Title	Developing upper primary students' 21st century skills: Inquiry learning through collaborative teaching and Web 2.0 technology
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Comments

"Dr. Chu and his colleagues provide an excellent examination of important advances in Hong Kong's educational environment, and reflect on significant improvements made in teaching and learning that are applicable to other populations globally. The book is a useful primer on constructivist teaching and learning detailing a two-year intervention in schools, complete with time-tables and lessons for use by integral players on the educational team who become collaborative educational partners. The authors expand the notion of collaboration to include subject and language teachers, information technology specialists, and librarians. This excellent book is a practical resource for library and information science professionals and educators on methods to improve student motivation and academic performance. Empirical evidence based on the authors' studies provide compelling reasons to redesign educational practices to include more inquiry-based and project-based learning, greater use of Web2.0 technologies, and expanded collaborative instruction ensuring that 21st century educational goals are met."

Dr. Patricia Montiel-Overall
Associate Professor
School of Information Resources and Library Science
University of Arizona (U.S.A.)

"Samuel Kai Wah Chu's interests in Web 2.0 tools and their impact on knowledge-based economies are apparent in this book. The ingredients that make this book relevant and timely: presentation of how to immerse the digital native generation in collaborative learning so they can experience it with joy and excitement; ideas of digital literacies (information, media and technology) & learning skills which are basic to Dr. Chu's notion of making students "active constructors of knowledge"; and Web 2.0 tools as facilitators of the interactive constructivist approach to 21st century learning. The universal applicability of this reference to educators cannot be underestimated."

Taghreed Alqudsi-ghabra, Associate Professor
Department of Library & Information Science
Kuwait University

"There are side-effects when educators train students in a didactic approach: the students recognize pressure, exhibit signs of stress and become reluctant to study. Sam Chu and his colleagues from the University of Hong Kong demonstrate that there are new ways of instruction actually enjoyed by students. The authors work successfully with inquiry project-based learning using Web 2.0 services (especially Wikis) as teaching tools to develop students' digital literacies - ICT skills, information literacy and media literacy. Although this book is mainly concerned with teaching digital skills in Hong Kong's primary schools, it is an important contribution to pedagogy and information science all over the world."

Prof. Dr. Wolfgang G. Stock
Head of the Dept. of Information Science
Heinrich-Heine-University Düsseldorf
(Germany)

"Professor Sam Chu and his colleagues have built a strong case for establishing an education policy that promotes new and effective approaches to better prepare children for the 21st century. The authors have demonstrated that a combination of project-based and inquiry-based approaches to learning among upper primary schools in Hong Kong is much appreciated and enjoyed by the students. In particular, implementing the new learning approach with the support of wikis has been shown to be effective in developing students' 21st century skills as the technology promotes online collaboration, learning while doing and leveraging of group knowledge."

Dr. Serafin D. Talisayon, Professor
Technology Management Center
University of the Philippines

"The book describes how the 21st century skills can be improved among primary students using a technology enhanced project-based learning approach, supported by a

collaborative teaching team. The success of the suggested approach is based on its comprehensive and carefully-planned delivery method considering the effectiveness of different pedagogical theories, the Chinese socio-cultural environment and the needs of both teachers and learners. As the approach is effective in equipping even primary students with the 21st century, the model has the potential to be applied to all citizens of 21st century."

Michele Notari, Lecturer,
PHBern
University of Teacher Education
Institute for Lower Secondary Education
(Switzerland)

"This book illustrates cutting-edge research on online pedagogy and the ways to bridge the digital literacy gap. The authors also explored the local case of Hong Kong to elaborate the significance of online pedagogy and student involvement in the whole learning process. It would be beneficial for all educators as a reference."

Wu Shianghau, Assistant Professor
Faculty of Management and Administration
Macau University of Science and Technology

"Current teaching practices are sometimes putting too much burden on students, making learning become a stressful and obnoxious activity. This book gives an excellent overview of alternative practices for teaching and learning. This is a book for educators and parents who are willing to equip the younger generations with skills to cope with the challenges of the 21st century in a playful and enjoyable way."

Franz Barachini, Associate Professor
Vienna University of Technology (Austria)

"Though the circumstances may be different between Hong Kong and Japan, the concept of collaborative teaching which the authors suggest seems to appeal to Japanese readers of educational institutions. As for me, a university librarian specializing in information literacy education, this guide advises that librarians have to fit their role into class activities and make best efforts to communicate with faculty members to maximize their existence values."

Kenshi Hyodo, Librarian
Kyushu University (Japan)

"The education reform of Hong Kong has repeatedly emphasized developing students' life-long independent learning capabilities (The Curriculum Development Council, HKSAR, China. 2001). The teaching community has been struggling to find effective ways to translate the reform into visions and practices. The project and its background described in this book provide evidence-based practical examples of how teaching staff and librarians could function as a team. It illustrates that, "only when teachers understand that information literacy must begin with them, is an information literate school community possible" (Henri, Hay and Oberg, 2002)."

Angel Leung Yuet Ha, President
Hong Kong Teacher-Librarians' Association

"It has been argued that technology-enhanced learning could respond to the needs of the new knowledge society and transform learning. However, despite isolated achievements, the education system remains remarkably unchanged. In this context Dr. Chu's book is of great value. The importance of equipping students with contemporary skills through inquiry PjBL, implemented with a collaborative teaching approach and Web 2.0 technologies cannot be underestimated. With its concrete guidance, this book is an important contribution to the work of transforming the education towards learner-pull models where students learn how to learn and become motivated to developing new and relevant skills of today."

Dr. Ove Jobring
Department of Sociology and Work Science
University of Gothenburg (Sweden)

"Inquiry Project-based learning (PjBL) is a wonderful design for student-focused learning situations, which support intrinsic learning motivation. Enhance your students' joy of learning and prepare them for the knowledge society."

Prof. Dr. Uwe Wilkesmann
Chair of Organization Studies & Continuing Education
TU Dortmund University
(Germany)

"Using an inquiry project-based learning approach to develop upper primary students' 21ˢᵗ century skills, brings together three strands of educational research located in the terrain of digital technologies, inquiry and project based learning as well as collaborative teaching. The book is grounded in the experience of a group researchers and practitioners who propose a set of strategies designed to develop 21ˢᵗ Century skills. The structure used by the authors enables readers to progress from a contextual to conceptual understanding of the inquiry and project based learning as an instance of classroom application of constructivist principles. The last section is rooted in an empirical investigation whose outcomes are used to propose an integrated approach to the teaching and learning of 21ˢᵗ century skills. Unlike many books on pedagogy, the authors discuss very concrete and down to earth pedagogical strategies designed to develop higher order thinking skills in a collaborative set up for both teachers, students working with significant others in the school set up. Its practical orientation recommends itself to all teachers who are critically engaged in enhancing three interrelated sets of skills, namely learning and innovation skills, information, media, and technology skills, and life and career skills at the level of primary schools."

Dr Hyleen Mariaye, Associate Professor
Department of Education Studies
Mauritius Institute of Education

"A thoroughly researched, readable & informative text. Although essentially related to the Hong Kong primary education scene, the messages outlined, the theories propounded and the strategies suggested by using Inquiry Project Based Learning will have resonance with many teachers, educators and school librarians around the world. I'm delighted to see the role of school library staff in the primary school given status and purpose. Both visionary and practical - I learnt a good deal I know others will too."

Geoff Dubber
Education Libraries and Learning consultant
Past Chair UK School Library Association
2010 – 2012

"As a Subject librarian I find the book very interesting, especially in Chapter 6 where the authors suggest a collaborative teaching approach which encourages librarians to team up with subject teachers. It is fascinating to know that such innovative yet promising teaching approach is not only limited to higher education, but is also applicable at primary level."

Fan Aihong, Deputy Director
Reference & Information Services
Tsinghua University Library (China)

"This book offers a comprehensive framework of supporting primary learners' literacy skills in inquiry project-based learning. There are practical strategies for equipping students' integrated skills, ranging from basic computer and research skills to data analysis and presentation skills, which are deemed essential for this information-explosion era. I would love to share this initiative in collaborative teaching and learning with my colleagues and explore a better way to support children's learning through project work."

Irene Ho Ka Wai, English Teacher
Kau Yan School (H.K.)

"This book is certainly an enjoyable read written in a clear language. It uses practical cases to illustrate possible implementations of the theoretical framework of the pedagogy and requirements for students skills in the 21ˢᵗ century. I see this book as a useful tool for teaching teams in implementing inquiry PjBL. The book emphasizes the importance of collaboration of teachers and librarian as well as parents showing that it is good to keep parents informed and possibly involved as observers. The statements were very clear and the examples on using wiki as presented in one of the chapters were very useful."

Dr Tanya Linden
School of Management and Information Systems
Victoria University (Australia)

"These days, education institutions use various pedagogical approaches to make the learning process more meaningful and interesting. However, it is also a fact that

many students as well as their parents feel stressed and overloaded with a stream of educational activities. The authors of this book have very convincingly established the point that how the use of appropriate pedagogical approaches, such as inquiry-based learning, can make learning a more engaging, non-threatening and less stressful process. They have also highlighted the point that adequate level of digital and information literacy can make students independent and life-long learners. The team teaching approach suggested by the authors, involving subject teachers and librarians could be very useful in imparting certain desired skills. This book also shows how librarians can help teachers integrate information literacy skills in different subject topics and class activities. The book will be very useful for teachers as well as school administrators to consider more innovative approaches to teaching and learning.”

Shaheen Majid, Associate Professor
Wee Kim Wee School of Communication & Information
Nanyang Technological University (Singapore)

“This book has not only provided insights for teachers into the rationale behind the use of Project-Based Learning and Web 2.0 technologies, but it has also given a practical guide to teachers of different subject areas to collaborate and plan their curriculum. While this book focuses generally on primary school settings, teachers of secondary schools, especially Liberal Studies teachers who are supervising Independent Enquiry Studies (IES) projects, would definitely obtain insights from this book about how to facilitate students' inquiry learning. I would highly recommend the book to educators who are looking for new elements in their teaching and guiding strategies.”

Mr. Stephen Fung, Liberal Studies Teacher
Po Leung Kuk Ngan Po Ling College (H.K.)

“Dr. Chu's work explains the relationship between 21st Century skills, inquiry PjBL and its practice very clearly. Most importantly,it successfully demonstrates that we cannot simply expect students to become inquiry-project based learners and constructors of knowledge without a

proper pedagogical approach to motivate them, e.g., open-ended scaffolded learning opportunities, real and virtual (Web 2.0) spaces that facilitate group work and appropriate support from teaching teams which includes school librarians. Furthermore, the detailed integrated timetable examples and team teaching role outlines are innovative, helpful and illuminating. I have absolutely no hesitation in recommending this excellent book which will be of value to any teacher who seeks to continually rejuvenate their pedagogical approach.”

Dr. Geoff Walton, Senior Researcher I
Staffordshire University (U.K.)

“Nowadays, school librarians have taken an important role in developing students' information literacy. Dr. Chu and his colleagues suggest a collaborative teaching approach, which unit the subject teachers and the school librarians as one teaching team, to create a dynamic learning environment for students with the use of Web 2.0 technology. The book not only offers an innovative teaching approach that is effective in raising students' digital literacies; it also urges educators to reflect on our old teaching strategies, hence encouraging professional development.”

Hui Oi Shuen
IASL-HKTLA Teacher Librarianship Excellence Award 2012 (H.K.)

“A very important book that shares applicable examples on equipping students and teachers with 21st century skills through inquiry PjBL.”

Mohammad Reza Poosti
General Manager
Arman Sanaat Evan Co. (Iran)

Content

Preface

"Do not train a child to learn by force or harshness; but direct them to it by what amuses their minds, so that you may be better able to discover with accuracy the peculiar bent of the genius of each." – Plato

Plato is regarded as one of the greatest teachers in history. Have educators, teachers and parents been following his advice in training their students or children in ways that sufficiently excite them? Or have adults been, consciously or subconsciously, training them with harshness?

Although Hong Kong students have ranked amongst the top internationally in terms of their academic abilities (e.g., Math and Science skills) (OECD, 2005), they may have paid too high a price to attain such outstanding performance. Students in local schools, from kindergarten all the way to secondary school, have always been pressured into doing lots of homework and taking innumerable tests and exams so that they may be thought to be well-prepared for university. I have met a 6-year-old girl, a Primary 1 student, who have just started school two weeks before and was crying on a Sunday night because she had to go to school the next day. Another 9-year-old boy, a Primary 3 student, who was very excited about going on a fun trip with his family on a holiday, was "forced" to stay at home to prepare for a test that was scheduled for the day after the holiday. One of these students studied in a "good" school and the other attended a "top" school in Hong Kong in terms of their academic performance. These schools may have been practicing exactly the opposite of Plato's philosophy. Schools, in these students' minds, are "harsh" and scary. And if they had a choice, they might not want to be there!

This book suggests that there are better ways of teaching and learning. When students who are engaged in group projects are free to choose topics which interest them using an inquiry learning approach, and when their learning is scaffolded by a team of subject teachers (e.g., General Studies, Language and IT) and school librarians during the inquiry process, students can be motivated to excel in their work. Besides, they can make significant progress in their core competencies – reading and writing abilities, IT and information literacies, communication and research skills, which are all essential 21st century skills.

What seems to be more important than academic excellence is the excitement that students experience with this mode of learning. One mother reported that her son, who was in Primary 4, enjoyed the PowerPoint part of his group project so much that he stayed up until 5a.m. to complete the work even though the following day was a holiday and not the due date of the project. Generally speaking, educators do not encourage students to stay up late for school work. However, if a child is so enthusiastic about what he or she learns, this may be taken as a positive sign. In another case, a girl in Primary 4 enjoyed her inquiry group work so much that she carried the folder containing the information about the project back and forth between school and home every day though this was not required. According to the mother, this child did not care about her school work in the past, and so her interest in the project was most encouraging. More than that, it was noticed that with group work, this girl learned to work better with others and to be more sensitive to others' feelings.

One important element that this book emphasizes is that parents are not required to provide extensive support to their children as they engage in their inquiry group project work. The children would be supported by a team of teachers and the school librarian during the entire project period, and hence, guided in developing their ability and skills needed to excel.

It is the hope of the authors of this book that educators can replace most, if not all, boring homework tasks and unnecessary tests and exams with more meaningful tasks for students. Educators are encouraged to adopt a teaching and learning strategy similar to what was suggested by Plato. Teachers should be "directing" students with what amuses their minds (e.g., inquiry group project work that is well supported by teachers and librarians), so we may be better able to help the students discover "the genius of each".

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Acknowledgement

Chapter 1: Introduction

This book aims to serve as a practical guide for education practitioners and researchers in gathering evidence-based strategies towards helping students develop the increasingly important skills that are required in the 21st century. With the implementation of inquiry project-based learning (inquiry PjBL) using a collaborative teaching approach and the use of wiki, empirical evidence on the effectiveness of the suggested new pedagogical approach are presented. Detailed suggestions on implementing inquiry PjBL in Hong Kong primary school settings are also provided. This book includes an introduction to the new 21st century skill sets and guides for teaching strategies and schedules, teachers' roles and assessment materials.

1.1 Rationale behind the book

Three sets of skills have been identified to be among the most in demand in the 21st century: (1) learning and innovation skills, (2) information, media, and technology skills (collectively referred to as 'digital literacies'), and (3) life and career skills (Trilling & Fadel, 2009). These skills are not brand new. For instance, critical thinking and problem solving, which are included in the first set of skills, have been recognized as important throughout human history (Rotherham & Willingham, 2009). Nonetheless, the evolving demands on the workforce of knowledge-based economies and the significant role of technology in production have resulted in the increasing value of these skills in the contemporary society (Levy & Murname, 2004).

Amongst others, digital literacies, consisting of information literacy, media literacy and technology literacy, are perceived as crucial skills to be acquired in today's society (American Association of School Libraries, 2007). New pedagogical methods have come to the fore to bring the teaching of these skills and literacy into the more traditional curriculum (Kuhlthau, 2004; Scott & O' Sullivan, 2005). The global trend of learning in schools is moving from the traditional didactic approach towards inquiry learning, which requires students to be "active constructors of knowledge" (Chu, 2011, p. 133). One of the most discussed teaching approaches is inquiry PjBL. Recently, Hong Kong's Education Bureau (EDB) has incorporated inquiry PjBL into its General Studies (GS) curriculum for primary schools. EDB stipulates that this learning approach facilitates the development of students' independent learning capabilities and enables them to connect and construct knowledge through a variety of learning experiences (EDB, 2001). Although a great deal of research has shown inquiry-based learning to be more effective than traditional forms of rote learning (Donham, Bishop, Kuhlthau, & Oberg, 2001; Harada & Yoshina, 2004a; Hu, Kuh, & Li, 2008), the actual implementation of the strategy in the context of primary school education in Hong Kong has not been explicitly discussed. When this approach is implemented in an inappropriate manner, it is possible that this would significantly hinder students' learning. Here is one story that may resonate with many educators and parents:

> *In a "good" (i.e.,"good" in terms of academic performance) local primary school in Hong Kong, teachers started to incorporate project work into their teaching and assessment with intentions of equipping students better with the new sets of skills emphasized in the society. Students were required to work on inquiry projects in almost all courses. It might be true that by replacing traditional assignment tasks with inquiry projects, students were able to learn more effectively. However, the students did not appear to be well equipped with the necessary knowledge and skills for completing their project work. Without adequate scaffolding and support by their teachers, a number of students encountered much difficulty with getting the projects done. Some of the parents of these students took the initiative to assist their children because the expectations of the teachers on the project were set so high. Moreover, the guidelines were not clear enough such that even the parents found the projects difficult. Eventually, parents of two of these students decided to take their children out of the school.*

Some educators or parents may think that this is only a problem faced by teachers and students in local Hong Kong schools; however, the same situation exists in one of the top international schools in the territory where the teaching strategies and learning environments are quite similar to private schools in English speaking societies.

