Leading knowledge management in a secondary school

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Abstract

Purpose – *This paper aims to explore the influence of a principal's leadership in kicking off knowledge management (KM) implementation and the following KM processes in the school. The author tries to propose a model of knowledge leadership for principals to adopt at the beginning of KM journey and during the process of KM implementation. The paper shares the lessons learned during the process of implementation: what he has done and what should be improved. Thus, this paper can provide a model for school principals to implement KM in their schools. This paper also sheds light for KM researchers about the issue of leadership during KM implementation.*

Design/methodology/approach – *The study uses an action research (AR) to explore how the principal's leadership can enhance KM implementation in a school environment and evaluates the effectiveness of the knowledge leadership framework for KM implementation in a school setting. An insider AR methodology was adopted to study and reflect on the processes of KM implementation and lessons learned. Multiple data sources, including observations, questionnaires and interviews, have been collected for evaluation.*

Findings – *In this study, the principal kicked off KM in the school. It was found that KM "cannot" be implemented without the principal's effective knowledge leadership. If there was only little KM leadership, such as the leadership in Stage 1, the launching of KM was found to be difficult. After awareness of the need of strengthening leadership in Stage 2, the principal exercised stronger leadership in pushing the KM process further, and the school had more obvious KM outcomes. Therefore, this study proves that leadership is essential for KM implementation, especially at the beginning of the KM processes. The principal acted as the knowledge leader with the roles of the knowledge vision builder, knowledge enabler builder and knowledge role model. The roles of knowledge leadership are found to be potent and critical for the process of KM implementation to facilitate sharing information/knowledge and nurturing a sharing culture and trust. In this study, the principal kicked off KM in the school. It was found that KM "cannot" be implemented without the principal's effective knowledge leadership. If there was only little KM leadership, such as the leadership in Stage 1, launching KM was found to be difficult. After awareness of the need of strengthening leadership in Stage 2, the principal exercised stronger leadership in pushing the KM process further, and the school had more obvious KM outcomes. Therefore, this study proves that leadership is essential for KM implementation, especially at the beginning of the KM processes. The principal acted as the knowledge leader with the roles of knowledge vision builder, knowledge enabler builder and knowledge role model. The roles of knowledge leadership are found to be potent and critical for the process of KM implementation to facilitate sharing information/knowledge and nurturing a sharing culture and trust.*

Research limitations/implications – *Although the results of the study conducted in one school may not be generalized to other school contexts, the lessons learned in the study might be a reference to other schools for their future development. Because of his unique position as the principal in the researched school, the researcher adopted an insider approach generating value for investigation of KM implementation in this study, as there were multiple mediating processes through which leaders could influence school functioning, and, hence, knowledge sharing or other issues in KM implementation.*

Practical implications – *This study could contribute toward KM implementation in the public sector, especially in schools. Moreover, the approaches, the strategies, the processes and the challenges the principal and the school faced can shed light on practice and research for further KM implementation. In addition, although leadership has been commonly regarded as an important factor in KM implementation, few studies have explored the impact of leadership during the KM process. With the*

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principal's leadership as the main component, this study is important for an analysis of the role of leadership during the process. The framework of knowledge leadership adopted in this study has been tried and evaluated to be applicable and necessary for KM implementation in a school environment.

Social implications – *Most people might think that KM can be applied only in the commercial sector. This study shows that KM can also be adopted in schools and in other sectors. Moreover, it shows that the principal's leadership was the key driver for KM implementation. The principal's leadership with clear direction and thoughtful procedures of implementing may be a showcase for the leaders in other sectors.*

Originality/value – *Fullan (2002) mentions the essence of KM in schools, the importance of principals' leadership in the promotion of KM in schools, the moral purpose and knowledge sharing and leadership and sustainability, but he does not provide any practical suggestion for how principals can become knowledge leaders. Therefore, this paper hopes to further propose a model to show how to help a principal transform into a knowledge leader to overcome barriers and difficulties in kicking off KM at the beginning of their KM journey and during the process of KM implementation.*

Keywords *Community of practice, Role model, Principal leadership, Enablers builder, Knowledge leadership, Vision builder*

Paper type *Case study*

Introduction

Educators all over the world are facing the challenges presented by education reform and social change. Principals and teachers cannot perform their tasks with the experience and knowledge that they used in the past. Educators need to discover new ways to meet the numerous demands brought by change. To this end, Leithwood *et al.* (2004) note that principals should understand and have the knowledge to improve decision-making so as to face the climate of increased external and internal pressures for school improvement. Knowledge management (KM) has been widely accepted as a promising strategy for facing challenges in the business sector, but few studies have been done to explore the feasibility of KM in education, particularly in schools. Although, in the literature, it is commonly regarded that leadership is a necessary and sufficient condition for KM implementation, few researches exist that explore the exact role for leaders and how they should behave when developing KM programmes. This study examines how a principal leads KM implementation in a school.

As Fullan (2002) suggests, principals should become knowledge leaders so that they can use all available assets to identify and map critical knowledge; facilitate sharing among teachers of their knowledge, experiences and best practices; and make decisions for student learning and school improvement. However, Fullan (2001, p. 79) found that "knowledge sharing and creation" were extremely difficult to orchestrate in schools irrespective of the importance of organizational knowledge. Since Fullan's 2002 proposal that principals should be knowledge leaders, there have been only a few studies that explored KM implementation in schools, to say nothing of the proposition of principals as knowledge leaders (Leung, 2010; Kurland *et al.*, 2010; Thambi and O'Toole, 2012). Fullan (2002) mentions the essence of KM in schools, the importance of principals' leadership in the promotion of KM in schools, the moral purpose and knowledge sharing and leadership and sustainability, but he does not provide any practical suggestion for how principals can become knowledge leaders. Therefore, this paper not only incorporates Fullan's (2002) idea of a principal as a knowledge leader so as to optimize its effective implementation in the school, with the goal of providing empirical evidence of Fullan's (2002) proposition, but also further proposes to show how to help a principal transform into a knowledge leader. This paper tries to explore the influence of the principal's leadership in kicking off KM implementation and the following KM processes in the school to shed light on the impact of leadership in KM implementation and the needs and conditions of leadership for KM implementation in the education sector. The author tries to propose a model of knowledge leadership for principals to adopt at the beginning of their KM journey and during the process of KM implementation. The author hopes the experiences outlined in this paper can shed some light for principals or school leaders on understanding what difficulties they might encounter and what solutions they might find. This paper also hopes that the findings

can encourage further studies to explore the impacts of leadership affecting KM implementation in schools.

