contribute to the body of research showing evidence for the benefits associated with inquiry PjBL (see Hmelo-Silver et al., 2007 for a review) and collaborative teaching (e.g. see Kuhlthau, Maniotes, & Caspari, 2007). In particular, this research showed that the combination of collaborative teaching and inquiry PjBL contributes to the development of information literacy and IT skills. Few studies have
explicitly investigated the integration of these two approaches, and the results of this study may aid teachers and librarians to collaborate in improving these skills of their students.

Information literacy has been shown to be of relevance not only to a select few, and it has become a “survival skill in the information age” (American Library Association, Presidential Committee on Information Literacy, 1989). Given their crucial role of information literacy and IT skills in modern society, educators must find ways of leading students towards gaining competency in these skills. The approach undertaken in this study has been shown to be a promising strategy for educators to aid students, as young as primary school level, towards becoming skilled in IT and information literate.
References


literacy and the web. Education for Information, 19, 201-223.


Information Science Research, 31, 12-17.


Livingstone, D., & Lynch, K. (2000). Group project work and student-centered active


APPENDIX A

Telephone Interview Survey for the Parents

1. How much do you think your child enjoyed the inquiry project?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Very much so</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Can you please elaborate/say more about this?

_____________________________________________________________________

2. From your perspective, how difficult did your child find the inquiry learning project?

<table>
<thead>
<tr>
<th>Very difficult</th>
<th>Very easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Can you please elaborate/say more about this?

_____________________________________________________________________

If your child did encounter difficulties, how did he/she manage to overcome them?

_____________________________________________________________________

3. How much help did you offer your child when he/she was doing the project?

<table>
<thead>
<tr>
<th>None</th>
<th>A lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

If any, what kind of help did you offer?

_____________________________________________________________________

4. Does the project help your child improve in the following aspects?

<table>
<thead>
<tr>
<th>Aspect</th>
<th>None</th>
<th></th>
<th></th>
<th></th>
<th>A lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability in finding information (e.g. can find relevant articles/books more easily)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Interest in reading (e.g., read more books/articles)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading ability (e.g. read faster, can identify the main points of articles more quickly)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Writing ability (e.g. can write with a wider base of vocabularies)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer related skills (e.g.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N:\Sam-publications\published articles\journals\final draft\Chu 2010 Using Collaborative Teaching and Inquiry PBL help Primary Students Develop Info Literacy.docx  3/7/2011
Improvement in other aspect(s) as a result of working on the project:

5. Do you find the overall support from school sufficient in equipping your child with the knowledge and skills to tackle the project? (e.g. the talk on inquiry-based learning for parents, broad loan from public library)

<table>
<thead>
<tr>
<th>Not at all</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Very much so</th>
</tr>
</thead>
</table>

Can you please elaborate/say more about this?

6. Do you think that it is advisable for the school to keep organizing inquiry-based learning project/activity(s) for the students in the future?
APPENDIX B

Survey for all P4 students on Information Literacy and IT Skills

Class:

Name:

**Purpose:** To assess students’ development in information and IT literacy in terms of: (1) what information literacy/IT skills and knowledge they have become familiar with; and (2) what information literacy/IT skills and knowledge they find important/useful for their inquiry-based learning projects. The findings from the survey may help teachers in class planning in future. This questionnaire takes 15 minutes to complete.

**Please answer the following questions based on your experiences from Phase I & II of the inquiry-based learning projects.**

1. How familiar were you with the following information literacy/IT skills and knowledge before the inquiry-based learning projects (before December 2006)?
2. How familiar were you with the following information literacy/IT skills and knowledge after the inquiry-based learning projects (end of June 2007)?
3. How important/useful were those information literacy/IT skills and knowledge to your inquiry-based learning projects (end of June 2007)?
<table>
<thead>
<tr>
<th></th>
<th>Before the inquiry-based learning projects</th>
<th>After the inquiry-based learning projects</th>
<th>Perceived level of importance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of familiarity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = Not familiar</td>
<td></td>
<td></td>
<td>1 = Not familiar</td>
</tr>
<tr>
<td>5 = Very familiar</td>
<td></td>
<td></td>
<td>5 = Very familiar</td>
</tr>
<tr>
<td><strong>A. Sources/databases:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The use of the school library</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>School Library’s online catalog</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>The use of the public libraries</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Public Libraries’ online catalog</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>WiseNews</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Google</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Yahoo</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>School/Library suggested websites</td>
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<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Others, please specify</td>
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<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>B. Search skills &amp; knowledge:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dewey classifications</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
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<tr>
<td>Reference books</td>
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<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Newspapers</td>
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<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
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<tr>
<td>Keyword search</td>
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<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Boolean operator “And”</td>
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<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Boolean operator “Or”</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Boolean operator “Not”</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Others, please specify</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td><strong>C. IT skills and knowledge:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juefeng input method</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Canjie input method</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Writing pad</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>PowerPoint</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Excel</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Others, please specify</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>