> *In an international school, the year 5 students (of an average age of 9) were told to work on an inquiry project. Although the workload in this international school is much more reasonable when compared to the local school that was previously mentioned, one of the students, who has an academic ability of above average, was still very confused about the work. This student brought the task assignment home, which was eventually completed by the mother. After reading the homework, the teacher noticed that it was not done by the student and wrote, "You didn't do this. Did someone do this for you? Do the homework yourself again". As this happened in an international school, this implies that the benefits of inquiry PjBL is not being maximized not only in the local education system of Hong Kong; it is possibly a global issue.*

With insights gained from both of the stories, we can see that there are constraints, difficulties and challenges that are faced not only by students but also by educators and parents, with the adoption of innovative teaching approaches. Students (9-year-old) have reported deficiency in inquiry-related knowledge and skills, such as essential IT skills (e.g., Excel and PowerPoint) to present ideas in their projects, information literacy to identify related resources, and reading and writing abilities to understand key ideas and report findings (Chu, 2009). Apart from this, students may not have been well supported during the inquiry process. Some teachers conveyed to the first author of this book that they did not have sufficient knowledge and confidence to guide their students through their projects using this new pedagogical approach.

Although inquiry PjBL has been promoted by EDB in Hong Kong, students and teachers are facing different challenges in adopting this new teaching and learning approach. Acknowledging these challenges, this book is published with the hope of helping teachers implement inquiry PjBL more successfully. Concrete insights

have been derived from our experiences of adopting the approach at Primary 4 (P4) and Primary 5 (P5) levels, and are thus presented as recommendations for teaching.

1.2 Organization of the book

To facilitate teachers' understanding of inquiry PjBL, collaborative teaching and use of online tools (e.g., Web 2.0 technologies), and to enable easy referencing for implementation strategies of the new teaching approach, the ideas and recommendations will be presented in three major sections:

Part One: What are 21st century skills and why are they important in Hong Kong primary education?

In this section, the 21st century skill sets will be introduced and linked to Hong Kong EDB's recent modifications of the school curriculum.

Part Two: Teaching strategies to foster students' 21st century skills development

A selected range of teaching strategies will be proposed to foster students' acquisition of 21st century skills. In this section, the supporting theories and research-based evidence from our projects will be discussed such that teachers will have a better understanding of the basis and effectiveness of these methods.

Part Three: Practical guide on implementing inquiry PjBL in collaborative teaching using Web 2.0

In the last section of the book, we aim to provide specific and practical guidelines to teachers who wish to explore the use of these methods in their teaching. Detailed information on teaching strategies and schedules, assessment methods and roles of different teachers will be presented in the format of a guideline.

The conceptual framework supporting the development of 21st century skills, as utilized in the reported projects in this book, is illustrated in Figure 1. The two major sets of 21st century skills that are particularly addressed are learning skills and digital literacies. It is proposed that a pedagogical approach that incorporates inquiry PjBL with Web 2.0 applications (e.g., wikis) would have beneficial effects on students' learning outcomes. Outcomes may be described in terms of the processes that students go through, and in terms of the output or product of their learning activities.
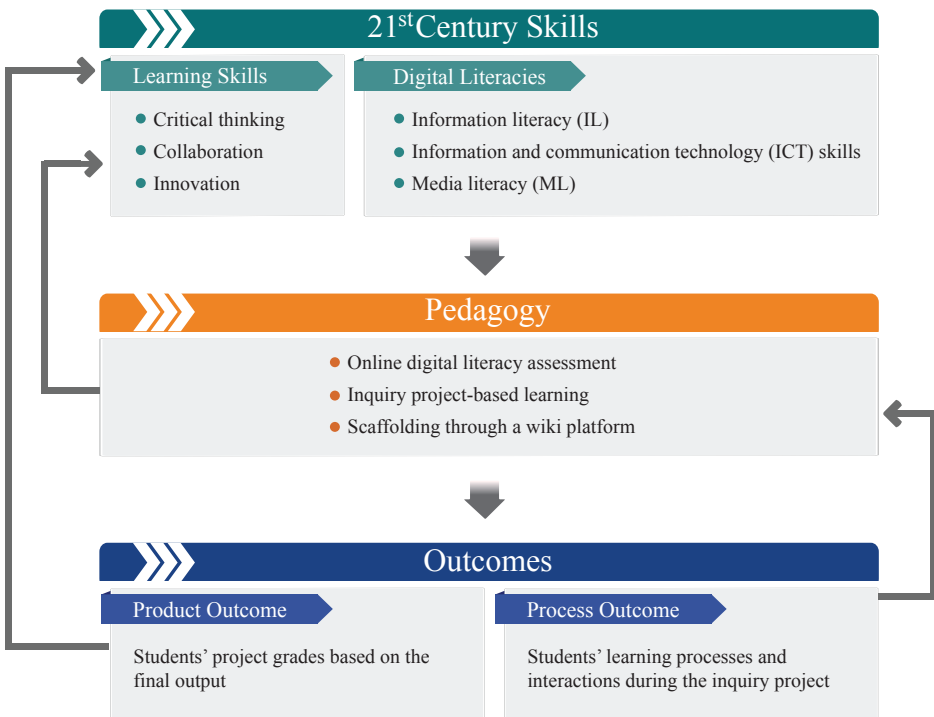

Figure 1: Conceptual framework of the relationship between 21st century skills and teaching strategies

Part One:
What are 21st century skills and why are they important in Hong Kong primary education?

Chapter 2: 21ˢᵗ century skills

The ever-changing global structure consequently results in shifting needs and demands for societies. To address this, educators have continued to modify their teaching goals in order to provide students with the skills they need to contribute to their societies. The acceleration of digital technology development in the 21ˢᵗ century has required people to be equipped with skills and literacy that are important in this information age (Black, 2009). The changes associated with globalization have affected business organizations across the world such that core business competencies have become more knowledge-intensive, mobile across space, and collaborative in nature (Dunning, 2000). Meanwhile, tasks consisting of routine cognitive and manual work are generally being assigned to computers, such that the labor force is appointed to jobs that emphasize expert thinking and complex communications (Levy & Murname, 2004). Consequently, the skills required of the human workforce of the 21ˢᵗ century have become less of the routine-type, and increasingly influenced by technological advancement.

The movement that supports the development of 21ˢᵗ century skills has emerged from the United States (US) with most of the published literature having North American concerns (e.g., Bruett, 2006; Schwarz & Stolow, 2006). However, the circumstances that have led to this movement are not unique to the US, but are instead global. Hong Kong, in particular, has been described as having moved towards a knowledge-based economy faster and farther than any other country in the world (Enright, 2000). Such shift is more apparent in developed countries where people are being allocated tasks of research and development, design, marketing and sales, and global supply chain management (NCEE, 2007).

A greater proportion of routine work is being assigned to people in less developed societies given the substantial role of automation and technology. Despite such disparity, stress has been laid on preparing students for future roles that will address the complexities inherent in a knowledge-based economy (Asian Development Bank, 2007).

2.1 What do 21st century skills entail?

While the term '21st century skills' may appear to be trendy, the skills being referred to are "not new, just newly important" (Silva, 2009, p. 631). For instance, skills such as critical thinking and problem solving have been essential in human progress from the early development of tools and throughout industrialization (Rotherham & Willingham, 2009). The difference lies in the evolving demands on the workforce that are associated with the shift towards knowledge-based economies and the increasing role of technology in production (Levy & Murname, 2004). In other words, most of the skills have just become more crucial in the current era.

To further clarify what 21st century skills embody, numerous groups of educators have developed different frameworks (e.g., Metiri Group and NCREL, 2003; OECD, 2005a; Partnership for 21st Century Skills, 2009; American Association of Colleges and Universities, 2007; 21st Century School, 2010). Each group has operationally defined 21st century skills, and offered recommendations on how these skills could be developed through classroom teaching.

The framework proposed by Partnership for 21st Century Skills (P21, 2009) has been more widely adopted by schools, presumably because it is clear and well-structured, and has embraced the importance of core subject knowledge areas. Moreover, the P21 framework appears to be applicable to the context and syllabus of primary school education in Hong Kong. In this framework, three sets of skills were identified: (1) *learning and innovation*; (2) *information, media and technology skills* (referred collectively as '*digital literacies*'); and (3) *life and career skills*. These skill sets are built on the knowledge of core subjects and themes in the 21st century society.

As such, it needs to be emphasized that while the three skill sets may not be new, a clear link exists between them and the thematic concerns that are relevant and specific to the 21st century.

2.2 Key capabilities of the sets of 21st century skills

The P21 framework defines each skill set with specific key capabilities, such that 12 components make up the 3 skill sets (P21, 2009). As shown in Table 1, learning and innovation skills consist of competencies for engaging in critical thinking and problem solving, communicating, collaborating, and being creative and innovative. Digital literacies cover the following three components: information, media and technology. Information literacy (IL) has been defined as being "able to recognize when information is needed and hav(ing) the ability to locate, evaluate, and use effectively the needed information" (American Library Association, 1989, p. 1). Media literacy (ML) refers to the ability to decode, evaluate, analyze, and produce print and electronic media (Aufderheide, 1997). Technology literacy points to the ability to use digital technology, communication tools, and/or networks to access, manage, integrate, evaluate, and create information (International ICT Literacy Panel, 2002). Life and career skills include capabilities to be flexible and adaptable, have a self-direction, engage in social and cross-cultural interactions, be productive and accountable, and have the potential to manage leadership and responsibilities.

Table 1. Capabilities for each set of 21st century skills

3 skill sets:	Learning and Innovation	Digital Literacies	Life and Career Skills
12 components:	Critical thinking and problem solving Communication Collaboration Creativity and innovation	Information literacy Media literacy Technology literacy	Flexibility and adaptability Imitative and self-direction Social and cross-cultural interaction Productivity and accountability Leadership and responsibility

The composition of 21st century skills has also been summarized by Trilling and Fadel (2009) using the following formula:

$$\textit{3Rs x 7Cs = 21}^{st}\textit{ Century Learning}$$

The more traditionally established skills of "**R**eading", "w**R**iting" and "a**R**ithmetic" are represented by the **3Rs**. The second key component, the **7Cs**, stand for **C**ritical thinking and problem solving, **C**ommunication, information and media literacy, **C**ollaboration, teamwork and leadership, **C**reativity and innovation, **C**areer and learning self-reliance, **C**ross-cultural understanding and **C**omputer and ICT literacy. This formula is apparently easier to be remembered compared to the structure of the three skill sets and their corresponding 12 components. Nevertheless, the studies reported in this book have focused on the three skill sets as the major dimensions of interest, and in the specific context of Hong Kong. In the next chapter, the importance and application of 21st century skills in Hong Kong education will be discussed.

Chapter 3: 21ˢᵗ century skills and the Hong Kong education roadmap

The primary education system in Hong Kong, along with the curricula, roadmap and quality assurance processes, is monitored by the Education Bureau (EDB) of the government (EDB, 2011). EDB periodically conducts reviews that assess the suitability and effectiveness of learning roadmaps and teaching approaches in promoting students' development to address the needs of the society.

3.1 Hong Kong education roadmap

The Curriculum Development Council (CDC) of EDB has set seven learning goals (EDB, 2007a) to facilitate the holistic development of students through primary and secondary education. These seven learning goals also serve as pointers for designing teaching approaches as shown in Table 2. These goals have been defined on the basis of a comprehensive approach that focuses on students' whole-person development, and addresses not only learning skills but personal interest and value enhancement as well.

Table 2. Seven learning goals set by the Curriculum Development Council

EDB (Hong Kong)	Detailed Expectations
Responsibility	Recognize their roles and responsibilities as members in the family, the society, the nation; show concern for their well-being
National Identity	Understand their national identity and be committed to contributing to the nation and society
Habit of Reading	Develop a habit of reading independently
Language Skills	Engage in discussions actively and confidently in English and Chinese (including Putonghua)
Learning Skills	Develop creative thinking and master independent learning skills (e.g. critical thinking, information technology, numeracy and self management)
Breadth of Knowledge	Possess a breadth and foundation of knowledge in the eight Key Learning Areas[1]
Healthy Lifestyle	Lead a healthy lifestyle and develop an interest in and appreciation of aesthetic and physical activities

[1] According to EDB, the eight Key Learning Areas include: Chinese Language Education, English Language Education, Mathematic Education, Science Education, Technology Education, Personal, Social and Humanities Education, Arts Education and Physical Education (EDB, 2011c)

3.2 Goals of Hong Kong education and 21st century skills

The seven learning goals set by EDB of Hong Kong are distinct from the 21st century skills. However, the detailed expectations of the learning goals are largely coherent with the capabilities that are expected of the 21st century skill sets. Table 3 summarizes the evident associations between the seven learning goals and 21st century skills.

Table 3. Association of 21st century skills with the learning goals set by EDB

EDB (Hong Kong)	Corresponding 21st Century Skills
Responsibility	Life and Career Skills
National Identity	
Habit of Reading	3R – Reading
Language Skills	3R – wRiting
Learning Skills	Learning and Innovation Skills Digital literacy Life and Career Skills
Breadth of Knowledge	Core subject 3R – aRithmetic
Healthy Lifestyle	Life and Career Skills

The elements of the seven learning goals are expected to be developed "through-out all stages of schooling and across the Key Learning Areas (KLAs) which include Chinese Language, English Language, Mathematics, Science, Technology Education, Personal, Social and Humanities Education, Art Education and Physical Education" (EDB, 2007a). Similar to the suggested approach in fostering 21st century skills, the learning goals could be achieved through the teaching-learning processes of core subject knowledge.

Digital literacy is one of the important 21st century skills. The EDB of Hong Kong does not appear to explicitly encourage the development of digital literacies as much as that of life and career skills, 3R skills and learning skills. However, information technology (IT) skills have actually been designated as one of the Key Learning Areas (KLAs) in the new curriculum design. IT skills, which the EDB expects students to acquire, consist of, but are not limited to, information literacy, media literacy and technology literacy – the three components which make up digital literacies. Thus, it appears that digital literacy is actually valued and considered by EDB in the new curriculum.

EDB has also provided enablement guidelines for primary schools in Hong Kong to implement educational strategies that facilitate the achievement of the seven learning goals. As shown in Table 4, these guidelines cover the aspects of (1) co-ordination and collaboration, (2) system adjustment and management, and (3) professional development. The implication behind these enablement guidelines is that schools and teachers are urged to devise strategies that are systematic and that provide constructive feedback to students as scaffolding and support. As these goals are highly associated with 21st century skills, a similar strategy may be effective in helping students develop the skills. Therefore, new pedagogical approaches such as collaborative teaching and provision of scaffolding support in the form of constructive feedback, thought-provoking questions and hypothesis to questions are highly recommended in helping students equip themselves with 21st century skills. Details on the proposed teaching strategies will be further discussed in Chapter 5.

Table 4. Enablement guidelines to facilitate the development of EDB's learning goals

Coordination and collaboration	• Partnership with all sectors (parents, employers, schools, teacher education institutions, etc.) • Maximizing use of community and work environments, local and overseas if possible • Convergence between systemic and bottom-up initiatives (e.g., useful QEF experiences) for the best benefit of students • Connecting on-going curriculum change to the new vision (e.g., New Technical Curriculum) • Tripartite partnership in development-practice-resource building • On-site school-based support to help teachers and principals • Promoting a sharing culture of curriculum experiences (e.g., websites, e-mails, informal networking)
System adjustment and management	• Interactive, evolutionary system feedback and adjustment at policy level • Provision for transition and alternatives • Alignment with other educational initiatives: school-based management, quality assurance, school building design • Leadership at school • Resources including information technology and other school facilities • Evidence-based development and research priority and refocusing
Professional development	• Informing and reforming pre-service and in-service teacher education/continuing teacher education • Teacher development through participation in school-based curriculum development and on-going curriculum development processes • Participation in action and applied research to generate knowledge and use knowledge in research • Dissemination of good practices (e.g., websites, informal networking, conference participation)

Chapter 4: Digital literacies in local primary education

Digital literacies have been identified as one of the three skill sets that are considered to be newly vital in the 21st century society (see chapter 2 for the context). This chapter further explores the definitions and components of digital literacies within the context of teaching approaches that would be relevant to the Hong Kong education system.