Theoretical foundations

In a knowledge-based economy, knowledge has been recognized as a strategic intangible asset and a vital resource in any organization (Nonaka and Takeuchi, 1995; Nonaka, and Toyama, 2005; Grant, 1996; De Long and Fahey, 2000). As Davenport and Prusak (1997) suggest, if new knowledge is effectively integrated into daily operation, and knowledge is accessible when needed, the effectiveness of the organizations that have KM implementation will be significantly enhanced.

Knowledge management and knowledge management strategies

Alvarenga Neto *et al.* (2009) posit that knowledge can be managed by establishing the environment but not directly, as evidenced by the studies of 23 international firms providing enabling factors (enablers) to facilitate knowledge building and sharing through social interconnection.

In this paper, KM is defined as "the systematic process of acquiring, organizing, and communicating the knowledge of organizational members so that others can make use of it to be more efficient and productive" (Alavi and Leidner, 2001, p. 114). As Lin and Lee (2012, p. 422) advocate, KM can be regarded as the process of "collecting, modeling, storing, reusing, evaluating and maintaining knowledge". Thus, in the present study, KM is defined as the formulation of the processes in establishing an environment to foster organizational members to create, share, learn and use knowledge comprising experience in the *know-how*, together for the organization's advantage.

KM strategies vary in their scope and attention among KM practitioners for fostering organizational members to create, share, learn and use knowledge together for an organization's advantage. One of the common classifications of KM strategies, which is commonly adopted by KM practitioners, recognizes two main approaches: personalization and codification (Hansen *et al.*, 1999). The personalization approach assumes that tacit knowledge is shared through dialogue and direct contact. Codification focuses on the conversion of knowledge to artefacts for storage and retrieval later. On the other hand, Wang *et al.* (2014) notice that KM systems (KMSs) are commonly used to help document, distribute and transfer between employees' explicit and tacit knowledge for knowledge sharing to increase organizational effectiveness. Although there are some advantages of using KMSs in some companies, such as Siemens and Xerox, many others companies have not succeeded with expected benefits. It may be taken for granted that employees will naturally share knowledge after using these KMSs.

Therefore, this study will take a balanced approach in KM implementation by adopting Dalkir's (2011) KM strategies, similar to Hansen *et al.*'s (1999) classification of KM strategies in the following approaches.

Information-based approach (codifying and storing content). This approach emphasizes explicit knowledge over tacit and favours the externalization process by establishing an electronic platform (Handzic, 2011) for knowledge codification, storage, retrieval, presentation, sharing and updating, as well as other KM processes/activities.

People-/Interaction-based approach (connecting knowers). This approach focuses on knowledge-sharing interactions by motivating, recruiting and grouping organizational members to form Communities of Practice (CoPs) (Lave and Wenger, 1991) to share their knowledge by favouring the socialization process (Jeon *et al.*, 2011). As Lin and Lee (2012) commend, CoPs are "popular means to improve learning, knowledge sharing and management in organizations and enterprises". The members of CoPs are concerned with a specific practice and they meet and interact regularly to learn how to improve the practice.

The implementation of the two approaches in the transfer of knowledge induces some controversies among practitioners, such as, which approach should be implemented first, how the two approaches can be put in place in balance, what knowledge should be shared and retained and what other knowledge should be just shared without storage.

Wang *et al.* (2014) commend that "knowledge sharing is critical, as it can contribute to knowledge application, innovation and ultimately an organization's competitive advantage". Wang *et al.* (2014) claim that knowledge sharing can "help others accomplish goals, collaborate with others to solve problems, develop new ideas, or implement policies or procedures" by providing others with necessary explicit knowledge (such as formulas, processes and routines) and tacit knowledge (sharing experiences and know-how).

Knowledge management in schools

Although KM has been regarded as an advanced management strategy in the business world for leveraging intellectual assets, schools seem to be lagging behind in introducing KM as a practice and are also ignoring the essence of knowledge. Therefore, there have been more voices advocating essentials of KM application in schools. For example, the OECD (2000, 2004) observed that few school teachers were found to share knowledge freely with their colleagues. Sallis and Jones (2002) urge that schools should be places not only for learning but also for the development and implementation of knowledge. Hannum (2001) and other researchers and practitioners (Adhikari, 2010; Carroll *et al.*, 2003; Petrides and Nodine, 2003) recommend the importance of KM to educators for "improving the practice of teaching by gathering tacit and explicit knowledge from experienced teachers". Thambi and O' Toole (2012, p. 91) further suggest that KM has the potential to be extensively adopted in schools for fostering the "sharing of innovative practice, avoiding duplication and discouraging the loss of valuable knowledge" similar to how business organizations benefit by KM implementation (Becerra-Fernandez and Stevenson, 2001; Bain, 2006). Teaching is characterized by its complexity, diversity and the non-standard nature of teaching processes. Teaching is about delivering the content of subject knowledge to the recipient of the knowledge content, i.e. the students, and about the effectiveness of the transfer process. An effective means of improving teaching quality is to share knowledge among teachers, helping to prevent mistakes that have already been encountered in the past and to enhance the process.