Digital literacies are made up of three components: information literacy (IL), information and communication technology (ICT) skills, and media literacy (ML). These components interact in a nonlinear and dynamic learning process (Livingstone, 2004). Information literacy (IL) is the ability to "recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (American Library Association, 1989, p. 1). Information and communication technology (ICT) skills, as defined by the International ICT Literacy Panel (2002), refer to the ability to use digital technology, communication tools, and/or networks to access, manage, integrate, evaluate, and create bodies of information. The last component, media literacy (ML), is associated with the ability to decode, evaluate, analyze, and produce print and electronic media (Aufderheide, 1997).

Digital literacies have been deemed essential for learners to harness the power of digital technologies in amplifying their opportunities for learning, communication, collaboration, and knowledge creation (Trilling & Fadel, 2009). It has been particularly linked with inquiry learning as its component skills are essential for successful and effective implementation of such a learning approach. When students

engage themselves in inquiry projects, it is crucial for them to have the IL proficiency needed to gather the information they require to generate further research actions, which contributes to their successful mastery of knowledge (Todd, 2006). In addition, ICT skills allow students to utilize technological tools in their learning process. For students with Chinese as their first language, these skills may particularly include computer input of Chinese characters. Equally important is ML, which allows students to acquire and share information in different media forms (e.g., videos, music, podcasts). It is believed that ML is becoming increasingly powerful in our everyday lives (Bazalgette, Bevort & Savino, 1992; Kubey, 1997; Trend, 1994; Tyner, 1998) and this explains why media education has now become a global movement (Brown, 1998; Hart, 1998; Lee, 1997; Kubey, 1998; Kubey & Baker, 1999; Chu, 2010). The definitions of these components of digital literacies, specific to primary students in Hong Kong, along with examples are summarized in Table 5.

Table 5. Operational definition of the components of digital literacies

Component	Definition	Example
Information literacy (IL)	Ability to recognize when information is needed, and have the capability to locate, evaluate, and use the information effectively and ethically.	Searching for information through the Internet or other materials (e.g., books, newspapers, television).
Information and communication technology (ICT) skills	Ability to use digital technology, communication tools and/or networks, to access, manage, integrate, evaluate, and create information.	Using MS Excel to produce charts or histograms from a set of data.
Media literacy (ML)	Ability to decode, evaluate, analyze, and produce print and electronic media.	Recording and editing a music file.

4.1 Digital literacy education in Hong Kong

Prior to the year 2000, digital literacy education was not given much focus in the Hong Kong curriculum (Education Commission, 2000; Morris, Kan & Morris, 2000). A shift has occurred in the recent years as evident in the series of new curriculum guidelines that were established by Hong Kong EDB. With digital literacies of students in Hong Kong becoming a relevant point of concern for local educators, EDB has laid down specific learning targets that would address the component skills (i.e., *Information Technology Learning Targets*). The information literacy framework for Hong Kong students has also been outlined (EMB, 2005), and the implementation guidelines of General Studies (GS) in primary school has emphasized the use of inquiry as a teaching approach.

4.2 Information technology learning targets

The Curriculum Development Council (CDC) (2000) has developed the *Information Technology Learning Targets* document which provides guidelines for schools in developing teaching strategies that aim at sharpening students' skills with the use of information technology (IT). Learning targets have been determined to help teachers strengthen their teaching approaches such that students can develop into "habitual IT users in accomplishing learning tasks in schools and job-related tasks in their future workplace" (CDC, 2000, p. VI). The teaching targets and learning outcomes are classified into five different stages from Primary 1 to Secondary 7 according to students' cognitive development (refer to Table 6).

The first stage is directed at primary levels one to three, and mainly focuses on cultivating students' skills with operating computers and other related devices. This stage also aims to introduce them to the use of IT not only in general daily life, but specifically in learning as well. The second stage, which is for primary levels four to six, acquaints students with IL skills as apparent in the goals that include information access and processing. The use of IT in inquiry learning is also an explicit goal based on the target of developing students' cooperative learning skills. The third stage involves secondary levels one to three, and further strengthens IL and

Table 6. Summary of Information Technology Learning Targets

STAGE	STAGE TARGETS	SKILLS (21st century digital literacy skills)
I (P.1 to P.3)	• Know how to operate computers and related devices; • Be aware that IT is commonly used in daily life; • Demonstrate an interest in using IT as learning tools.	• Operate computers in schools; (ICT) • Input Chinese characters with a handwriting recognition device; (ICT) • Use multimedia resources to support learning with the help of teachers; (ML) • Communicate and handle information with IT tools in learning activities. (ICT)
II (P.4 to P.6)	• Use IT tools to support learning; • Access information via computer networks; • Develop simple techniques in information processing; • Develop communication skills to facilitate cooperative learning; • Show concern over various issues involved in IT usage.	• Use a number of software packages for word-processing, calculation, image-processing, and other learning activities; (ICT) • Input Chinese characters with a handwriting recognition device and with the aid of a Chinese input method; (ICT) • Access information via computer networks and other media; (ICT, IL) • Process information using IT tools. (ICT, IL)
III (S.1 to S.3)	• Use IT tools in information processing and learning; • Develop the capability to process and present information; • Demonstrate the ability to verify and evaluate the accuracy and reliability of information; • Work collaboratively with peers in project assignments; • Behave ethically in applying IT in information processing.	• Use appropriate IT tools to facilitate learning; (ICT) • Use IT tools and strategies for processing and presenting information; (ICT, IL, ML) • Communicate with others via electronic mail; (ICT) • Verify and evaluate the accuracy and reliability of information. (IL)
IV (S.4 to S.5)	• Develop the ability to select and use appropriate IT tools to support further study and lifelong learning; • Demonstrate the ability to understand and analyze information; • Share information on the Internet; • Reflect on the use of IT by oneself and others; • Demonstrate a will to be responsible when using information.	• Improve self productivity; Compare the effectiveness of various ways, including the use of IT tools, to solve a given problem; (ICT, IL) Use and analyze information; (IL) • Produce multimedia presentation. (ML)
V (S.6 to S.7)	• Become frequent and sophisticated IT users in future studies and at work; • Generalize the experiences of using IT and employ appropriate IT tools for specific purposes; • Evaluate critically the usefulness of emerging IT tools.	• Integrate the uses of a wide range of IT tools to fulfill specific purposes; (ICT, IL, ML) • Select and apply appropriate IT tools in different aspects of study, such as collecting and analyzing information, problem solving, and decision-making. (IL, ICT)

Note: Adapted from EDB: http://www.edb.gov.hk/FileManager/EN/Content_3735/ITLT-e.pdf

collaborative learning skills. ML skills appear to be stressed as well by facilitating students' ability to present information. At the fourth stage, which is targeted at secondary levels four to five, students learn to appreciate the use of digital technologies for their own learning and future plans. Both the skills of IL and ML are continually reinforced, evidently to a greater extent. The fifth and last stage, being the terminal phase, is designed for students in the last two years of secondary school. At this point, the goal is for students to have sophisticated IL, ML, and collaborative inquiry learning skills that they can apply to situations beyond those afforded by their formal education.

Table 6 shows the components of digital literacy skills for the 21st century that are being addressed in each stage of the *Information Technology Learning Targets*. While the first two stages are focused on skills that support ICT literacy, each progressive stage evidently includes IL and ML skills increasingly and for progressively more sophisticated purposes. Essentially, if the *Information Technology Learning Targets* set by CDC were achieved within a student's education, he or she would become an individual equipped with the relevant digital literacy skills for the challenges of the 21st century. In addition to this, this individual would also be capable of engaging in cooperative and collaborative work with peers.

4.3 Information literacy framework and curricular changes

Based on the philosophy that information literacy (IL) is "part of the basic human right of lifelong learning", Education and Manpower Bureau (EMB, the former EDB) of Hong Kong formulated the *Information Literacy Framework for Hong Kong: Building the capacity of learning to learn in the information age*. Serving as the overarching guide for empowering students with IL, this set of guidelines aims to "enable students to master the necessary skills to comprehend, locate, analyze, critically evaluate and synthesize information and apply their knowledge to inform decisions and problem solving" (EMB, 2005, p. 12). Teachers are encouraged to frame their learning and teaching activities using the following concepts: "reading to learn", "project learning",

"IT for interactive learning" and "moral & civic education" (EMB, 2005, p. 9). It is assumed that students would gain proficient IL skills through these activities.

Curricular changes in primary school education have also been seen to contribute towards the development of digital literacy. The General Studies (GS) curriculum has been revised to encourage students to "develop a holistic view of themselves as individuals in the community, their place in the natural world, and the interaction of human beings with the environment" (EDB, 2011b, p. 10). The current revision emphasizes independent learning using not only traditional learning materials such as resources from books, but "IT", "project learning" and "web-based materials" as well. IT has been a particular focus as one of the units in the curriculum. The contents include the teaching of simple software, introducing digital equipment and spelling out the current concerns in the Information Technology and Computer (ITC) world such as intellectual property rights (EDB, 2011b). More opportunities for students to use IT as an education tool is advocated and EDB calls for teachers to employ "student-centred learning strategies" (EDB, 2011b, p. 70), such as project learning, to help students practice their IT skills in the GS curriculum.

Digital literacy skills, especially ICT and IL, have been increasingly regarded as critical in Hong Kong education as it is hoped that such skills would help young people to mature into life-long independent learners. The use of IT as a teaching and learning tool has been a central focus. The EDB of Hong Kong supports "student-centered learning strategies" (EDB, 2011b, p. 70) such as project-based learning to help students strengthen their IT skills. In the following chapters, constructivist teaching strategies that facilitate the development of digital literacies among students will be examined in greater depth.

Part Two:
Teaching strategies that foster students' 21st century skills development

Chapter 5: Inquiry Project-based learning (Inquiry PjBL)

5.1 Constructivist approaches to teaching and learning

Inquiry-based learning (IBL) is a pedagogical approach that involves students actively in their learning process through the generation of answerable questions (Harada & Yoshina, 2004a). Findings of studies have indicated that IBL is more effective in facilitating positive learning outcomes such as deep thinking, the ability to apply knowledge, and reasoning skills when compared to the more traditional didactic approach (Dochy, Segers, Van den Bossche, & Gijbels, 2003; Zmuda & Harada, 2008; Hickey, Kindfield, Horwitz, & Christie, 1999; Hmelo-Silver, Duncan, & Chinn, 2007; Hu, Kuh, & Li, 2008; Kuhlthau, Maniotes, & Caspari, 2007). One way of implementing IBL in schools is by creating opportunities for students to do group projects (Chu, 2009; Hmelo-Silver et al., 2007).

Project-based learning (PjBL) engages students in an in-depth exploration of issues, themes or problems without predefined answers (Harada, Kirio, & Yamamoto, 2008). PjBL has been shown to provide students with chances to immerse in realistic and thought-provoking learning environments (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 point to the greater effectiveness of both IBL and PjBL over more traditional rote learning approaches (Guthrie et al., 2004; Hickey et al., 2000; Hickey, et al. 1999; Hmelo-Silver et al., 2007; Langer, 2001; Lynch et al., 2005; Wu & Tsai, 2005). The integration of PjBL and IBL could therefore be a promising teaching and learning strategy (Chu, 2009; Krajcik et al., 1998). In this book, the combined approach is referred to as inquiry PjBL.

5.1.1 Inquiry based learning (IBL)

The Education Bureau of Hong Kong describes IBL as a student-centered approach that promotes the integration of skills, knowledge, and values in learning (EDB, 2002). It is one of the pedagogical approaches that constructivist educators have discussed and advocated for. In this approach, teachers assume the role of facilitators who prompt students with questions and hints to arouse students' curiosity in exploring and deepening their understanding of certain topics (Harada & Yoshina, 2004b). Students are encouraged to generate questions and find answers to the questions through their own search processes. Consequently, students learn to actively construct their knowledge base and solve problems through a systematic procedure of information collection and analysis. In the context of the Hong Kong Chinese society, one of the key factors that affect the implementation of IBL is parental participation. As indicated by Ng (2000), parents of primary school children in Hong Kong tend to play a highly active role in the school activities of their children.

However, self-generated or semi-imposed tasks are emphasized in IBL (Harada & Yoshina, 2004b). Open inquiry was found strongly associated with the sense of independence, ownership and achievement amongst learners (Hepworth & Walton, 2009; Levy & Petrulis, 2012). Peer negotiation is facilitated in the process of problem-solving such that students will be able to cultivate a stronger sense of ownership with regards to their tasks (Gross, 1999). Through IBL, students have been found to be more engaged in their work and eager to investigate the truth, eventually developing their inquiry projects along with their personal interests (Levy & Petrulis, 2012). This strategy has been shown to result in better performance of students in terms of their research skills, subject knowledge, and writing abilities (Chu et al., 2007; Chu et al., 2008; Frank et al., 2003).

5.1.2 Project-based learning (PjBL)

Project-based learning is an instructional approach that involves the carrying out of an investigative project (Blumenfeld et al., 1991; David, 2008; Marx et al., 1997; Thomas, 2000). An individual or group activity is implemented over a specified period of time and results in an output (e.g., product, presentation, or performance). Teachers, again, play the role of facilitators guiding their students throughout the project stages. In the process of project completion, students have been seen to develop research, problem solving, and decision making skills.

Open-ended assignments that are used in PjBL have been found to be effective in encouraging students to actively engage in information search and data evaluation (Prince & Felder, 2006). PjBL has also been found useful in teaching children with different learning styles, cultural and ethnic backgrounds, and ability levels (Railsback, 2002). Similar to IBL, students who take part in PjBL are offered the chance to explore their own interests, thus nurturing their individual strengths and enthusiasm in project work. Consequently, students develop a greater sense of responsibility as they take charge of their own learning processes (Alloway et al., 1996).

5.1.3 Inquiry project-based learning (Inquiry PjBL)

The integration of IBL and PjBL results in an innovative pedagogical approach called inquiry PjBL, which is solidly based on constructivist principles. Constructivism has been regarded as one of the leading learning theories since the 1980s (Mayer, 1996). Vygotsky (1987), one of the most well-known constructivists, stresses the importance of providing students with opportunities for active exploration to learn new cognitive skills under the guidance of a more skilled person through scaffolding. Dewey (1916) likewise suggests that students learn ideas and knowledge from experiences which are meaningful and significant to them. Through different forms of exposure, they would build their personal conceptualizations of the world piece by piece based on the knowledge they gain (Kuhlthau et al., 2007).

In contrast, more traditional approaches to teaching utilize a transmission mode

through which students learn by "copying word for word from a text or lecture and then reporting back, usually in the form of a test" (Kuhlthau, 1997, p. 710). In such approaches, students appear to have limited meaningful experiences, which limits the potential for knowledge construction. Nowadays, educators are increasingly favoring constructivist approaches as these have been shown to be more effective teaching concepts. Constructivist approaches allow students to be engaged in stimulating learning encounters. While each student begins with incomplete ideas, the dynamics of experiences allow for a gradual development of isolated ideas into a structured set of concepts and procedures (Kuhlthau, 2004; Singer & Moscovici, 2008).

A key concept in constructivist approaches to learning is scaffolding. Through scaffolding, teachers guide students in their discovery of new learning by providing support in the form of questions, demonstrations, or through the generation of hypotheses for explanations (Moran, 2007). Hmelo-Silver and her colleagues (2007) assert that such scaffolding is critical for students to learn in complex domains without excessive cognitive loads. What needs to be noted, is that the level of task difficulty has to be within the learners' zone of proximal development. In other words, the assigned tasks have to be of a level of difficulty that they are not likely to be able to complete them alone, but would be manageable and achievable when given mentoring guidance (Bee & Boyd, 2002; Rogoff, 1990; Vygotsky, 1987). These constructivist concepts are central to the structure of inquiry PjBL, and are expected to contribute significantly to students' independent learning.

The distinctions among IBL, PjBL, and inquiry PjBL are illustrated in suggested operational definitions that are summarized in Table 7. It is evident that inquiry PjBL integrates the key components of the inquiry process and the implementation of a group project. This approach is largely consistent with at least three out of the four key tasks that structure the learning and teaching activities in the curriculum reform in Hong Kong: Reading to Learn, Project Learning, and IT for Interactive Learning (CDC, 2001).

Table 7. Operational definitions of constructivist approaches

Terms	Definition
Inquiry-based learning (IBL)	A learner-centered approach focusing on questioning, critical thinking, and problem-solving. The learner is actively involved in formulating the question/problem.
Project-based learning (PjBL)	An individual or group activity that is implemented over a specified period of time, resulting in an output (product, presentation, or performance).
Inquiry PjBL	A constructivist approach that engages students in formulating a question/problem within their areas of interest. The answers to the question are generated through group activities that include information search, evaluation, and management. The entire process leads to an output (report and presentation) that is generated through the use of digital technologies.

5.2 Empirical evidence for the benefits of inquiry PjBL

Previous studies conducted among primary school students in Hong Kong using an inquiry PjBL approach suggest that this approach could be beneficial to both students and teachers. In the study conducted by Chu (2009), for example, students who used inquiry PjBL were able to progress from simple searching tasks towards a more investigative process of understanding learned facts. Teaching staff, parents and P4 students were found to hold positive perceptions on the influence of inquiry PjBL on eight dimensions of learning, such as information literacy, reading ability, writing ability, IT skills, subject knowledge, social and communication skills, presentation skills and research skills. Based on self-administered surveys, inquiry PjBL was reported to be beneficial in promoting the achievement of key learning outcomes (See Table 8 for detailed ratings). All these eight dimensions of learning are examples of 21st century skills which are expected to be acquired by students.

Table 8. Participants' perceptions on the dimensions of learning benefits from inquiry PjBL.

Dimension of learning	Teaching staff (n = 11)	Parents (n = 27)	Students (n = 141)
1. Information literacy	4.00 (.63)	3.74 (.68)	3.60 (1.12)
2. Reading ability	3.91 (.30)	3.26 (.99)	3.48 (1.07)
3. Writing ability	3.73 (.65)	3.18 (1.07)	3.48 (1.11)
4. IT skills	3.82 (.60)	3.37 (1.02)	3.28 (1.21)
5. Subject knowledge	4.18 (.75)	3.60 (.96)	3.88 (1.05)
6. Social and communication skills	3.82 (.75)	3.40 (.83)	3.72 (1.1)
7. Presentation skills	4.00 (.82)	n/a	3.40 (1.13)
8. Research skills	3.50 (1.14)	n/a	3.60 (.52)

Note: The respondents rated the influence of inquiry PjBL on different dimensions of learning according to a scale of 1–5, where 1 refers to (*none*) and 5 refers to (*a lot*) (Source: Chu, 2009).

Aside from these, students' critical thinking, problem solving, self-directed learning, and collaborative skills have also been reported to improve. For instance, a student wrote how they learned to collaborate with their groupmates in the context of inquiry PjBL. Chu (2009) has also shown that these benefits were evident in the higher quality of group output of the inquiry PjBL group compared to groups that used more traditional approaches. Parents also reported that the engagement of their children in inquiry PjBL enhanced their communication with each other, where the children spontaneously shared more information and experiences with their parents. Other investigations of the inquiry PjBL approach have also found associated improvements in IL skills (Chu, Tse, & Chow, 2011), and enhanced reading abilities and reading interests (Chu, Tse, Loh & Chow, 2011). These aspects that appear to benefit from inquiry PjBL are relevant aspects of 21st century skills.

5.3 Inquiry PjBL and 21st century skills

It appears that inquiry PjBL could be a useful approach for facilitating the development of 21st century skills among primary school students in Hong Kong. Table 9 outlines the consistencies between inquiry PjBL as evident in the Hong Kong context, and various aspects of 21st century skills.

Table 9. Positive effects of inquiry PjBL and its relevance to the components of 21st century skills

21st century skills	Description of 21st century skills	Related positive outcomes of inquiry PjBL
Core subjects and 21st century themes	Knowledge of core subjects (e.g. English, Mathematics, Science, General Studies) Interdisciplinary themes (e.g. global awareness, environmental literacy)	Reading abilities Writing abilities
Learning and innovation skills	Creativity and innovation Critical thinking and problem solving Communication and collaboration	Problem-solving skills Collaborative skills Presentation skills Reading interests
Information, media and technology skills	Information literacy ICT literacy Media literacy	Information literacy ICT skills
Life and career skills	Flexibility and adaptability Initiative and self-direction Social and cross-cultural skills Productivity and accountability Leadership and responsibility	Social and communication skills Self-directed learning skills Self-confidence Research skills

In brief, constructivist teaching approaches create opportunities for students to build their own knowledge by engaging them in stimulating learning experiences. Students are able to actively develop their understanding by expanding their existing knowledge through active reasoning (National Science Education Standards, 2007). Inquiry PjBL, as an approach that is in line with constructivist principles, could be an effective strategy towards equipping students with 21st century skills. Such an approach is expected to be most effective when digital technologies are utilized and when teachers are engaged in a collaborative teaching approach. These will be discussed in greater detail in the following chapters.

Chapter 6: A collaborative teaching approach

Although inquiry PjBL has been found effective in facilitating students' development of 21st century skills, there are constraints and challenges faced by both students and educators as they experiment with the new pedagogy. Collaborative teaching emphasizes teachers' joint efforts in co-planning and implementing teaching ideas (EDB, 2007b). Such a teaching approach has been found to be beneficial in enhancing student learning (John-Steiner, 1992; Murata, 2002; Thousand, Villa, & Nevin, 2006). It also reinforces the coordination of teaching staff and hence enables teachers to better monitor and scaffold their students during the process of project completion (Thousand et al., 2006). According to the Education Bureau (EDB, 2011b), the number of primary schools that have been actively adopting collaborative teaching is currently increasing.

6.1 Extended teaching team

The involvement of librarians in collaborative teaching has been advocated by IL researchers and practitioners (Donham, Bishop, Kuhlthau, & Oberg, 2001; Harada, Kirio & Yamamoto, 2008; Kuhlthau, Caspari & Maniotes, 2007; Todd, 2008). The growing involvement of librarians in collaborative teaching across different educational settings, characterized by partnerships between librarians and subject teachers (Donham et al., 2001) is evident in a number of recent studies (Chu, Chow, Tse & Kuhlthau, 2008; Konzal, 2001; Mokhtar & Majid, 2006; Montiel-Overall, 2008; Warmkessel & McCade, 1997). While subject teachers contribute their domain knowledge, librarians play a key role in helping students develop their IL skills, enabling students to evaluate and interpret relevant information (Harada, 2010). Kuhlthau et al. (2007) suggested that optimum collaboration can be made possible

through a flexible three-member team consisting of two subject teachers and one librarian who work together in guiding students' inquiry learning projects.

Librarians have taken a central role in promoting IL within the context of regular curricula, and have become more involved in student education (Limberg & Alexandersson, 2003; Montiel-Overall, 2008). Professional guidelines for librarians have evolved such that collaborative work with teachers has become integral to aiding the development of students' IL proficiency (AASL, 2007). Despite much anecdotal evidence regarding successful teacher and librarian collaboration, research that looks into the specific practice of teacher-librarian collaboration in elementary schools is scarce (Montiel-Overall, 2008).

The collaborative teaching group is referred to as an extended team when school administrators and parents are also included as participants. In the Hong Kong context, such extended collaborative teaching approach, has been employed when implementing inquiry PjBL. Three kinds of subject teachers (General Studies, Chinese language, IT) and the school librarian have been involved in carrying out inquiry PjBL among primary four students (Chu, 2009). The teachers' respective roles were in accordance with their areas of expertise such that students were given sufficient training to acquire the skills and knowledge (i.e., subject knowledge, IL skills, reading and writing skills and IT skills), which are essential for carrying out inquiry projects. Consistent with the extended team recommended by Kuhlthau et al. (2007), school administrators and parents were involved as well. Figure 2 illustrates the inquiry PjBL model that has been used in Hong Kong primary schools (Chu, 2009). These members of the extended team could potentially be engaged in further implementations of inquiry projects.
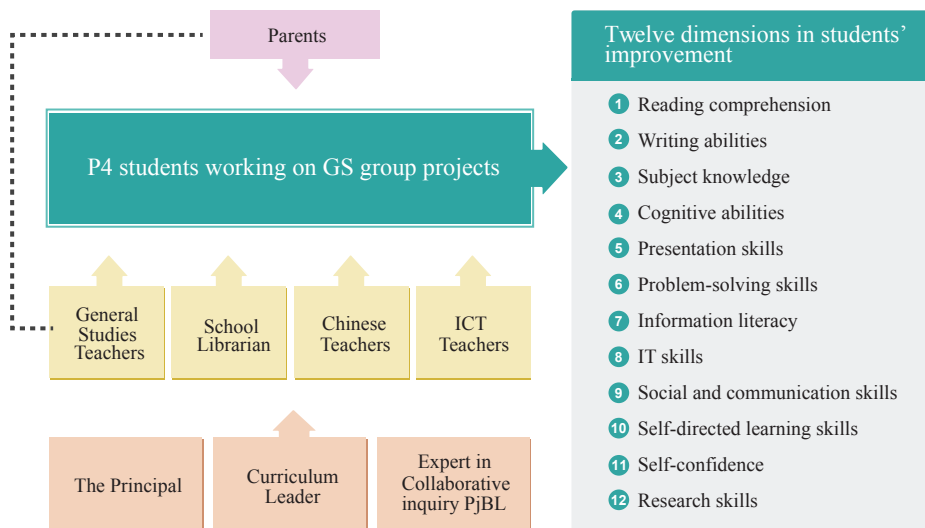
Figure 2. Inquiry PjBL model illustrating the members of the extended team (adapted from Chu, 2009)

Curriculum leaders are known to make contributions to school restructuring by coordinating the teaching staff, and principals are held accountable for school effectiveness by providing support and motivation (Chen, 2008). Thus, the role of the principal and the curriculum leader in this model is important and explicitly outlined. An expert in inquiry PjBL and library and information science is also included in the model, as someone who could guide the implementation of the different components of inquiry PjBL which is new to many teachers.

Apart from members of the school, the role of parents is indispensable in students' learning. A number of researchers (e.g., Bowen & Lee 2006; Cheung, 2009; Epstein, 1984; Lee & Kao, 2009; Seginer & Vermulst, 2002) have advocated that parental involvement is beneficial to positive learning outcomes such as academic achievement and personal development. The Hong Kong government has also recognized this advantage and has given increasing attention to parent-school communication. A range of programmes such as the Home–School Co-operation Committee (Education Commission, 1992) were launched to encourage better bridging

between parents and schools. In addition to this, the government has included par-ent-school linkage as a benchmark for the quality assurance evaluation of schools (Education Department, 1997). Parent-school communication was also highlight-ed in the educational reform of 2003 (Education and Manpower Bureau, 2003).

Unfortunately, parental involvement in primary school education in Hong Kong seems to have taken a form that is not really a partnership with schools (Llewellyn, 1982; Ng, 1999; Pang, 2004). Parents generally care about their children's aca-demic work more than their gains in other areas (HKCSS, 2010; Shen, Pang, Tsoi, Yung & Yip, 1994; Tam & Chan, 2010). As indicated by Tam and Chan (2010, p. 8), parents tended to believe that "homework is important for learning". In the Chinese society, parents tend to get heavily involved in their children's schoolwork instead of partnering with the schools. As evident in the recent findings of the Hong Kong Council of Social Service (HKCSS, 2010), almost half of the parents devoted time to helping their children in their homework every single day.

In the collaborative teaching model, the parental role is recognized, but parents are encouraged to provide support to their children only when they really needed help. This is because inquiry PjBL is a kind of self-directed learning that advocates students' responsibility and independence in learning. When parents are assured that students would receive adequate support in their learning activities, they are able to limit their contribution to their children's schoolwork, as reported by both parents and children (Chu, 2009).

6.2 Benefits associated with a collaborative teaching approach

A collaborative teaching approach in guiding students through their inquiry pro-jects could be beneficial to students. This was evident in a study conducted by Chu (2009) among Hong Kong primary 4 students that utilized the model shown in Figure 3. Students, teachers and parents were found to have positive perceptions on the advantages of a collaborative teaching approach. Based on self-adminis-tered surveys, participants gave ratings that offer evidence of the impact of such

approach (see Table 10 for details of ratings). In general, students thought that the various contributions of the collaborating teachers helped them complete their projects. Moreover, students did not perceive the project as too difficult or too easy, indicating that the scaffolding from various teachers and the librarian was within the students' zone of proximal development.

Table 10. Participants' perceptions of the helpfulness of the components of a collaborative teaching approach for inquiry PjBL in a Hong Kong primary school.

Dimension of learning	Teaching staff (n = 11)	Parents (n = 27)	Students (n = 141)
1. Overall school support	3.90 (.57)	3.26 (.99)	3.71 (.69)
2. Helpfulness of general studies assignments	3.86 (.38)	n/a	3.63 (1.17)
3. Helpfulness of Chinese in-class reading/ writing assignments	4.43 (53)	n/a	3.63 (1.17)
4. Helpfulness of Chinese take-home writing assignments	4.14 (.69)	n/a	3.65 (1.01)
5. Helpfulness of librarian	4.29 (.75)	n/a	3.58 (1.04)
6. Helpfulness of IT teacher	3.86 (.69)	n/a	3.47 (1.27)

Note: The respondents answered according to a scale of 1–5, 1 being *not at all* and 5 being *very much so* (Source: Chu, 2009).

In this study, teachers who participated in the collaborative approach for inquiry PjBL also expressed a number of gains for themselves and the school. Primarily, the new method increased the opportunities for teachers to communicate with one another. For instance, one of the teachers noted that collaboration resulted in "some positive effects on curriculum development and integration between subjects as we decreased the overlapping topics, which made it more efficient for teachers" (Chu, 2009, p. 1677). Other positive aspects of collaborative teaching included integration of subject areas, which facilitated students' knowledge incorporation, and enhanced the chances of determining effective teaching strategies.

On the other hand, the teachers also reported that the implementation of a collaborative teaching approach for inquiry PjBL was challenging owing to time constraints. One of the participating teachers said, "There were more papers and journals to mark. I had to guide the students in doing the Chinese and GS exercises. The workload increased and I had to do extra marking" (Chu, 2009, p. 1681). In

spite of this, teachers always found ways to complete the tasks.

In typical practice, teachers assess students' performance, give feedback, and evaluate learning difficulties. In a collaborative teaching approach, teachers take a step further by identifying learning objectives in different subject areas and engaging themselves in discussions with other teachers. Such discussions may contribute to sustained learning outcomes (EDB, 2011b). Essentially, teachers could be more responsive to students' needs when different subject teachers contribute to the co-planning and implementation process (EDB, 2011b; Thousand et al., 2006). The role of librarians in a collaborative teaching approach for inquiry PjBL was critical, and their contributions to the project appeared to be well appreciated more by the subject teachers than by the students. This is most likely due to the librarians' contributions being less direct as perceived by students owing the nature of their tasks (e.g., block loans of several hundred books from the central library, preparation of newspaper clippings).

6.3 Factors affecting the implementation of a collaborative teaching approach

The implementation of collaborative teaching is affected by various factors. While some of the factors are seen contributing to a successful implementation of the teaching approach, some of them may hinder the adoption process. In the following sections, these enablers and inhibitors will be discussed.

6.3.1 Enablers

A number of factors that have been identified to be significant in promoting a collaborative teaching approach in inquiry PjBL are summarized in Table 11. Enablers are subtle elements that contribute to a successful implementation (Kuhlthau et al., 2007). The first important enabler that has been noted is the strong leadership of the administration perceived by the rest of the staff. If the principal of the school displays enthusiasm in the new teaching approach, teachers will receive more encouragement and feel more motivated to experiment with the approach.

Table 11. Factors affecting the implementation of a collaborative teaching approach in inquiry PjBL

Enablers	Inhibitors
Strong administrative leadership	Limited teaching time
Formal meetings	Workload of teachers
Informal discussions	Limited teaching experience
Commitment to IL development	
Constructivist view of learning	
Well-designed assignments	

The participating staff would also need to gain familiarity with the new teaching method and acknowledge the potential benefits of its implementation. As such, one other enabler has been identified to be the scheduling of formal meetings, which would ensure that all members of the teaching team understand and are convinced of the objectives and plans of the project. Moreover, the formal meetings were also felt to be necessary to ensure that strategies are well formulated and executed to minimize the increased workload of the teachers brought about by the new approach.

Informal discussions among the teaching staff have also been found to be crucial at different stages of the implementation of the project. One subject teacher would serve as the coordinator, the main coordinator of communication among the team members. Such discussions are important in determining students' specific needs. For instance, in one case, the librarian may modify the components of information literacy training sessions depending on the students' ability. In another case, subject teachers may share their teaching progress with one another so that they could adjust the pace of teaching and according the students' needs. Other enabling factors that have emerged in earlier studies include commitment to information literacy development, a constructivist view of learning, and well-designed assignments (Kuhlthau et al., 2007).

6.3.2 Inhibitors
Inhibitors are factors that may delay the progress and success of the implementation

of a collaborative teaching approach in inquiry PjBL (Kuhlthau et al., 2007). One inhibitor that has been identified was teachers' limited time resources. Related to this, inquiry PjBL has been perceived by teachers as contributing to their increased workload, particularly more paperwork. As such, to ensure a more successful implementation of a collaborative approach in inquiry PjBL, it is recommended that strategies be planned to reduce the potential overload of the collaborative team members.

Another inhibitor that has been noted is the relatively limited experience of teachers in facilitating inquiry PjBL as a learning activity. While teachers may encounter difficulties with the new teaching approach, the inhibitory effect decreases with time and greater experience. Essentially, it has to be considered that a change in teaching approaches takes time before it gets implemented smoothly.