Recently, Reid (2014) confirms that school leaders are important in supporting the knowledge creation and mobilization processes by engaging school-based knowledge influencers and fostering cultures of trust and risk-taking. Reid (2014) further explains that when educators analyze data, dialogue, trust and reflection, data can be transformed into

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knowledge so as to support informed decision-making in school administration. Reid (2014, p. 333) points out that:

> [. . .] as the teams created and shared knowledge with others at different levels of the organization, knowledge was amplified and mobilized as knowledge moved through individuals, groups, divisions, and organizations. A process of organizational learning occurred when the new knowledge of individuals became part of the practices of the organization.

Thus, the researcher claims that KM can also be applied in schools.

Leadership in knowledge management

Some researchers have noticed the importance of leadership in initiating KM implementation (Baldanza and Stankosky, 2000; Koh *et al.*, 2005; Ward and Aurum, 2004; Anantatmula, 2008). Skyrme (2000, p. 81) proposes the term "knowledge leadership" and notes "in contrast to KM, knowledge leadership refers to constant development and innovation – of information resources, individual skills and knowledge and learning networks". Some researchers try to understand the impact of leadership and the roles of leaders on managing information and knowledge in organizations (Dirkx, 1999; Viitala, 2004). However, both researchers and practitioners know relatively little about the mechanisms by which leadership may assist organizational members' knowledge-sharing (Nonaka and Toyama, 2005), in particular by cultivating a social context in which organizational members share knowledge.

Viitala (2004) emphasizes the importance of leadership in KM implementation, so he defines knowledge leadership as the processes by which a leader helps others in knowledge processes for the benefit of a group or an organization. Popper and Lipshitz (2000) posit that the knowledge leaders' major mission is to help the organizations become learning organizations by providing conditions to foster learning among members. Carmeli *et al.* (2011) and other researchers (such as Agashae and Bratton, 2001; Capshaw and Koulopoulos, 1999; Carmeli and Waldman, 2010; Macneil, 2001; Nonaka and Toyama, 2005) also spot similar tasks of knowledge leaders. Lakshman (2008) uses the findings of his study of interviewing the CEOs of corporations and suggests five proposed capabilities in knowledge leadership:

1. *Visionary capability*: Recognizing the importance of KM.
2. *Network establishment and maintenance capability*: Establishing knowledge networks and managing knowledge.
3. *Search and acquisition capability*: Providing and obtaining (sharing) information with stakeholders (internal) and customers (external).
4. *Provision and use capability*: Providing opportunities to all employees to obtain information from customers (internal and external).
5. *Role modelling capability*: Participating in the process of sharing information in daily activities and organizing information networks.

Viitala's (2004) also identifies tasks of knowledge leaders similar to those of the study by Laskshman:

- Leaders as orienteers of learning to build vision identify the knowledge gap, devise strategies and goals of an organization and articulate stakeholders' needs with timely feedback and quality measurements.
- Creators of organizational climate with safe and supportive conditions for learning.
- Supporters of learning processes by providing opportunities to interpret and evaluate experiences and lead him or her in the reflection.
- Leaders as role models as an example for promoting learning and development.

The researcher notes that Lakshman's (2008) and Viitala's (2004) works are most comprehensive and practical from a leader's perspective in KM implementation, so Lakshman's (2008) and Viitala's (2004) works are adopted and compiled in this study. The researcher identifies the common features of the roles and tasks of knowledge leaders from Lakshman's (2008) and Viitala's (2004) works. Then, those common features are compiled to formulate the components of the models of knowledge leadership in this study as shown in Table I.

The features of the three main themes are described as follows.

Knowledge vision builders. Vision builders recognize the importance of KM and determine vision, strategies and goals for the organization by making sense of the context to determine the knowledge gap of the organization, giving a direction for acquiring the knowledge that the organization needs. Many studies emphasized the importance of leaders in establishing vision, strategies and goals for the organization that can justify the knowledge vision of a leader in this study (Prahalad and Hamel, 1990; Senge, 1990b; Leonard-Barton, 1992; Long and Vickers-Koch, 1995; Sanches and Heene, 1997; Sveiby, 1997; Ellinger and Bostrom, 1999; Senge, 2000). They all mention the importance of vision in leadership in organizations. The knowledge leader should align his knowledge vision with that of the situational context of the school and spread it throughout (and even outside) the school.

Knowledge enabler builders. Enabler builders provide conditions for all employees to access information and knowledge internally and externally in networks to support the learning process. They can also provide spaces either physically (meeting rooms) or virtually (a computer network), or even mentally (common goals), to nurture communities by building trust in the community of work. Many studies in learning organizations emphasize the importance of a leader providing knowledge-enabling conditions to nurture safe and supportive working contexts, and so can justify the importance of the knowledge enabler builder (Pedler *et al.*, 1991; Lindell and Rosenqvist, 1992; Nonaka and Konno, 1998; Crossan *et al.*, 1999; Ellinger and Bostrom, 1999; Popper and Lipshitz, 2000). They note that leaders should be facilitators of learning by providing support to learning in the employees' community. The importance of a positive climate is a necessary precondition for organizational learning (Senge, 1990a; Pedler *et al.*, 1991; Nonaka and Takeuchi, 1995;

Table I Formulation of knowledge leadership model by comparing attributes of knowledge leaders from the literature

Lakshman (2008)	*Viitala (2004)*	*Current study*
Leaders' knowledge visionary capability	Orienteer of learning	Knowledge vision builders: recognize the importance of knowledge management and establish direction
Leaders' knowledge network establishing and maintenance capability Leaders' knowledge provision and use capability	Creators of organizational climate Supporters of learning processes	Knowledge enabler builders: provide safe and supportive conditions to enhance learning
Leaders' knowledge role modelling capability Leaders' knowledge search and acquisition capability	Role model	Knowledge role model: personally participate in the process of sharing information as an example

Nonaka and Konno, 1998; Crossan *et al.*, 1999). The organizational learning perspective further proves the essence of this domain of leadership activity in knowledge leadership.