One potential strategy that could streamline the process of preparing documents and materials used in inquiry PjBL is the incorporation of more recent online and mobile technologies. Such tools are believed to aid teachers in managing more efficiently and effectively the output of their students. There is a range of online tools and Web 2.0 applications that have increasingly been generating interest among educators. For instance, social networking tools such as Facebook and Twitter have increasingly been used for diverse purposes, including education. Wiki, on the other hand, has been attractive to educators due to its potential support for collaborative learning. Nevertheless, the utilization of online technologies in teaching could possibly result in other inhibitory factors such as the Internet network hardware and infrastructure of a school, and teachers' own knowledge and skills in relation to digital technologies. These issues related to the use of Web 2.0 technologies in inquiry PjBL will be further discussed in Chapter 7.

Chapter 7: Web 2.0 (wiki) technologies and upper primary students' 21ˢᵗ century skills development

7.1 Web 2.0 technologies and wiki

With rapid technological advancement and with the new generation being described as digital natives (Cheese, 2008), integrating Web 2.0 technologies (e.g., blogs, wikis) into education has been seen as beneficial in facilitating teaching and learning (Chu, Chan & Tiwari, 2012; Chu & Kennedy, 2011; Richardson, 2006). Web 2.0 is a collective term that encompasses various Web developments and its key concepts such as collaboration, user participation, file sharing and social networking (Chiang, Huang & Huang, 2009). Web 2.0 technologies facilitate quick dissemination of information and this explains why they have been generating interest from educators as tools to support teaching. Wiki is one of the more popular forms of Web 2.0 technologies.

A wiki is often described as "a collaborative web space where anyone can add content and anyone can edit content that has already been published" (Richardson, 2006, p. 8). Studies on the application of wiki at different levels and domains of education – primary, secondary and tertiary across different subject areas including Chinese, English, General Studies, Geography, Science, Knowledge Management and Information Management – have shown its benefits to students at large (e.g. Chu, 2008; Fung et al., 2011; Law et al., 2011; Li et al., 2010; Mak & Coniam, 2008; Pifarre & Starrman, 2011; Tavares & Chu, 2011; Woo et al., 2010; Woo et al., 2011; Yu et al., 2011).

This chapter focuses on exploring the use of Web 2.0 tools, particularly wiki, in primary school settings. An instructional design on how wiki has been implemented

in primary school classrooms will be discussed, with illustrations from two studies that have been conducted in Hong Kong. One study involved the implementation of a group project in General Studies in the Chinese language, while the other study involved students doing collaborative writing in English on wiki. Google Sites was used as a teaching and learning platform. Findings from these studies form the basis of recommendations for integrating wiki into primary school classroom teaching.

7.2 Web 2.0 as a teaching tool

Integrating Web 2.0 technology into mainstream education is likely inevitable because technology advancement has made significant changes on the knowledge and skills expected from students, and on the possibilities in teaching methods that suit students' learning styles (Dede, 2007). Web 2.0 as a tool has been found to be effective in facilitating learning and teaching in schools. Studies on the application of such technology, wiki in particular, have yielded positive outcomes in the primary school context. Pifarre and Starrman (2011) point out that wiki opens up shared dialogic spaces for students to discuss ideas and accomplish tasks together using such ideas, thus scaffolding their critical thinking and problem-solving skills (Woo et al., 2011). In addition, through the exchange of ideas or peer comments on wikis, students have been shown to be able to give constructive feedback on the content and language use of their shared work (Mak & Coniam, 2008; Tavares & Chu, 2011; Woo et al., 2010). Walton and Hepworth (2011) have highlighted the positive impact of online social network learning, which incorporates discussion, reflection and peer assessment, on students' information literacy development. The processes generated by using wiki appear to have promoted collaboration, enhancement of work quality (Chu, 2008), and development of social skills in the course of negotiation (Fung et al., 2011).

Wiki was used in two subjects in primary level 5 (P5) in four primary schools in Hong Kong. In the General Studies (GS) subject, students were engaged in inquiry group projects (i.e., inquiry PjBL as discussed in Chapter

5) in the Chinese language. The group project was implemented over a period of 2 to 3 months during which a wiki webpage, which was accessible to the students, served as a platform for their communication and co-construction of output. In the English language subject, students participated in collaborative writing. During the first term, students engaged in collaborative writing on paper to experience collaboration with their peers and evaluation of one another's work. In the second term, a wiki was introduced and students were guided to move from paper-based collaborative writing to using an online technology.

A wiki with a multilingual interface covering both Chinese and English would be desirable. Since the language and cognitive abilities of primary students are in the developing phase, it is believed that a wiki using the mother tongue (Chinese) of primary students would allow them to learn technological applications better. Among the popular wikis (i.e., Mediawiki, Pbworks), it was found that only Google Sites provides an interface with various languages, including Chinese and English. Therefore, Google Sites was selected to be the wiki platform for both GS project and English collaborative writing. As such, P5 students could utilize the Chinese interface for their GS group project where classes were conducted in Cantonese. On the other hand, they could choose either the Chinese or English interface for their English collaborative writing project.

On Google Sites, the collaborative platform allowed students to present their project with different sections separated by hyperlinks. The wiki was also equipped with multimedia features through which students were able to present their output in the forms of texts, tables, pictures and videos. A sample of the students' GS project on wiki is illustrated by the interface presented in Figure 3. As evident in this sample, students could upload different types of materials through the file attachment feature. Everyone else who had access to the wiki platform (peers and teachers) could leave comments, making it possible for students to receive timely feedback and comments from both their teachers and classmates.

While members of the same group could revise the group project virtually any-time, they could also review earlier versions made by their peers. Besides co-construction of group work, the students could also utilize the platform for communication and negotiation purposes through wiki's commenting feature. The teachers, who had access to students' online platforms, were able to continuously monitor students' work output and provide evaluative feedback when necessary.

Figure 3. Sample of students' GS project work on Google Sites (with annotations in red)

7.3 Evaluation of the use of wiki in primary school teaching

To evaluate the use of wiki, an online survey was administered to 420 P5 students who participated in the GS group project. The online survey consisted of questions that were adapted from a scale that examined four factors: learning/pedagogy, motivation, group interaction and technology (Hazari, North & Moreland, 2009; see Appendix 1 for the actual questionnaire used). The questionnaire was anchored on a 5-point Likert-type scale which measured the extent to which students agreed or disagreed with the 20 statements that described wiki's influence on their learning (with 1 being "strongly disagree", 5 being "strongly agree"). In addition to this, group interviews were conducted with a total of 42 students who took part in the English collaborative writing. In these interviews, the students' insights on the use of wiki in collaborative writing were explored. Specifically, students were encouraged to talk about how they used wiki for their English collaborative writing

and compared it with previous group work that used the more traditional word processing software. Students also talked about both the advantages and challenges associated with using the new technology. The interview responses were analyzed qualitatively to uncover common themes.

7.3.1 Findings from the online survey (GS group project)

It appears that students perceived wiki as a useful instrument for learning (Chu, Wong, Lee, Chow & Ng, 2011; Tavares & Chu, 2011). The average of the students' responses on the rating scales indicates positive perceptions on the effects of wiki on the four aspects of learning. As shown in Table 12, all of the Likert scores were above 3.0, which is the midpoint of the scale. The sample sizes for the different items vary because some students did not respond to some of the items in the survey.

Table 12. Students' responses to the influence of wiki in GS group project work.

Statements regarding wiki's influence on students' learning	Likert Score (SD)	Sample Size
Factor 1: Learning/Pedagogy		
A1. Use of the wiki enhanced my interest in the course	3.73 (±1.16)	385
A2. I would like to see wikis used in other courses	3.81 (±1.20)	384
A3. I will retain more material as a result of using the wiki	3.77 (±1.10)	384
A4. I participated in the assignment more because of using the wiki	3.65 (±1.10)	384
A5. Use of the wiki aided me in achieving course objectives	3.87(±1.06)	385
Factor 2: Motivation		
B1. Benefit of using the wiki is worth the extra effort and time required to learn it	3.58 (±1.12)	383
B2. I would recommend classes that use wikis to other students	3.71 (±1.15)	380
B3. I would prefer projects that use wikis over other projects that do not use wikis	3.71 (±1.19)	384
B4. I will continue to use wikis in other project works	3.75 (±1.15)	384
B5. I stayed on the task more because of using the wiki	3.73 (±1.09)	383
Factor 3: Group Interaction		
C1. I liked seeing other students' interaction with material I posted in the wiki	3.56 (±1.10)	385
C2. Use of the wiki for the assignment helped me interact more with students	3.64 (±1.11)	381
C3. Because of using the wiki, my group was able to come to a consensus faster	3.61 (±1.10)	385
C4. I learned more because of information posted by other students' in the wiki	3.63 (±1.11)	381
C5. Use of the wiki promoted collaborative learning	3.73 (±1.09)	383
Factor 4: Technology		
D1. The wiki interface and features were overall easy to understand	3.93 (±0.98)	386
D2. Benefits of using the wiki outweighed any technical challenges of its use	3.52 (±1.17)	384
D3. Browsing/editing information in the wiki was easy	3.84 (±1.09)	386
D4. Compared to other online discussion board, the wiki was easier to	3.59 (±1.21)	384
D5. Technical features in the wiki helped enhance my learning	3.76 (±1.07)	385

Notes:
1. The respondents answered according to a 5 point Likert-type scale, 1 (Strongly Disagree) and 5 (Strongly Agree). Items to which the respondents answered "don't know" and unanswered were not included in the analysis.
2. The mid-point of the rating scale is 3 (Moderate). Hence, any rating that is larger than 3 would be considered as edging towards positive perception and vice versa.

Learning/ Pedagogy

The aspect of 'Learning/ Pedagogy' assesses students' perceptions on the effectiveness of wikis in facilitating the retention of materials, encouraging active participation and aiding students in achieving course objectives. Students' ratings were all in the positive side of the scale, indicating that they perceived wiki as an enabling tool for learning which enhances their interests. While students tended to perceive wiki as helpful in achieving course objectives, they also supported the use of wiki even in other school subjects.

Motivation

Students also reported that the use of wiki enhanced their enthusiasm for the group projects. With the introduction of the wiki platform, technological constraints could have hindered students' interest in using the new technology. On the contrary, students appeared to believe that the benefits associated with using wiki is worth their time and energy resources devoted to learning it. Moreover, teachers noted that students, who had not been able to complete their work in the past with the traditional pen-and-paper approach, became more enthusiastic about their work and succeeded in producing work of higher quality when wiki was used. It appears that being able to employ different media to present their GS group project on wiki (e.g., pictures, video-clips) motivated students to complete the given tasks.

Group interaction

Enhanced communication and ability to reach a group consensus were also observed with the use of wiki. It also appeared that students perceived wiki to have facilitated collaboration, and thus shared learning during their group project implementation. Moreover, students acknowledged that it was more convenient to communicate with their group members on wiki, as commented by one student, "*Before using Google Sites, we had to speak to one another before deciding what to edit which was very inconvenient. With Google Sites, we now just have to post our concerns on the web and everyone can see it*". Many students believed that the collaborative learning process with wiki allowed them to learn more from

their peers, which in turn, facilitated their acquisition of knowledge and skills.

Technology

Despite wiki being a relatively new learning platform for students, the impact of technology was perceived to be positive. Specifically, the interface and technological features of wiki were deemed generally easy to understand. Students also found that managing information materials on the wiki was efficient. Moreover, the Internet access allowed students to work on their projects "anytime and anywhere". Unlike using a word processor (e.g., Microsoft Word) where students have to work in their own space and time, they could work on the project with their group mates simultaneously on wiki and exchange views through the site. The online nature of the platform also facilitated easier access to shared information, as one student said "*Google Sites is better because we can easily locate all the information we need online*".

7.3.2 Findings from the group interviews (English Collaborative Writing)
Peer learning

The group interviews indicate that students generally thought Web 2.0 facilitated peer learning and enhanced interpersonal relationship skills. Compared to the pen-and-paper mode of collaboration, students stressed that wiki is more advantageous because it created an avenue for them to leave comments on each other's work. Essentially, students were presented with ample opportunities to evaluate each other's work and reflect on their own, possibly leading to improved quality of their writing. In the interaction between two students, one of them stressed, "*If we use Google Sites as the collaborative platform, we get to read the pieces of writing from other classes, exchange views and comment on our classmates' work. If we write on paper, we can only read a few pieces.*" The other student responded that "*Google Sites allows other people to comment on our work and we can learn more from that.*" In general, students welcomed having the chance of sharing their work on wiki.

Students also reported that help and support were offered to one another on the wiki platform. As illustrated by the following example, a student wrote, "*Your writing is good but I do not [understand] the meaning of truthful*" after reading his classmate's work and the writer responded by saying, "*truthful means honest.*" Some more capable students made detailed suggestions to their classmates with respect to grammar and vocabulary while others contributed in raising stimulating questions which led to revisions. The possibility of reading the work of their peers also allowed the students to have greater access to their shared output, consequently widening their learning and allowing them to help each other by way of suggestions or encouragements. Figure 4 illustrates some comments made on language use by various students in a class and the corresponding revisions made on the writing.

Figure 4. Comments made on grammar by various students and the corresponding revisions made by the group on their writing (indicated with words in red and green)

Technology

Consistent with the findings of the online survey, the group interviews also revealed that students found the experience of using wiki for their English collaborative writing very rewarding due to its accessibility. As expressed by a participant of the study: "*When we use Google Sites, all our group members can do the project at the*

same time, unlike using Microsoft Word. This makes things simpler and easier to manage." No major technological difficulties with using wiki were reported by students despite being probed about it. On the contrary, students found using the wiki technology convenient and easy to use.

7.4 Evaluation of findings in relation to teaching

A total of 44 teachers from the four participating schools were interviewed after using wikis in both GS and English collaborative writing projects. While the teachers faced some challenges, wiki technology was nevertheless perceived as an effective teaching aid. With the revision history function in wikis, information could be accessed in terms of what was revised, who made the revision, and when the revision was done (Richardson, 2006). Even the number of revisions in a document could be monitored. As such, teachers were able to monitor the contribution and engagement of students in the group work, providing a form of objective basis for the assessment of students' performance (Chu, 2008; Woo et al., 2011; Yu et al., 2011).

The use of Web 2.0 technologies, especially wikis, has been shown to have a positive impact on the implementation of inquiry PjBL. Both students and teachers reported educational benefits, and the current evidence offers some support to the potential benefits of introducing wiki into the collaborative teaching model as shown in Chapter 6. The empirical basis for teaching practice could be further strengthened in future projects that would continue to evaluate the use of digital technologies with inquiry PjBL. Subsequent work in the future might also consider the development of teaching materials that would enhance the support for teachers during implementation. Based on the current findings, information and suggestions on using wikis in teaching will be presented in Chapter 9.

Part Three:
A practical guide for implementing inquiry PjBL using a collaborative approach and Web 2.0 technologies

Chapter 8: Guide & suggestions for the first year of intervention

In the previous chapters, we have discussed the implementation and effects of inquiry PjBL. In chapters 8 and 9, practical strategies are presented, which aim to guide teachers towards a more concrete picture of how inquiry PjBL could be brought into classroom teaching.

It is proposed that, in order to help students develop the necessary skills and knowledge to conduct inquiry projects independently, a two-year teaching plan should be administered. In the first year of intervention, the teachers would work collaboratively to equip their students with the essential inquiry-related skills and abilities such as IL, reading and writing abilities and IT-related skills (e.g., Microsoft Excel, PowerPoint and Chinese input methods). It is crucial that students are given sufficient time to develop as well as strengthen such research and presentation skills so that they could effectively apply them in more challenging projects of an inquiry nature in the following year. In our research project, the teaching programme began at Primary 4 and teachers continued to work with the same group of students as they moved up to Primary 5. However, it should be noted that the proposed teaching strategies and schedules would have to be adapted and modified to suit different students' abilities and schools' diversified needs.

In this chapter, focus is placed on the teaching strategies and suggestions for the first year of introducing the proposed learning approaches. To facilitate the teachers' exploration and implementation of the new teaching methods, an overview is presented here in the form of an integrated timetable. The important points in a collaborative teaching approach are highlighted. The unique roles of teachers and the school

librarian in the collaborative teaching process are also described in detail in tabular form. Finally, specific timetables for subject teachers and the school librarian are given to illustrate the potential learning activities and the associated teaching goals.

8.1 Suggested integrated timetable for equipping students with knowledge and skills for their inquiry group projects (first year)

In the first year of experiencing the new teaching approaches, students typically develop basic skills such as research skills, IL, reading and writing abilities and IT skills (e.g., PowerPoint). The timetable shown in Table 11 could be modified to best fit the schedule and students' abilities in different schools. The collaborative nature of this teaching strategy is within the context of four subject areas that have been chosen for this project: General Studies, Library Lessons, Chinese Language, and Computer Studies. The first term is spread out over a period of 12 weeks, within which the teaching and learning activities are introduced and carried out. At the end of the 12-week period, the students would have completed their GS projects and be ready for presentations. All the teaching and learning activities in the timetable are expected to contribute towards the students' final project output.

The GS components are characterized by KWL, 5W1H, and mind-mapping. KWL is a graphic organizing approach which aims to enhance students' logical thinking by prompting them to relate their experiences to three categories: what I *Know*, what I *Want* to know, and what I *Learned*. The 5W + 1H is another approach to these learning activities, where 5W represents the question-words *Who*, *What*, *Why*, *When* and *Where* while 1H refers to *How*. Teachers could facilitate the development of students' thinking skills by helping them identify these components from any piece of information. Mind-mapping is an exercise that has been known to help students develop their research topics and methods in a systematic way.

Library Lesson prepares students by empowering them with the ability to search for, access, evaluate and cite information. For instance, WiseNews is introduced to students as a local online database for Hong Kong primary schools, which has been shown to be useful in searching for information regarding General Studies (GS) projects (Chow et al., 2007). Media education is targeted at providing students with the skills to evaluate the relevance and reliability of the information in newspapers, online news databases and other reference books. The Chinese Language studies consist of learning activities that focus on improving students' reading comprehension and writing skills. Last but not the least, the Computer Studies component addresses the skills that will allow students to use technology in their learning processes.

In the second term, students would engage in a relatively more complex group project. Besides basic IT literacy, they will then demonstrate research skills that progresses from searching for relevant information, towards conducting basic information analysis. Upon completion of this academic year, students would have improved reading and writing capabilities, developed ICT skills and IL profieiency such that they would be able to identify relevant information independently, and present their output effectively using visual aids (e.g., Microsoft PowerPoint).

Table 13. The Integrated Teaching Timetable of the 1st Term (first year of intervention)

Week	General Studies	Library Lesson	Language (Chinese)	Computer Studies
1			Reading Comprehension Assessment 1 (Narrative)[1, 2]	Chinese Input Methods
2			Reading Comprehension Assessment 2 (Expository)	
3			Writing Assessment 1	
4		Library search and web searching strategies and skills	Literacy training 1[3]	
5	KWL; 5W+1H; Mind-mapping	WiseNews	Self-reflection 1[4]	
6		Media education	Literacy training 2	
7	Groupings, topic chosen and information collection	Information Literacy Assignment 1[5]	Self-reflection 2	PowerPoint
8	(Students collecting information)		Literacy training 3	
9			Self-reflection 3	
10	Data analysis and writing up the report			
11				
12	Oral presentations (e.g., PowerPoint, drama, or video production)			

[1] The reading/writing assessments are meant to evaluate students' reading/writing abilities prior to the commencement of the inquiry group projects so that schools and teachers would have objective basis of evaluating the effectiveness of the proposed inquiry PjBL approach in strengthening students' reading/writing abilities. In addition, it is recommended that the teachers go through the answers with students shortly after they are tested so they can learn from their mistakes.

[2] The two reading comprehension assessments are different in a sense that one covers a piece of narrative writing while the other consists of an expository passage. This is designed understand the students' reading abilities better, as different reading skills and techniques are required to deal with different types of texts.

[3] Literacy trainings are in-class exercises designed to develop students' reading comprehension and writing abilities. Students are presented with a passage and are required to find out the topic sentences of each paragraph and outline the key ideas of the text with around 100 – 150 words. A sample of the literacy training could be found in Appendix 3.

[4] Self-reflection is a homework done in the form of journal writing. The task could be a book review, or collecting articles related to their GS projects and writing a summary and review of the collected information. This exercise aims to develop students' abilities in writing and organizing information.

[5] Information literacy assignment aims to provide students with opportunities to apply what they learn from the library lessons to a real context. A sample of the worksheet can be found in Appendix 4.

Table 14. The Integrated Teaching Timetable of the 2nd Term (first year of intervention)

Week	General Studies	Library Lesson	Language (Chinese)	Computer Studies
1			Reading Comprehension Assessment 3	Chinese Input Methods
2			Reading Comprehension Assessment 4	
3			Writing Assessment 2	
4		Library lessons (School librarians are encouraged to design the teaching content according to their students' abilities and needs)	Literacy training 4	
5	KWL; 5W+1H; Mind-mapping		Self-reflection 4	Excel
6			Literacy training 5	
7	Groupings, topic chosen and information collection	Information Literacy Assignment 2	Self-reflection 5	PowerPoint
8	(Information collection)		Literacy training 6	
9			Self-reflection 6	
10	Information analysis			
11	(Information collection)			
12	Information analysis and writing up the report			
13				
14	Oral presentations			
15				

8.2 Teachers' role in the first year of intervention

In order to facilitate students' inquiry learning, teachers are expected to assume the role of facilitators who assist their students' learning and foster their interest by providing the necessary scaffolding and support. Table 15 below illustrates the roles and responsibilities of each subject teacher as they implement inquiry PjBL using a collaborative teaching approach. GS teachers not only focus on advancing students' subject knowledge, but also on integrating the development of research, communication and presentation skills into their lessons. Language teachers integrate reading comprehension and writing tasks with the topics of GS group projects. The school librarian ensures the development of students' IL skills, and the Computer Studies teacher takes care of the skills needed to utilize digital technologies in learning opportunities.

Table 15. Roles of different subject teachers and the school librarian in the first year of intervention

GS Teachers	Language (Chinese) Teachers	Computer Studies Teachers	School Librarian
• Assist students in mastering their *subject knowledge* • Facilitate students' development of their *research, social and communication,* and *presentation skills* • Monitor and give constructive feedback on students' questioning skills • Teach students how to evaluate the relevance of information sources • Assess students' presentation using PowerPoint or other means such as staging a drama • Reinforce students' ability to reflect by asking them to do a reflection on wiki upon project completion • Foster students' critical thinking skills through the implementation of peer evaluations	• Facilitate the enhancement of students' *reading comprehension* and *writing abilities* • Give constructive feedback to students on their writing through the assessment of various writing tasks • Provide students with reading passages that are related to the GS topics • Develop students' oral presentation skills by maximizing opportunities for students to use GS topics in their practice for oral presentations	• Equip students with IT skills • Provide training on Chinese input methods and the use of Excel and PowerPoint • Train students to effectively use technology (presentation software such as PowerPoint) as a tool to enhance their presentation skills	• Facilitate students' development of information literacy skills (e.g., the ability to evaluate the usefulness of a piece of information) • Ensure students' access to a variety of information sources such as books, news clips and web sources that would address a variety of students' needs

8.3 Teaching suggestions for subject teachers (first year)

8.3.1 Suggested teaching schedule for General Studies teachers

It is important for GS teachers to allow students to freely choose a project topic according to their interests. Students' interest is one of the more essential factors in engaging students actively in their inquiry group project work (Chu, 2009).

In the first term of teaching, GS teachers may initially introduce students to the concepts and application of KWL, 5W+1H and mind-mapping. These concepts reinforce students' logical thinking and are found to be useful in assisting them in formulating highly relevant research questions and producing well-structured projects. After that, teachers could divide students into groups and guide them in their search for information relevant to their topics. Subsequently, teachers could teach them how to summarize the information found and conduct basic analysis. Upon project completion, students present their output in the form of written reports.

In the second term, teachers could use a similar teaching schedule as that adhered to in the first term, starting with knowledge review with the help of the three organizers, KWL, 5W+1H and mind-mapping. Students could then be encouraged to use these tools to identify their research areas and come up with research strategies for a new group project. Teachers could ask students to construct mind-maps with pen and paper. At this stage, students could be expected to conduct a more comprehensive and thorough analysis of their gathered resources, relative to their output in the first term. They could be required to present their findings using charts or other forms of visual illustrations in the form of oral presentation or any other means preferred by the students.

In terms of evaluation, assessment for learning should be given major emphasis. Teachers should monitor students' learning process and offer guidance when needed instead of just focusing on grading the final reports. In addition to teachers' evaluation, self- and peer- evaluation opportunities should also be maximized. Table 16 illustrates the suggested teaching schedule.

Table 16. Suggested teaching schedule for General Studies teachers

Session	Theme	Learning activities
1 2	KWL; Five Ws and One H (5W+1H); Mind-mapping	• Introduce the definition of KWL (What do I *K*now?; What do I *W*ant to know?; What did I *L*earn?) by using worksheets. Students could fill in the columns of K and W in accordance with their chosen topics of the GS project. The column of L would be filled in after students have learnt about the 'Five Ws and One H' and experienced some form of mind-mapping. • Class activities: Show the reading materials to stdents and guide them in finding out the 5W+1H (who, when, where, what, why and how). After that, teachers could discuss the answers with the students in class. • Homework: Students would identify the 5W+1H in the assigned reading materials. • Illustrate the idea of drawing mind maps briefly, and suggest that students incorporate 5W+1H into their mind maps. • Students could then construct a mind map using pen and paper on the topic of their GS project to clarify their thoughts and facilitate logical thinking. • Teachers could comment on students' mind maps and give them suggestions on how to improve their mind maps, depending on their strengths and weakness. • Students could bring back the completed KWL worksheets in week 2. Teachers could direct students to identify from the worksheets their areas of interested, and encourage them to collect information accordingly.
3	Groupings and Topic selection	• It is recommended that each group would consist of 4-6 students, with a mixture of boys and girls, and of students with various learning abilities (Harrison et.al, 2002; Fiske & Neuberg, 1990; Williams & O'Reilly, 1998). • Amongst the main themes, teachers would assist students in choosing a sub-theme as their project title.
4 5	Information collection	• Students would visit libraries, surf the Internet or go to related organizations to collect relevant information. • Students would utilize the news database & search engines on the web to collect related information. • Under the guidance of their teachers, students would design their own questionnaires to collect data for the GS projects.
6 7	Information analysis and writing up the report	• Students would outline the main points from the reading materials; categorize and analyze the information collected.
8	Report	• Written Reports (for the 1st term) • Oral Presentations (for the 2nd term)

8.3.2 Suggested teaching schedule for Language (Chinese) teachers

Tables 17 and 18 show the proposed teaching schedules for Language (Chinese) teachers. Teachers need to bear in mind that it is important to equip students with adequate reading and writing capabilities so they could understand and present the information in an effective manner. In the first year of intervention, students are expected to develop reading skills, such as identifying key ideas in an article.

In the first term, teachers could consolidate students' reading and writing abilities by engaging them in tasks that require them to identify the key points and topic sentences of each paragraph in a short passage. In the second term, as students develop a stronger ability to determine key phrases and topic sentences, teachers could prepare reading materials that demand a higher level of reading comprehension and writing competencies. Writing assessments aim to evaluate students' development of writing abilities throughout the academic year. The writing topics of these tests could be set according to the GS themes so that students could apply the knowledge from their GS lessons into their writing. Furthermore, self-reflection tasks are beneficial as they engage students in reflecting upon their learning experiences. To facilitate knowledge integration, teachers could also encourage students to review some articles that are relevant to their GS projects. It is suggested that the self-reflection tasks could be designated as homework if this is going to take up too much class time.

Table 17. Suggested teaching schedule for Language (Chinese) teachers (1ˢᵗ term)

Session	Learning activities	Aims
1	Reading Comprehension Assessment 1 (Narrative; around 200-250 words)	To evaluate students' reading abilities
2	Reading Comprehension Assessment 2 (Expository; around 200-250 words)	
3	Writing Assessment 1	To evaluate students' writing abilities
4	Literacy training 1[6]	To consolidate students' reading and writing abilities
5	Self-reflection task 1[7]	
6	Literacy training 2	
7	Self-reflection task 2	
8	Literacy training 3	
9	Self-reflection task 3	

[6] Literacy trainings are designed to develop students' reading comprehension and writing abilities. Students are presented with a passage and are required to find out the topic sentences of each paragraph and outline the key ideas of the text with around 100 – 150 words. A sample of the literacy training could be found in Appendix 3.

[7] Self-reflection is a homework done in the form of journal writing. The task could be a book review, or collecting articles related to their GS projects and writing a summary and review of the collected information. This exercise aims to develop students' abilities in writing and organizing information.

Table 18. Suggested teaching schedule for Language (Chinese) teachers (2nd term)

Session	Learning activities	Aims
1	Reading Comprehension Assessment 3 (Narrative; about 250 words)	To evaluate students' reading abilities
2	Reading Comprehension Assessment 4 (Expository; about 250 words)	
3	Writing Assessment 2	To evaluate students' writing abilities
4	Literacy training 4	To consolidate students' reading and writing abilities
5	Self-reflection task 4	
6	Literacy training 5	
7	Self-reflection task 5	
8	Literacy training 6	
9	Self-reflection task 6	

8.3.3 Suggested teaching schedule for Computer Studies teachers

For Computer Studies teachers, the main teaching aim would be to equip students with essential IT skills which will enable them to to input Chinese more efficiently and to present their findings in an effective way (refer to Table 20). In the first term, teachers may start with teaching students Chinese input methods so they could apply the skills as they search for information on the Web. Microsoft Excel could be introduced at a later stage when students start organizing and analyzing their data. Teachers could then demonstrate the use of PowerPoint so that students would be able to make use of it in presenting their project output.

In the second term, teachers could adopt a similar teaching schedule. They could review the skills and knowledge that were taught in the first term, and assist the students in applying these skills in implementing their current GS projects. It would be relevant to consider each student's mastery of and confidence in using the skills. One suggestion in the teaching plan would be for teachers to focus on the delivery of theories and skills in the first term by means of demonstration and practice, while in the second term, as students become more acquainted with the skills, teachers could guide them in applying them to their inquiry projects. For example, teachers could introduce of the skill of creating charts using Excel in the first term, and subsequently assist students in presenting project data and findings in chart form in the second term. Another suggestion would be for teachers to start by instructing their students on the techniques of making slides with PowerPoint, such as inserting graphs and presenting ideas in bullet point form, and later helping them develop their slides as part of their oral presentations of the projects. However, as Chinese input methods require more time and practice for students to master, teachers could provide sufficient practice opportunities for students throughout the academic year. Furthermore, teachers could prepare lesson summaries to facilitate students' mastery of these skills.

Table 19. Suggested teaching schedule for Computer Studies teachers (1st term)

Session	Learning activities	Aims – To teach students how to…
1	Chinese Input Methods	• use Chinese Quick Input Methods so that they may be able to type Chinese characters when doing searches on the Web, preparing presentation slides and creating charts.
2		
3		
4		
5	Excel	• create charts so that they can demonstrate their data in their presentations more effectively.
6		
7	PowerPoint	• make presentation slides so that they can apply this skill in their oral presentations.
8		

Table 20. Suggested teaching schedule for Computer Studies teachers (2nd term)

Session	Learning activities	Aims – To teach students how to…
1	Chinese Input Methods	• the Chinese Quick Input Methods, and provide sufficient opportunities for them to practice typing Chinese.
2		
3		
4		
5	Excel	• the skills and knowledge taught in the first term and focus on aiding them in constructing charts to present their data more effectively.
6		
7	PowerPoint	• the skills and knowledge covered in the first term and focus on assisting them in making the presentation slides for their oral presentations.
8		

8.3.4 Suggested teaching schedule for School Librarians

School librarians are recommended to allocate three lessons per term to helping students develop the knowledge and skills listed in Table 21. In the first term, search skills could be introduced to students before the start of their inquiry projects so that they could apply them when completing their projects. Librarians could also introduce their students to the library's classification system. In the second term, school librarians could aim to equip students with more advanced search knowledge and skills, and deepen their understanding of various media forms.

To foster students' development of IL proficiency, school librarians are encouraged to provide students with adequate practice opportunities. For example, to ensure that students are familiar with the skills needed to search references in the Public Libraries' Online Public Access Catalog (PLOPAC), librarians could design a worksheet which requires students to perform an actual search on the web and subsequently answer questions regarding the information search process. As students become more familiar with the operation on the PLOPAC, librarians could then include new areas such as WiseNews in the second assignment so that students are provided with an opportunity to work on the database. The students' performance in the homework could also serve as an indicator of students' learning process in the lessons. This would inform the school librarian if there is a need to adjust the teaching pace. A sample of these assignments is attached as Appendix 4.

Table 17. Suggested teaching schedule for School Librarians

Session	Learning activities	Aims – To teach students how to…
1	Library search, web searching strategies and skills	• conduct a search using the school library catalog • conduct searches in public libraries • use search engines
2	WiseNews (a news database)	• search for news and magazine articles using WiseNews
3	Information evaluation and citation, and media education	• evaluate the authenticity and reliability of the gathered information • create proper citations • differentiate the kinds of news stories so as to familiarize them with different types of media • show the top stories of different newspapers to students and guide them in determining which newspapers the stories belong to • direct students to read various news stories and get them to decide which story should be put on the front page of a newspaper

For more details regarding suggested teaching guidelines and suggested materials, please refer to: http://web.edu.hku.hk/staff/samchu/docs/book/Teacher-Guide-IPjBL-P4.pdf.