Knowledge role model. A role model participates personally in the process of sharing information in routine activities, actively transferring and disseminating content and serving as knowledge channels where they are required. A role model can be justified from the literature on leaders as role models and in theories of referent power (House, 1977; Yukl and Falbe, 1991). The proposed element of knowledge role model is consistent with the conceptualization of "principal as role model" mentioned by Printy (2008). Printy (2008) posits that principals should serve as knowledge brokers, allowing teachers to emphasize teaching and learning, encouraging innovation, shaping teacher learning and providing adequate resources for teachers' work. Both role models are applicable in transformational and instructional influences in these leadership roles for principals.

After justification from the aforementioned literature, the researcher would like to propose a framework of knowledge leadership for this study (Figure 1).

The researcher proposes a working model for this study based on the specific duties and tasks of knowledge leaders identified from the literature.

Methodology

The study attempts to explore how KM can be led by a principal's leadership. This study reflects the researcher's practice-based research, using an insider action research (AR) methodology to explore the impact of the principal's leadership on KM implementation.

Action-based research method

In this study, the researcher would like to posit AR as an appropriate method for this investigation. AR can provide the researcher an opportunity as a reflective practitioner (McNiff and Whitehead, 2006) to examine how effective the leadership can be in KM implementation through systematic data collection and analysis and also reflection on the result. In this study, steps of "diagnosis, action planning, intervention and reflection" (Davison *et al.*, 2004, p. 72) were adopted as shown in Figure 2 below.

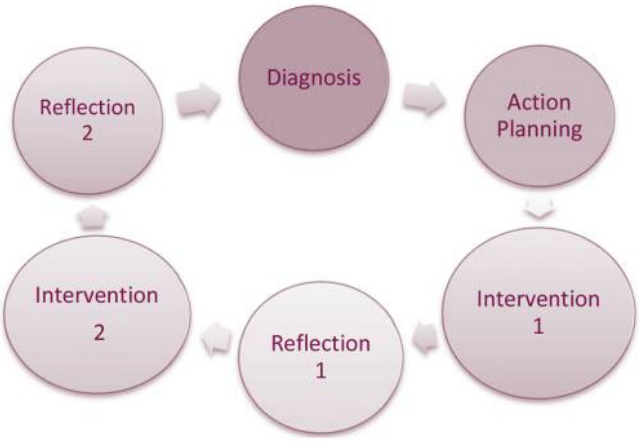
Insider perspective in action research

Because the researcher of this study also served as the principal of the school in the study, the researcher operated in dual roles: external analyst and inside researcher. The researcher quotes Labaree (2002, p. 103) on the strengths of an insider research: "shared experiences; greater access; cultural interpretation; and deeper understanding and clarity of thought for researchers". Furthermore, Hawkins (1990) posits that certain unique advantages and opportunities occur when the principal also plays the role of the researcher, such as "facilitated access to school information" and "objectivity compared with normal teachers". The dual roles, occurring in the research process, might create problems but such dual roles have benefits because it provides for a privileged insider approach. This gives an advantage that cannot be used in traditional research conducted

Figure 1 Framework of knowledge leadership

Source: Adapted from Lakshman (2008), Viitala (2004)

Figure 2 AR process



Source: Modified from Davison *et al*. (2004, p. 72)

by outsiders. On the other hand, the researcher has to be sensitive to the potential problems possibly linked with the insider perspective: dual role conflict, potential ethical issues, subjectivity and biased interpretation of data (Kanuha, 2000).

The researched school and the researcher

The School is a fully government-subsidized secondary school in Hong Kong. It has a population of around 900 students, about 27 classes, 60-65 teachers and 30 support staff over grades 7-12. The researcher has been the principal of the research school since September 2009. The researcher used the KM model to promote and initiate KM implementation in the School, especially enhancing the enabling context of knowledge sharing.

Data collection

The AR can use multiple sources of data including qualitative and quantitative data (McNiff and Whitehead, 2006). The raw data consist of everything in the research log: the field notes, MP3-recorded interviews, interview transcripts, the results of questionnaires and other school documents. The field notes contain the researcher's own impressions of and hunches about emergent findings, as well as questions and areas to be explored in the study. Owing to the nature of an insider research, interviews were conducted not by the researcher himself but by two professional outsider interviewers, who were researchers in local universities. The outsider interviewers compiled the data and presented them to the principal during regular meetings both in MP3 recordings and transcripts in WORD format. For MP3 recordings transcribed by a professional transcriber, the researcher proof-listened to the recordings and read the transcripts to ensure their accuracy. The transcripts provided the bulk of the material for subsequent interpretation of the meaning. The aims of this study are to explore the practicability of principal leadership for KM implementation in the school. The research subjects are the researcher himself and teachers.

Data analysis

Analysis is a search for patterns and meaning from data (Spradley, 1980). Quantitative research deals with variables, whereas qualitative research deals with categories of analysis. Qualitative data analysis followed Miles and Huberman's (1994) approach with several activities:

- meaning condensation;
- meaning categorization; and
- meaning interpretation.

Data collected were reorganized according to various coded categories. After interviews, teachers' answers were transcribed as participating teachers' scripts. The teachers' scripts were reorganized by coding keywords, and the codes were then organized according to similar concepts. Similar concepts were organized further to produce categories. The process of analysis consisted of several stages, and this was an on-going process throughout the research cycle.

Diagnosis and action planning

In this stage, the researcher uses the result of the pilot study and his observation for identifying the needs of this study and for formulating action plans to fulfil the needs of the school.

Action planning

From September 2009, the researcher used his first year as principal as an opportunity to learn everything about the School, including meeting and working with staff, students, parents and other parties related to the School and learning the School rules, regulations, procedures, culture and traditions. The researcher shared his vision on KM implementation in the School. After a certain period of time, the School's management team was convinced that KM could improve teacher professional development and knowledge sharing among teachers, in turn, improving overall school performance. The project received full support from the schools' management teams. Several teachers who were interested in the KM implementation were invited to start a task group for promoting KM implementation, and one colleague was appointed as the task group leader to execute knowledge initiatives in the school. This meant that the project could be carried out smoothly. Before the appointment of the principal as the researcher, the School adopted an email system with low functionalities. It had only basic email functions and some fragmented tailor-made school-based programmes for staff to use via the school webpage. The school purchased a school-wide integrated platform to provide a learning management system for e-learning, an email system and intranet.