Chapter 9: Guide & suggestions for the second year of intervention

In the previous chapter, practical teaching insights specific to the first year of implementing inquiry PjBL have been presented. In this chapter, some teaching ideas will be suggested on how inquiry PjBL and English collaborative writing using Web 2.0 (mainly wiki) can be carried out in the second year of intervention. In this academic year, it is proposed that the first term of teaching be focused mainly on the General Studies project conducted in Chinese, while the second term could be focused English collaborative writing on wiki. In our research project, we used these teaching schedules and strategies at Primary 5, during which the participating students have already acquired the essential skills for inquiry learning during their Primary 4 studies.

Consistent with chapter 8, an integrated timetable is outlined to highlight the importance of collaborative teaching and to illustrate how teachers can actually implement this teaching approach. Various subject teachers' roles in implementing inquiry PjBL using a collaborative approach are also summarized. Finally, specific timetables for subject teachers are shown to further illustrate the learning activities with the associated teaching aims.

9.1 Suggested timetable for guiding students through their group projects and English collaborative writing (second year)

Upon completion of the first year of inquiry PjBL, students would have been trained to independently search for relevant information and to present it effectively using visual aids (e.g., Microsoft PowerPoint). Reading and writing, and IL and ICT skills would have been enhanced through collaborative teaching. In the second year, teachers could reinforce these skills learned in the previous year. Specifically, ICT literacy could now include the use of wiki while language lessons could be devoted to engaging students to work in groups in the context of collaborative writing in English. It would also be likely that the GS group projects could be implemented at a greater depth, using a wider variety of information sources. Presentations of work output could become more sophisticated with the use of PowerPoint and use of different media forms (e.g., video, audio files). With students' growth in knowledge and skills in other areas, the English language teacher could then focus on the promotion of collaborative writing.

Tables 22 and 23 illustrate an integrated timetable for the first and second term of teaching respectively. In the first term, students could be expected to work on their GS inquiry group projects that aim to recapitulate the knowledge and skills learned in the first year. To support the inquiry projects, students could be introduced to the basic skills in using a wiki platform. Meanwhile, they would start working on collaborative English writing in pen-and-paper format.

In the second term, students could be encouraged to start working on English collaborative writing using the wiki platform. Computer Studies teachers could identify a suitable wiki platform and students could be prepared to manage its technical requirements. It is believed that opportunities for collaborative writing could be further promoted by facilitating students' understanding of the use of wiki to allow for synchronous and asynchronous writing and editing to take place online. Students could be guided towards reviewing previous versions, and leaving constructive comments for their classmates. As such, students' ICT skills would be an important foundation to enable them to maximize the potentials for collaborative work on the online platform. Moreover, the skills that have been developed through GS inquiry projects (throughout the two years) would be important competencies that could facilitate the collaborative learning process. These competencies would include reading comprehension, writing, social and communication, research and presentation skills.

Table 22. The Integrated Teaching Timetable of the 1st Term (second year of intervention)

Week	General Studies	Library Lesson	English	Chinese	Computer Studies
1				Reading Comprehension Assessment[1] 1 (Expository + Narrative)[2]	Use of wiki (e.g., Google Sites, PB-works)
2				Writing Assessment 1	
3				Literacy training[3] 1	
4				Literacy training 2	
5	KWL; 5W+1H; Mind-mapping	A review of strategies and skills for library and web searching (optional)	Collaborative Writing (using pen and paper)	Literacy training 3	Use of wiki (e.g., Google Docs) (optional)
6	Groupings, topic selection and information collection				
7	Information collection and uploading the references onto the wiki				
8					
9	Self-reflection 2 (Optional); Information analysis and report writing				
10					
11	Oral presentations (Students are encouraged to make their presentations using wiki)				
12	Organizing an exhibition for students' parents, students in junior forms and the community(optional)				
13	Self-reflection 3				

[1] The reading/writing assessments are meant to assess students' prior reading/writing abilities before starting the inquiry group projects so that schools and teachers could evaluate the effectiveness of the inquiry PjBL approach in strengthening their students' reading/writing abilities. Besides, it is recommended that the teachers should go through the answers of these assessment tasks with students shortly after they have been administered so students can learn from their mistakes.

[2] The reading comprehension assessment consists of one piece of narrative writing and an expository passage. This is designed to better understand the students' reading abilities as different reading skills and techniques are required to deal with different types of texts.

[3] Literacy training is designed to develop students' reading comprehension and writing abilities. Students are presented with a passage and are required to find the topic sentences of each paragraph and summarize the key ideas of the text with around 100 – 150 words. A sample of the literacy training can be found in Appendix 3.

Table 23. The Integrated Teaching Timetable of the 2nd Term (second year of intervention)

Week	General Studies	Library Lesson	English	Chinese	Computer Studies
1				Reading Comprehension Assessment 2	
2				Writing Assessment 2	
3			WiseNews; Library catalog search; Web searching skills (searching for English resources)		
4					
5		English reading and writing assessment[4] (Pre-test)			
6		Self-reflection 1			Teachers can decide on the content according to students' ability
7		Collaborative Writing on wiki			
8					
9					
10		Self-reflection 2			
11		English reading and writing assessment (Post-test)			

[4] English reading and writing tests are meant to evaluate students' abilities in the respective areas, to compare their performance before and after English collaborative writing on wiki.

9.2 Teachers' role in the second year of intervention

Teachers are expected to assume the role of facilitators who mediate students' knowledge development and foster their interest in learning by providing the necessary scaffolding and support. Traditional didactic teaching approaches would be replaced by collaborative teaching, wherein learning activities are organized by different teachers who aim to achieve similar or related goals. Table 24 details the roles and responsibilities of each subject teacher when implementing GS inquiry projects and English collaborative writing with the use of wiki.

Table 24. Roles of different subject teachers and the school librarian (second year of intervention)

GS Teachers	Language Teachers (Chinese: [C]; English: [E])	Computer Studies Teachers	School Librarian
• Guide students in mastering their *subject knowledge*	• Facilitate the development of students' *reading comprehension* and *writing skills* [C+E]	• Equip students with *IT skills*	• Facilitate students' development of *information literacy skills* (e.g., the ability to evaluate the usefulness of a piece of information)
• Facilitate students' development of *research, social and communication,* and *presentation skills*	• Give students constructive feedback on their writing via assessment of various written tasks [C+E]	• Provide training on Chinese input methods, Excel, PowerPoint and wiki	• Provide students with access to a variety of information sources such as a block loan of books from public libraries, news clips and web resources, depending on their needs
• Monitor students and give constructive feedback on questioning skills, credibility of information sources and appropriateness of presentation materials *via* assessment of their presentation using PowerPoint or wiki	• Provide students with passages related to the GS topics to reinforce their learning [E]	• Enhance students' presentation skills through the effective use of presentation software (e.g., PowerPoint and Excel) effectively	• Equip students with knowledge of citing different types of sources appropriately
• Reinforce students' ability to reflect by requiring them to do a reflection on wiki upon project completion	• Encourage students to practice collaborative writing through group work [C+E]		
• Foster students' critical thinking skill via implementation of peer evaluations			

The teachers' respective roles should be in accordance with their areas of expertise. The GS teacher may wish to focus on students' mastery of subject knowledge, but could also monitor their research and relevant ICT skills. The school librarian could continue to support students in their search for relevant information from different sources. The language teachers (both Chinese and English) could facilitate the development of students' reading comprehension and writing abilities. The Computer Studies teachers could play a major role in strengthening the skills that students have learned in the first year of adopting the new teaching approach (e.g., Chinese input methods, Excel, PowerPoint) and train them with the skills needed to use and manage online wiki platforms.

9.3 Teaching suggestions for subject teachers (second year)

9.3.1 Suggested teaching schedule for General Studies teachers

GS teachers are encouraged to collaborate with Computer Studies teachers and exchange information about students' learning progress and their project titles. Essentially, the GS teacher could help the Computer Studies teacher determine the relevant ICT skills students would need when carrying out their GS group projects.

In the first term, GS teachers could create opportunities for students to employ the strategies of KWL, 5W+1H and mind-mapping. As students would already have the experience of constructing mind-maps using pen and paper in the first year of intervention, they could now try to develop a more sophisticated and comprehensive mind-map using a software (e.g., XMind). Groups could be formed, which would consist of students with different kinds and levels of abilities. Teachers are encouraged to allow students freely to decide on their own research topics. At this stage, students would be expected to perform data collection and analysis independently. Upon completion of the project, students could present their output on the wiki platform.

In terms of evaluation, assessment for learning is strongly encouraged. Teachers could evaluate students' learning process instead of just focusing on the final reports. Besides grading, teachers could provide constructive feedback at different stages of the students' work, facilitating continuous progress. Furthermore, peer-evaluation could be in place. Students could be given the chance to evaluate the work of their peers, which could help them better internalize the requirements of the task and the expectations of their teachers, and enhance their evaluation skills.

Table 25. Suggested teaching schedule for General Studies teachers

Session	Theme	Learning activities
1	KWL; 5W+1H; Mind-mapping	• Highlight the impact of KWL (What do I *K*now?; What do I *W*ant to know?; What did I *L*earn?) using worksheets. Students can fill in the columns of K and W in with respect to the topic they are interested in for their GS project. • Present the reading materials to students and guide them in finding out the 5 W + 1H (who, when, where, what, why and how). After that, teachers can discuss the answers with students in class. • Homework (HW): Students find out the 5W+1H in the assigned readings. • Illustrate the idea of drawing mind maps briefly, and suggest that students incorporate 5W+1H into their own mind map. • Students create a mind map on the topic of their GS projects in order to enhance their logical thinking. • Teachers read students' mind maps and give them suggestions on how to improve then for greater effectiveness. • Students bring back the completed KWL worksheets in week 2. Teachers could suggest that students find out the areas they are interested in exploring and encourage them to collect the appropriate resources accordingly.
2		
3	Information collection	• Students visit libraries, surf the Internet or go to related organizations to collect relevant information. • Students utilize the news database and search engines on the web to collect related information • Students upload useful information resources onto wiki and share them with other team mates.
4		
5	Information analysis	• Students outline the main points of the reading materials; categorize and analyze the resources collected • Students design questionnaires for data collection • Students prepare for the presentation of their data using charts and figures
6		
7	Report preparation using wiki	• Students upload the necessary materials onto wiki and prepare for their presentations
8		
9	Oral presentations	• Students use wiki to present their projects, or using PowerPoint as additional visual aids for their presentations. Depending on their learning experiences and abilities, they may also stage a drama or film a video to summarize their project findings.
10		

9.3.2 Suggested teaching schedule for English teachers

To promote collaborative writing among primary school students, teachers are expected to 1) respond to their work as an interested reader, 2) facilitate their independent learning through self and peer evaluation, 3) guide and encourage them in giving constructive feedback to their peers, 4) maximize whole-group participation and cooperation, and 5) provide quality feedback to students in the process as well as evaluate their overall performance in accordance with the assessment criteria presented to students.

Peer evaluation and teachers' evaluation could serve as complementary components. However, it is recommended that teachers' evaluation would come after peer evaluation to avoid students' reliance on teachers. Evaluations would address the three key aspects: content, organization and language. Besides assessing students' work, teachers are also encouraged to also review students' peer evaluations and provide the necessary feedback in terms of evaluating a piece of English writing.

Table 26. Suggested teaching schedule for Language (English) teachers (1st term)

Lesson		Title	Focus of Teaching and Learning Activities
Week 1	1	Introduction	• Understand the requirements of the collaborative writing task • Learn how to evaluate writing (Optional, depending on students' prior learning experiences) • Search for relevant sources of information at home after Lesson 1 to prepare for the group discussion in Lesson 2	• Explain what collaborative writing is and what skills it entails • Show students how to evaluate each other's work using a genre-based approach (Optional) • Introduce the carefully chosen new theme and the writing topic to students • Go over the schedule and evaluation criteria with students • Divide students into groups and give them roles • Explain the roles and responsibilities of each group member
	2	Pre-Writing	• Brainstorm ideas in relation to given prompts in groups • Participate in discussions and draw a mind-map in groups	• Design a worksheet to facilitate students' information search to prepare for the discussion in class • Facilitate students' group discussion • Give students feedback on their mind-maps in the process
	3	Evaluation I: Content	• Conduct peer evaluation on **content** based on the level of interest and relevance of their ideas (Evaluation sheet #1)[6]	• Conduct teacher's evaluation on **content** (Evaluation sheet #2) after Lesson 3

Table 26. Suggested teaching schedule for Language (English) teachers (1st term)

Lesson		Title	Focus of Teaching and Learning Activities	
Week 2	4	While-Writing	• Review peers' comments and read the teacher's feedback • Revise their mind-map based on peers' and the teacher's feedback • Start organizing their ideas in textual form • Begin writing in groups	• Give students whole-class verbal feedback on the 'content' aspects of their mind-maps • Facilitate group discussion and help weaker groups • Ensure collaboration in the revision and writing tasks during group work
	5	Evaluation II: Organization	• Continue with their writing • Conduct peer evaluation based on the **organization** of their ideas (Evaluation sheet #3)	• Guide students in providing quality feedback with the help of evaluation templates • Conduct teacher's evaluation on the **organization** of students' ideas after Lesson 5 (Evaluation sheet #4)
	6	Revision of students' work	• Refine their compositions based on peer and the teacher's feedback on organization	• Provide additional feedback on the **content** and **organization** after Lesson 6
Week 3	7	Revision of students' work	• Polish their composition based on additional feedback from the teacher and peers	• Facilitate group discussion and encourage equal participation among group members • Give students additional input on vocabulary and grammar if needed • Support weaker groups to give students more help as they refine their work
	8	Evaluation III: Language	• Conduct peer evaluation on language use based on grammar and vocabulary (Evaluation sheet #5)	• Conduct teacher's evaluation on students' language use after Lesson 8 (Evaluation sheet #6)
	9	Final revision	• Refine their composition based on peer and teacher feedback on their language use • Finalize their piece of writing • Conduct peer evaluation on their overall level of enjoyment of and contribution to the writing task (Evaluation sheet #7)	• Conduct teacher's evaluation and scoring of the final writing task after Lesson 9[7]

[6] An example of the evaluation sheets is included as Appendix 2. For more examples, please refer to: http://web.edu.hku.hk/staff/samchu/docs/book/Teacher-Guide-IPjBL-P5.pdf
[7] Teachers are suggested to follow the assessment criteria from TSA. The TSA assessment guide can be downloaded at: http://www.bca.hkeaa.edu.hk/web/TSA/en/2009QuickGuide_Pri/QG_Pri_PART_3.pdf

Table 27. Suggested teaching schedule for Language (English) teachers (2nd term)

Lesson		Title	Focus of Teaching and Learning Activities	
Week 1	1	Introduction	• Understand the requirements of the collaborative writing task • Review the evaluation process • Get familiar with the Google Sites writing platform	• Review what collaborative writing is and how to evaluate each other's/group's work (Optional) • Introduce the new theme and the writing topic to students • Assign each group member a role and entrust them with responsibilities • Go over the schedule and the writing platform on Google Sites with students
	HW	Information Search	• Search for relevant sources at home to prepare for the group discussion/ tasks in Lesson 2	• Design a worksheet to facilitate students' information search
	2	Pre-Writing	• Brainstorm ideas in relation to the given prompts in groups • Draw a mind-map in groups	• Facilitate students' group discussion • Give students feedback on their mind-maps in the process
	HW	Evaluation I: Content	• Conduct peer evaluation on **content** based on the level of interest and relevance of their ideas on wiki	• Conduct teacher's evaluation on **content** on wiki after peer evaluation
Week 2	3	While-Writing (Comp. Lab)	• Review peers' and the teacher's feedback on wiki • Revise their mind-maps • Begin drafting their ideas in textual form in groups on wiki	• Give students whole-class verbal feedback on the content aspects of their mind-maps • Facilitate group discussion as students revise their work on wiki • Ensure collaboration in the revision and writing process during group work • Provide technical support on the use of wiki
	HW	Evaluation II: Organization	• Continue with their writing • Conduct peer evaluation based on the **organization** of their ideas on wiki	• Conduct teacher's evaluation on the **organization** of students' ideas on wiki after Lesson 3
	4	Revision of students' work (Comp. Lab)	• Refine their composition based on peer and teacher feedback on **organization**	• Give students whole-class verbal feedback on the organizational aspects of their writing • Facilitate group discussion and help weaker groups act on the given feedback to revise their work • Ensure collaboration in the writing process • Provide teacher's feedback on the **content** and **organization** of students' ideas on wiki after Lesson 4

Table 27. Suggested teaching schedule for Language (English) teachers (2nd term)

Lesson		Title	Focus of Teaching and Learning Activities	
Week 3	5	Revision of students' work (Comp. Lab)	• Polish their composition based on additional feedback from the teacher (and peers)	• Facilitate group discussion and encourage even participation among group members • Give students additional input on vocabulary and grammar if needed • Support weaker groups to guide students in further refining their work
	HW	Evaluation III: Language	• Conduct peer evaluation on **language use** based on their grammar and vocabulary use on wiki	• Conduct teacher's evaluation on **language use** after Lesson 5
	6	Final revision (Comp. Lab)	• Refine their composition based on peer and teacher feedback on language use • Finalize their piece of writing	
	HW	Final Evaluation	• Conduct peer evaluation on their overall enjoyment of and contribution to the writing task	• Conduct teacher's evaluation and scoring of the final writing task after Lesson 6

9.3.3 Suggested teaching schedule for Computer Studies teachers

For Computer Studies teachers, their main role is to equip students with essential wiki-related skills which could strengthen their ability to use the online tool in writing, reviewing and editing their group project. Students would also be expected to have the skill of leaving comments to their peers on their written work. In the first term, teachers could start by introducing wiki as an online working platform and assess students in learning how to use it.