Pilot study

Before the core part of the study was conducted, a pilot study was performed to understand teachers' perception of the KM concept and its implementation. A KM Readiness Questionnaire (Appendix) was administered to all teachers in the School, which yielded a return rate of 97 per cent (65 of 67 questionnaires returned), to assess teachers' understanding of KM and their readiness of KM implementation. Moreover, an assessment of document storage (Appendix) was also conducted to identify the problems in investigating KM implementation in a school (Chu *et al.*, 2009, 2011). After understanding teachers' perception of KM implementation from the pilot study, KM implementation strategies were devised and implemented.

Problem identification and proposing actions

From the result of the pilot study and the researcher's observation, the researcher made a list of the problems in managing knowledge, the proposed solutions and the issues to be related (Table II).

Based on the identified problems, the researcher proposed corresponding actions to address the problems.

Table II Problems identified and solutions suggested after the pilot study

Problems identified	*Proposed solutions*	*Issues*
Unawareness of knowledge as a key intangible asset of schools	Knowledge-sharing activities should be introduced to engage staff attention and facilitate knowledge sharing within the school	People
Lack of principal's leadership to guide KM implementation in schools	School management should have a clear vision and strong leadership regarding KM development	People
Failure to equip teachers with practical knowledge by promoting knowledge sharing	A well-organized policy of KM implementation and a Teacher Professional Development Programme with strong leadership should be devised A sharing culture should be built up by the school management	People
Unsystematic document management system with little functionalities in searching and retrieval	A well-defined and organized knowledge repository should be designed and used for storing knowledge; create a systematic set of classifications to enable later search and retrieval	Infrastructure

Proposing framework of actions

The framework as presented in Figure 3 was proposed to address the aforementioned problems.

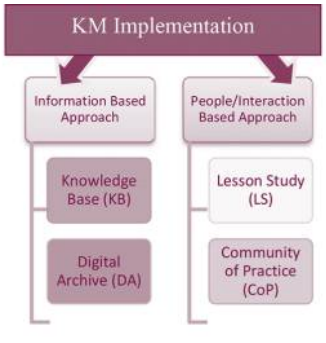
The framework consists of the two main approaches proposed by Dalkir (2011):

1. information-based (a well-defined and organized knowledge repository or platform for codifying and storing content for later search and retrieval); and
2. people- or interaction-based KM (connecting knowers by organizing knowledge-sharing activities for teachers to enhance their professional knowledge and nurture a sharing culture).

Both approaches were implemented during the two stages of intervention in the School during 2010-2011 and 2011-2012.

Reflection on the stage of action planning. In entering any new position from the outside, the leader (in this case, a principal) needs to assess the current situation (staff, practices and facility) before making changes. The principal needs to feel comfortable in the school, and as a leader the first year is important. The principal needs to feel accepted and respected by his colleagues. The principal relies on legitimate power, as identified by French and Raven (1959), because of his position as a principal, with the right to give commands and instructions and make decisions. In addition, the principal wants the teachers to regard the principal as holding both the referent power and expert power. The

Figure 3 Framework of KM implementation



Source: Modified from Dalkir (2011)

teachers believe that a principal should possess qualities that they admire and respect and the "expert knowledge" or skills that are relevant to the job or tasks they have to complete. The principal does not want to be a coercive leader.

Although the principal could start KM implementation immediately upon starting in the new position, the principal felt that the culture and trust of the school needed first to be well established among teachers. The former principal advised the principal that teachers in this school needed professional respect and autonomy. Teachers were not simply followers; they needed to know that the programmes and policies would be beneficial to the school, students and themselves.

Intervention of Stage 1 (September 2010-August 2011)

The researcher began implementing KM in the first stage to address the problems discovered in the pilot study (Table III).

Reflection on the implementation and leadership in Stage 1

After the researcher reviewed all the initiatives, he found that both approaches (information- and people-/interaction-based) had been implemented with only little effect. Moreover, teachers' feedback about the initiatives when they were first proposed was quite negative. This response made the researcher slow the KM process and strengthen the leadership-driven aspects of the KM programme. To make the project a success, the principal needed to exert his leadership more in sharing his vision and direction in developing KM, providing enabling conditions to encourage teachers to share their knowledge and setting as an example in KM.

The knowledge base should improve as a Knowledge Repository with information and knowledge to be stored in a transparent filing system so that the useful information needed by teachers can be accessed. In addition, the researcher saw that the school server or intranet only provided spaces for storage of documents, and foresaw the need for a knowledge repository to store documents with better functionalities for management, such as searching and version control. Therefore, the school should consider installing such a system to facilitate knowledge storage and sharing. On the other hand, the School needed to promote teacher sharing in face-to-face circumstances so that and an enriched sharing culture could be developed among teachers. The school management could consider implementing CoPs and launching a full-scale version of Lesson Study among teachers to facilitate sharing among teachers.

The researcher realized that leadership depended on the leaders' experience and exposure. Because the principal had a successful experience in launching Lesson Study in his previous school, he was more confident in understanding the impact of Lesson Study on teachers' effectiveness in teaching and was a strong advocate of the procedures for launching this new initiative in the School. The principal provided flexibility for teachers to try Lesson Study through a Taster session so that teachers would feel better about incorporating the Lesson Study as an effective KM tool. While Lesson Study could allow teachers within the same subject departments to share knowledge, the principal would use CoPs to provide more opportunities for teachers to share their knowledge beyond the boundary of their subject departments.

In retrospect, the researcher feels that background studies in the researched school should have been done, such as a Knowledge Audit. This would provide a basis for building foundations for future work. The researcher invited third-party personnel to study the Knowledge Audit of the researched school with reference to the Performance Indicator 2008 of School Performance for School Self Evaluation devised by the Education Bureau (EDB, 2008). The team members collected teachers' views from the School on the perceived related importance of each item extracted from the performance indicators from EDB. A general picture of the Knowledge Map was generated. This experience shows that

Table III Analysis of implementation in Stage 1 of intervention

Issues	*Explanation of actions of the implementation*	*Analysis on leadership*
Teacher readiness, acceptance to KM (people based approach)	The researcher was trying to initiate changes in the School for KM development and school improvement, but he sensed some resistance in the process of implementation because of heavy workload The sharing culture was weak among teachers	The principal estimated teachers' readiness and acceptance to KM so as to avoid their resistance and the deterioration of the principal/teacher working relationship The principal felt the situation would not support full KM implementation at that time, so he made a gradual introduction through a Taster programme
Teacher resistance and workload	The principal sensed that teachers were very busy with the heavy workload in preparing for School B's 40th anniversary activities	The principal worried about teachers' resistance and the extra workload from KM implementation
Delivering a brief talk on KM (People-/interaction-based approach)	The researcher gave a short talk to introduce KM Teachers were not interested in the concept and were unwilling to participate in any KM initiative	The principal could not wait for the accumulation of trust. He continued to exert his leadership to make the school change by taking some proactive steps. After seeing some resistance from teachers, the researcher slowed down the process of KM implementation
Implementing Lesson Study Taster Scheme (People-/interaction-based approach)	To minimize teachers' resistance, the researcher introduced a Lesson Study Taster Scheme to invite teachers to join voluntarily to facilitate teacher sharing Because the Lesson Study was related to teaching and learning, the teachers would be more willing to try the Taster Scheme	The leadership allowed for a certain degree of flexibility in the implementation
Developing the knowledge base (Information-based approach)	The School needed to develop a platform integrating different functions in a single portal to fully satisfy all the needs of the school No teacher or staff had time to develop such a sophisticated platform The school had to consider how to best develop the platform: by employing staff or using an outsourced service. Using an outsourced service is more feasible because of lower cost and human resource management The school decided to recruit a programmer as a staff member because the school had no experience in system development. The process of system development has been a learning process for not only the supervisor of the project but also for the members of the school management for understanding the school needs in the system requirements The programmer needed monitoring and supervision to ensure task quality. The school assigned the IT Committee chairman as the supervisor	The Information-based approach would not trigger teachers' negative emotions because of the lack of direct impact on people to reduce resistance The principal needs to decide if whether the Knowledge Base development should continue The principal examined whether the school context and needs matched with his vision for school development to determine the direction and the decision of each step There were many choices to be decided. The principal had discussions with teachers and used his leadership to make the appropriate decisions based on the knowledge and information of the team The principal needed to assign tasks to middle managers to supervise and monitor their subordinates, such as appointing an IT Committee chairman to supervise the programmer. The principal should also monitor and supervise the middle managers. The principal viewed this experience as a learning process

leadership needs information. The Knowledge Audit could provide information on the knowledge gaps of the school so that the principal could know the next step for KM implementation.

From the experience of this stage of intervention, the researcher felt that initiating change was not an easy task. It needed leaders with patience and vision for the long-term goal. There was little progress in KM implementation, but the researcher observed that an appropriate amount of implementation occurred. The principal needs to "think big but start small". If the principal forced through a tremendous number of initiatives at the same time, the teachers would be angered and worried by such changes. Therefore, the principal

decided to wait until the second year to start Stage 1, rather than in his first year as a principal at School B, when time would be better spent in understanding the culture of the school and gaining the trust and respect of the teachers to enable progress at later stages.

As the project rolled out, teachers began to accept new changes, such as Lesson Study, although they still worried about KM and the extra workload it brought about. Teachers seemed to be more receptive to sharing and discussing with other teachers because of enhanced trust and a supportive atmosphere. The researcher at this time became confident about initiating new change in the school in the next year.

Therefore, the researcher would make some changes for Stage 2 (Table IV):

- strengthening the principal's leadership in all KM initiatives;
- enhancing and implementing the Knowledge Base for sharing information;
- considering a powerful Document Management System for storing documents;
- expanding the scale of Lesson Study for sharing within departments; and
- launching CoPs for sharing across departments.

Intervention of Stage 2 (September 2011-August 2012)

The researcher experienced both success and failure in promoting changes related to KM implementation in the School. He noted teachers' preference for and reluctance about initiatives that he launched. He became confident in dealing with resistance in the process of launching new programmes in Stage 2.

Reflection on implementation and leadership in Stage 2

The researcher observed significant leaps in building mutual trust between the principal and staff. The principal became confident about how to deal with and overcome resistance in the process of launching new programmes. The researcher pushed KM implementation further by launching Knowledge Base, installing Document Management System, expanding Lesson Study and trying out CoPs. The leadership did not come from the principal alone. The exertion of the principal's leadership also needed teachers' trust, respect and acceptance. Even though the principal had expertise in KM implementation, the principal still needed proper support and agreement from teachers. Even though the principal was eager to promote KM, the teachers' acceptance of KM was vital. The researcher reflects that the principal's power comes not only from his position but also needs teachers' acceptance and support. The culture of accepting change might also encourage the principal's change.

After some teachers participated in the first Lesson Study programme in the school, the principal continued to inspire all teachers to join the Lesson Study, either as a core group member or in a lesson observation to give comments. From the Lesson Study experience, the researcher also launched CoPs, which are a typical approach to KM programmes in the commercial sector as one initiative to organize KM in this school. CoPs helped teachers share their knowledge in their interested topics across the committees and departments. However, the conception of CoPs was initially refused by teachers. After the implementation in 2011-2012, CoPs became more acceptable to teachers. From this experience, the researcher reflected that introducing Lesson Study Taster Scheme, Lesson Study and CoPs as a series of steps of implementation for fostering knowledge-sharing culture among teachers was entirely appropriate, especially suitable in this school which had not had such a sharing culture. Teachers have already broken through their barriers between each other for sharing their knowledge and skills regarding their practice. This has been a difficult barrier to overcome, as it is not easy for teachers to share because they like to work independently from each other. An analogy that teachers work independently similarly to eggs in an egg crate was made (Lortie, 1975).