Teachers could demonstrate the use of wiki to students step by step, beginning with some basic operations, such as editing text and leaving comments. The teaching schedule of the second term is similar to that of the first term, but the teachers could aim at consolidating the ICT skills that students have already developed. More advanced skills could then be incorporated, with consideration of students' ability and needs. For instance, teachers may wish to focus on equipping students with the necessary wiki-related skills in the first term. As students become more familiar with these skills in the second term, they could be guided in applying the acquired skills to the construction of wiki pages for their GS project.

Table 28. Suggested teaching schedule for Computer Studies teachers

Week	Learning activities	Aims – To teach students how to…
1	Creating an account	• Assign a username and password to each student and record this information down in case students may forget their login details. It is suggested that the usernames should be easy to remember and should be consistent among all students. For example, the username of the student in 5A with class number 1 can be set as 2010schoolname5a01. • Distribute the information which contains the username and password to students, after which they could be given help in logging in and creating an account. • If possible, technicians or teaching assistants can create the accounts for students in advance so teachers only focus on assisting students with the login.
2	Utilizing wiki	• Teach students how to carry out some basic operations on wiki, such as editing and inviting others to join the collaborative platform. * Google Sites is one of the suggested wikis as it is convenient and offers a multi-lingual platform. The link below provides more details about how to use Google Sites: http://web.edu.hku.hk/staff/samchu/docs/book/Google-Sites-Notes-for-P5-Students.pdf
3		
4		
5	Utilizing wiki (e.g., Google docs) (optional)	• Teach students how to create and manage their PowerPoint, Excel and Word files in Google docs.
6		

9.3.4 Suggested teaching schedule for School Librarians

School Librarians could review the key search knowledge and skills that were taught in the previous year with students in the first few weeks of the first term of teaching. The timetable suggested for the first term provided below is optional, and could be modified according to students' existing abilities and needs. In the second term, as students get more engaged in collaborative writing in English, they may need to conduct information searches in English to identify relevant materials. IL training could then be focused on searching for and evaluating materials in English.

Table 29. Suggested teaching schedule for School Librarians

Term	Session	Learning activities	Aims – To teach students how to…
First Term (Optional)	1	Library search, Web searching strategies and skills	• To review the search strategies and skills used 1. in the school library 2. in public libraries (OPAC) 3. when dealing with search engines 4. when searching for news articles on WiseNews 5. in citing a reference in Chinese
	2		
Second Term	1	WiseNews	• To teach students how to use WiseNews to search for news and magazine articles in English newspapers
	2	Searching for books	• To teach students how to search for English resources in the school library • To teach students how to search for English resources in public libraries (OPAC)
	3	Web searching strategies	• To teach students how to search for English resources by using search engines • To teach students how to evaluate information gathered • To teach students how to cite a source in English

9.3.5 Suggested teaching schedule for Language (Chinese) teachers (Optional)

The aim of the training in this area is to consolidate students' reading and writing skills in the Chinese language. It is optional, depending on whether students have already acquired the reading and writing skills to engage in General Studies inquiry group projects. Teachers may modify the schedule and content according to their students' specific needs.

Table 30. Suggested teaching schedule for Chinese Language teachers

Term	Session	Learning activities	Aims
First Term	1	Reading Comprehension Assessment (Expository + Narrative texts)	To assess students' reading abilities
	2	Writing Assessment 1	
	3	Literacy training 1[7]	To consolidate students' reading and writing abilities
	4	Literacy training 2	
	5	Literacy training 3	
Second Term	6	Reading Comprehension Assessment (Expository text + Lyrics) (Suggested time limit: 30 minutes)	To assess students' reading abilities
	7	Writing Assessment 2 (Topics related to students' daily life) (Suggested time limit: 60 minutes)	

[7] Literacy training is designed to develop students' reading comprehension and writing abilities. Students are presented with a passage and are required to find the topic sentences of each paragraph and summarize the key ideas of the text with around 100 – 150 words. A sample of the literacy training can be found in Appendix 3.

9.3.6 Further suggestions on the use of wiki in teaching

Acknowledging the fact that wikis are relatively new to teachers, a few practical recommendations on using Web 2.0 in teaching are put forward.

Choosing a wiki. There are a number of currently available wiki applications, and they vary in terms of interface, level of access and cost. Based on the experience of the research team, a wiki variant that is easy to use, requires minimal computer knowledge, and has a multilingual interface is preferable. With a multilingual interface, primary school students could choose the language that they are more comfortable with, therefore easing their cognitive and information processing load. This could allow them to devote their attention to the content of their work. In addition, a wiki programme that is freely available is desirable for educational purposes, such that budget constraints will not be a hindrance.

Providing technical support. A range of studies conducted has shown that students encounter technical problems in areas such as formatting of the content of their writing and uploading materials onto wikis (Chu, 2008; Cole, 2008; Fung et al., 2011; Law et al., 2011; Woo et al., 2011). For effective utilization of Wiki with minimal technical challenges, teachers may need to organize supplementary classes for students to ensure their familiarity with the use of the online technology. Similarly, teachers may also find it beneficial to have orientation programmes to familiarize themselves with the technical aspects of using a wiki as a teaching tool.

Addressing parental concerns. When students are using wikis for their projects, there is a possibility that they may be misunderstood by their parents to be visiting undesirable websites or playing online games (Fung et al., 2011; Law et al., 2011; Yu et al., 2011). It is therefore advisable that schools run workshops for parents to introduce them to this new mode of learning, such that they would expect the children's increased online activities and would be more cognizant of the potential benefits of wiki on their students' learning processes. These workshops could deepen parents' knowledge on the operation of wikis and suggest ways of monitoring

their children's work (Law et al., 2011). Before the implementation of wikis in the classroom, schools may also find it helpful to inform parents of wiki-related tasks that their children will be performing at home. Finally, it should be emphasized to parents that inquiry PjBL encourages students to be active learners. As such, parental participation in the students' work could be minimized to allow independent learning to take place and to enable students to experience maximum gains.

For more details regarding suggested teaching guidelines, materials and other ideas, please refer to: http://web.edu.hku.hk/staff/samchu/docs/book/Teacher-Guide-IPjBL-P5.pdf

Chapter 10: Summary and Conclusions

In this information-explosion era, 21st century skills are deemed essential for students to face challenges, which come with the rapidly changing society. Digital literacy skills, which comprise of information literacy, media literacy and technology literacy, have particularly become very important components of primary school education. In Hong Kong, the society has shifted rapidly towards a knowledge-based economy, consequently having demands on students to have high levels of problem-solving and communication skills. These skills, although not brand new in human progress, have been gaining greater significance in the recent time. With the intention of preparing our students better for the current social demands, the Education Bureau (EDB) of Hong Kong has recognized the importance of digital literacy and modified its education roadmap accordingly. Digital literacy training has been increasingly integrated into the school curriculum.

As educators continue to search for teaching approaches that could effectively develop students' 21st century skills, inquiry project-based learning (inquiry PjBL) appears to be effective in fostering such development. Inquiry PjBL is a teaching and learning approach, which integrates inquiry learning with project-based learning. The fundamental concept of this approach is built on the notion of constructivist teaching which encourages students to actively construct knowledge. In such an approach, teachers assume the role of facilitators in guiding students throughout their learning activities. Scaffolding strategies support students' learning by arousing and sustaining their interests and learning motivation. Scaffolds could come in the form of constructive questions and comments, demonstrations and hypotheses. Compared to the more traditional didactic approach, such a new teaching method

engages students in a more active exploration of knowledge, enabling them to develop the disposition and competence towards becoming independent learners.

To ensure that students benefit from inquiry PjBL, carefully planned teaching strategies are needed. Implementing inquiry PjBL through a collaborative teaching approach, which mainly involves subject teachers, school librarians and school leaders, has been shown to have a positive impact on both students and teachers. Evidence of students' improved performance suggests that inquiry PjBL, using collaborative teaching strategies, is a promising pedagogical approach in facilitating the development of students' 21st century skills. Such an approach has successfully enhanced both the growth of students' capabilities and their learning motivation in the process of project implementation. Collaborative teaching also benefits participating teachers through increased opportunities to communicate and exchange their views on students' performance. Teachers are thus provided greater opportunities to modify teaching strategies according to students' needs, while minimizing the repetition of subject knowledge and activities.

Apart from collaborative teaching, the use of Web 2.0 tools in facilitating the implementation of inquiry PjBL has also been increasingly valued. Amongst various Web 2.0 technologies, wiki has been shown to have positive effects on students' learning experiences by enhancing their learning interests, motivating them to achieve a higher level of performance and encouraging peer learning and interactions. For teachers, wiki affords them a better position to monitor their students' output and contributions to group work in an objective and detailed manner.

With this book, we wish to share with other education practitioners and researchers our experiences in facilitating the development of 21st century skills among students through inquiry PjBL, implemented with a collaborative teaching approach and Web 2.0 technologies. Through this initiative, students were found learning 'how to learn', being motivated to perform better and developing new and improved skills. We sincerely hope that this book

would serve as a practical guide and reference for teachers who wish to explore their options and adopt this new pedagogical approach in their teaching.

Appendix

Questions

Factor 1: Learning/Pedagogy

A1. Use of the Wiki enhanced my interest in the course (Google Sites 提高了我製作專題報告的興趣)

A2. I would like to see Wikis used in other courses (我會嘗試繼續使用Google sites來學習和製作其他專題報告)

A3. I will better retain the material as a result of using the Wiki (使用Google Sites 為我帶來更多知識)

A4. I was more engaged in the assignment because of using the Wiki (Google Sites令我更積極參與製作專題報告)

A5. Use of the Wiki aided me in fulfilling course objectives (Google Sites幫助我達成專題報告的目標)

Factor 2: Motivation

B1. The benefits of using the Wiki are worth the extra effort and time required to learn it (我認為值得花精力和時間學習使用Google Sites)

B2. I would recommend classes that use Wikis to other students (我會推介其他同學使用Google Sites製作專題報告）

B3. I would prefer projects that use Wikis over other projects that do not use Wikis (相比其他製作專題報告的方法，我更喜歡使用Google Sites製作的專題報告）

B4. I will continue to use wikis in other project works (我希望把Google Sites應用到其他專題報告)

B5. I stayed on the task more because of using the Wiki (Google Sites令我更集中完成專題報告的各項工作）

Factor 3: Group Interaction

C1. I liked seeing other students' interaction with material I posted on the Wiki (我喜歡看同學在我的Google Sites上的留言）

C2. Use of the Wiki for the assignment helped me interact more with other students (利用Google Sites 製作專題報告，加強了我和組員之間的溝通)

C3. Because of using the Wiki, my group was able to come to a consensus faster (Google Sites令我的小組更快達成共識)

C4. I learned more because of information posted by other students' on the Wiki (我從同學放在Google Sites的資訊中學會了更多)

C5. Use of the Wiki promoted collaborative learning (Google Sites 促進協作學習）

Factor 4: Technology

D1. The Wiki interface and features were overall easy to understand (Google Sites的版面和功能清晰易用)

D2. Benefits of using the Wiki outweighed any technical challenges of its use (使用Google Sites所帶來的好處多於操作時遇到的困難)

D3. Browsing/editing information on the Wiki was easy (在Google Sites瀏覽及編輯資料是容易的)

D4. Compared to other online discussion boards, the Wiki was easier to use (Google Sites比其他網上討論區更容易使用）

D5. Technical features in the Wiki helped enhance my learning (在製作專題報告的時候，Google Sites 的功能促進我的知識增長)

Appendix 2: Peer Evaluation: Content (Evaluation sheet #1)

We think…	How good?			
our ideas are relevant to the topic.	☺	☺	☺	☺
our ideas are easy to understand.	☺	☺	☺	☺
our ideas are interesting.	☺	☺	☺	☺
we give enough information to support our ideas.	☺	☺	☺	☺

We should …..

□add	□an idea □an example	about _____	because	□it is important. □it can make the story more interesting. □_____.
□add	□an idea □an example	about _____	because	□it is important. □it can make the story more interesting. □_____.
□add	□an idea □an example	about _____	because	□it is important. □it can make the story more interesting. □_____.
□add	□an idea □an example	about _____	because	□it is important. □it can make the story more interesting. □_____.

Here're some more ideas I want to share with my group:

_____

_____

_____

_____

Appendix 3: Sample of literacy training worksheet

細心閱讀文章，找出中心句，然後以100-150字寫出篇章大意及感想。
(Instruction: Find the topic sentences of each paragraph and summarize the key ideas of the text with around 100 – 150 words.)

人力車 (Topic: Pulled Rickshaw)

「人力車」，又名「車仔」，「黃包車」和「東洋車」，<u>是一種用人力來牽引拉動的車。</u>

<u>人力車起源於日本，由一美國傳教士發明。</u>自從在1868年左右首度出現，很快便被廣泛應用。由於當時汽車尚未普及，人力車是世界各地十分普遍及重要的運輸工具，尤其是東南亞各地的大城市。

<u>於中國，人力車扮演著十分重要的角色。</u>一位法國商人看準人力車的商業潛力，首先於1873年把人力車引入上海，成立公司經營人力車服務。三十年後，人力車的數目就倍增至多於9000輛，成為當時上海十分流行的交通工具。除了數目增加，人力車的設計亦被多番改良。以它的輪子為例，為了增加行走的穩定性，已由木輪改為橡皮輪，再進化為以後的打氣輪胎。

<u>人力車在1874年「登陸」香港。</u>因為其起源地為日本，香港人都稱它為「東洋車」。人力車的體積小巧，廣東人多叫它做「車仔」。另外，人力車又被稱為「黃包車」，因為車身有一漆布摺篷，座椅又被髹上黃色，每當車夫把摺篷拉下時，車的形狀像個「包子」。當時香港的交通工具以轎子為主，因為人力車較轎子行動快速，而且車費便宜，很快便在香港普及化。<u>全盛時期，香港擁有多約3000輛人力車，手車夫的數量更多達8000多名，可見人力車對香港的公共運輸曾有著舉足輕重的地位。</u>

<u>直至30年代，電車和巴士開始在香港流行，人力車的重要性亦漸漸被削弱。</u>加上香港人的生活水平提高，較富裕的人都紛紛購買私家車代步，最終，香港政府於1968年正式停止發出人力車牌照。時至今天，人力車已變成歷史，曾經是大批人力車聚集地的天星碼頭，現已拆遷，原本停在碼頭附近的人力車也完全消失了。
(The passage above explains the origin and development of pulled rickshaws.)

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篇章大意及感想（範例）： (Summary and Review - students summarize the ideas of the text and give their own opinions)

「人力車」創始於日本，「登陸」香港後，很快就成為香港一種大眾化的交通工具。人力車曾經是港九的主要交通工具。30年代起，人力車的需求開始走下坡。在1968年，香港政府正式停止發出人力車牌照。今天，九龍尖沙咀天星碼頭附近那幾輛人力車已經完全消失了。
我覺得人力車是一種不人道的交通工具，所以應該被淘汰。
（每段的中心句以底線標示） (Topic sentences are underlined in the passage.)

Appendix 4: Sample worksheet for library lessons

Online Information Search - WiseNews

- Go to the website of WiseNews: http://wisenews.wisers.net
- Search for information relevant to the GS topic "water pollution". Try to enter appropriate "keywords" in the search area and answer the following questions:

1. To search for articles related to "environment protection" and "water pollution"…
   I will key in the following in the search area: (put a ✓ in the correct box)
   □ environment protection + water pollution
   □ environment protection - water pollution
   □ environment protection / water pollution

2. There are totally _____ search results.

3. If the search is expanded to "within one month", there are totally _____ search results.

4. The title of the first piece of information listed in the search results is:
   _____

5. To search for articles related to "environment protection" or "water pollution"…
   I will key in the following in the search area: (put a ✓ in the correct box)
   □ environment protection + water pollution
   □ environment protection - water pollution
   □ environment protection / water pollution

6. There are totally _____ search results.

7. If filter search is applied and the search is limited to the articles published by "Ming Pao" and "Sing Tao" within one week, there are totally _____ search results.

8. The title of the first piece of information in the result list is:
   _____

9. To evaluate the reliability of a website, it depends on… (You may choose one or more item(s))
   □ the design of the website.
   □ the organization or name of author is clearly stated on the website.
   □ the update time and date are clearly stated on the website.
   □ the origin of the information cited on the website is clearly stated.
   □ the URL of the website is .edu instead of .com.
   □ the content of the website is enriched with pictures.
   □ there are a lot of advertisements on the website.

*This is a translated version of the original worksheet used in the study and only includes a selection of the questions.

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