Table IV Analysis of implementation and leadership in Stage 2 of intervention

Issues	*Explanation of actions of the implementation*	*Analysis on leadership*
Launching the Knowledge Base (Information-based approach)	The Knowledge Base was successfully developed with functions of analysis of students' academic results, students' attendance and lateness, homework submission and school uniform irregularity records	The principal provided the vision for building this platform that integrated knowledge, and also allocated resources, e.g. recruiting staff, getting financial support and delegating authorities, etc. The principal specified the kinds of information the school needed to put on the platform The principal encouraged teachers to use such information
Expanding Lesson Study implementation (People-/ interaction-based approach)	The scale of the Lesson Study was expanded to invite more departments and groups of teachers to be involved Teachers shared their knowledge in their departments and groups Teachers still had the freedom to choose the degree of involvement in the Lesson Study	After the Lesson Study Taster Scheme, the principal saw that the sharing culture improved, and teachers were more willing to pool their knowledge The principal's passion for KM and the Lesson Study motivated more teachers to join, even though some were still reluctant The principal gave freedom to teachers to choose their level of involvement
Trial of CoPs (People-/ interaction-based approach)	Several CoPs were successfully tried to provide opportunities for teachers to share their knowledge of their topics across committees and departments Teachers were satisfied with the use of CoPs in enhancing knowledge sharing among teachers in different channels of evaluation	The principal's promotion of KM techniques, despite the teachers' previous negative feedback, influenced the teachers to accept KM The successful CoPs experience raised the principal's confidence in promoting KM in the school The CoPs could break through the long-lasting barrier among departments and committees
Considering the launch of the Digital Archive (Information-based approach)	Because of the need to store documents and facilitate sharing, the school searched a better Document Management System. Because the requirement of functions was so sophisticated, the school had to use an outsourcing service for developing this repository system rather than recruiting a programmer. The school discovered that Microsoft SharePoint might satisfy the need of document storage, but such a proposal received strong rejection from the middle managers. The school had to find a way and identified that there was an add-on module of the existing e-learning platform called Digital Archive that could serve as a Knowledge Repository, with basic functions, such as version control and metadata input with searchable functionality The school management adopted Digital Archive as the School Knowledge Repository to facilitate knowledge sharing and perform KM processes Because the Digital Archive was a commercial product designed for common uses of schools, its functions might not suit this school's needs. The school had to customize the function and interface of the system Following the launch of Digital Archive, teachers were more willing to use the old system with some additional functions. They did not mind learning additional skills and knowledge in using the new module (Digital Archive) in their familiar interface, but they rejected giving up the old system and replacing with the new system (see SharePoint discussion above)	The principal anticipated the School's need for a knowledge repository and allocated resources for purchase of the system The decision to outsource was necessary because of the high demand of technology The principal supported the IT Committee despite their earlier failure The principal positively responded to the idea of purchasing the Digital Archive to show support and recognition of the IT Committee Adopting an outsourcing service might be appropriate when a readymade product or service might need to be customized to fit school need There was a substantial time investment in discussions with service providers This experience was a lesson in change management. Teachers were reluctant to use new systems because they needed to learn new skills. The principal encouraged them to use the new enhanced module that was part of a familiar system Middle managers were able to envision the school needs with the help of the principal and so they could understand the reasons for the school development

When installing the Document Management System, the school had a substantial need for a better system of storing, categorizing and retrieving documents.

Although an information-based approach alone is not enough to make KM implementation succeed, using the information-based approach as a structural part of the infrastructure is important to ensure that stored knowledge is available for later retrieval.

The principal noted that the school management overlooked the resistance and rejection from the middle managers. Their arguments concerning the familiarity of intranet and e-Learning system and the unfamiliarity of the new Document Management System were reasonable. Because the School had installed the intranet and e-Learning system for just 1.5 years, teachers had just learned to use this system. If the school changed to use another Document Management System, teachers would need to switch to the new system. Therefore, middle managers expressed their opinion that the school administrators should not change the system in such a short period, otherwise the staff would get confused. Inertia ensures that teachers prefer using the old systems unless the systems were found to have too many problems. Teachers were generally reluctant to learn a new interface features and techniques to access the new system. An alternative system was considered of adding an additional module (Digital Archive) to the original e-Learning system already in use. This satisfied the middle managers and they agreed with the adoption of the Digital Archive.

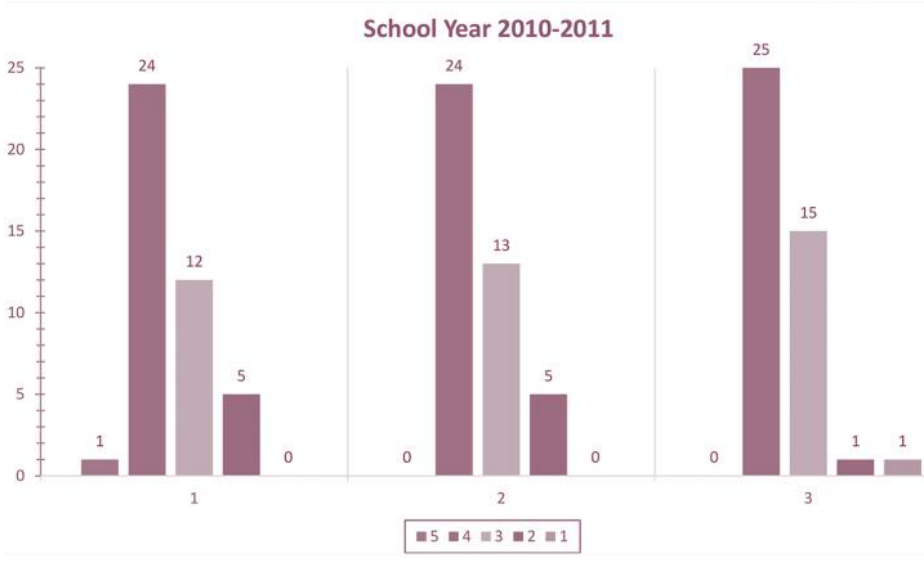
The KM task group should perform better with the principal to promote KM in the school. However, it was not as expected. It may be because of their heavy workload or overloading of other job duties and their lack of KM theoretical and practical knowledge. The researcher pushed KM implementation by activating the KM task group to discuss the steps of implementing a knowledge-sharing process. He also invited two members in the KM task group to attend the Certified Knowledge Management Professional Training Course, so that it could provide opportunities for the two members to communicate with a common language among the members of the task group and plant seeds of KM practitioners in the school. The researcher observed that the principal became confident in implementing KM in the school.

Evaluation of implementation

The principal used a school-based teacher questionnaire that collected teachers' views for evaluating KM efforts (Figure 4).

The survey comprised 19 questions soliciting teachers' views on the school's major concerns in the school year 2010-2011. The questionnaires were distributed to all teachers to solicit their feedback on their opinions. In total, 42 out of 60 teachers (70 per cent) finished and returned the questionnaire. All questionnaires were filled in anonymously to protect personal privacy. Table V shows the result of the school-based questionnaire of the School regarding KM implementation in 2010-2011. From the result of the survey, the item of the first rank was Q.3, with more than half of the respondents (average = 3.52, 59.5 per cent of Agree and Strongly Agree among all respondents) agreeing that colleagues were trying to accumulate and categorize teaching resources for retrieval in the future. Teachers did notice that colleagues had been starting to save and file teaching resources for convenient retrieval in the future. The second rank item was Q.1, with more than half of the respondents (average = 3.50, 59.5 per cent of Agree and Strongly Agree among all respondents) agreeing that the school had tried to develop, store and share resources for teaching. The resources have been built up for facilitating sharing among teachers. Finally, the last item was Q.2, with more than half of the respondents (average = 3.45, 57.1 per cent of Agree and Strongly Agree among all respondents) agreeing that colleagues would like to share their teaching experience and skills with others, which gradually inculcates a sharing culture.

Figure 4 Part of results of school-based teacher questionnaire 2010-2011



Notes: Strongly agree 5; agree 4; neutral 3; disagree 2; strongly disagree 1

Table V Part of results of school-based teacher questionnaire 2010-2011

No.	*School year 2010-2011*	*5*	*4*	*3*	*2*	*1*	*Average*	*Rank order*
1	I think that our school has tried to develop, store and share resources for teaching resources of the curriculum	1	24	12	5	0	3.50	2
2	I think that the colleagues would like to share their teaching experience and skills with others, which gradually inculcate sharing culture	0	24	13	5	0	3.45	3
3	I think that the colleagues are trying to accumulate and categorize teaching resources for retrieval in the future	0	25	15	1	1	3.52	1

Notes: Strongly agree 5; agree 4; neutral 3; disagree 2; strongly disagree 1

Table VI provides a similar questionnaire that was given in school year 2011-2012 (Figure 5):

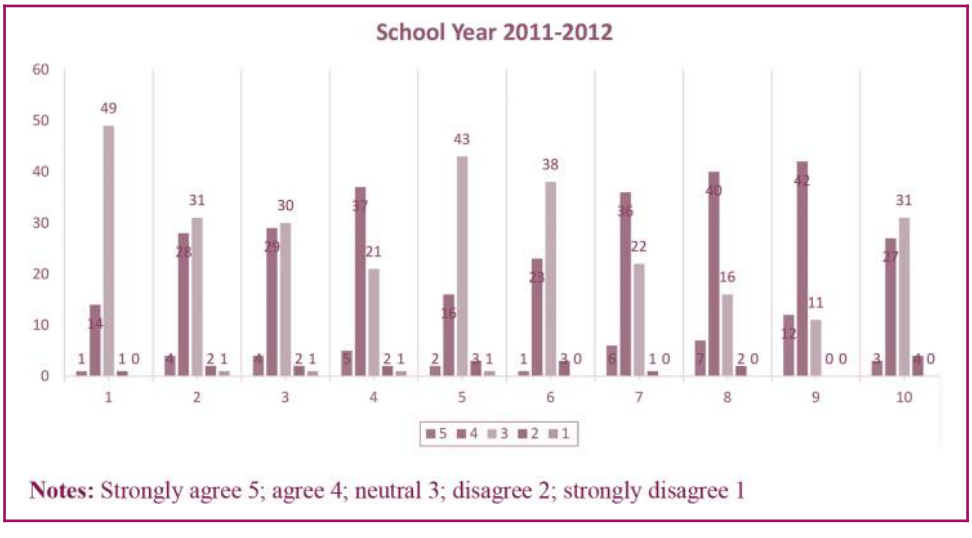
The school administrators administered a similar survey of 19 questions in the school year 2011-2012 for comparison with the result of the two years. The questionnaire was different from that of 2010-2011, with an additional part asking teachers' opinion on the necessity of the major concerns to be continued in the coming three years 2012-2015. In total, 65 out of 67 teachers (97 per cent) finished the questionnaire. The high response rate of this questionnaire might be due to the importance of the use of the questionnaire for evaluation of the existing Three-Year School Development Plan (2009-2012) and the development of the next Three-Year School Development Plan (2012-2015). Table VI shows part of the result of the questionnaire in 2011-2012. From the result of the survey, most questions received a positive response. From the evaluation of performance in 2011-2012, the highest score (3.95, 83.0 per cent of Agree and Strongly Agree among all respondents) could be found for Q.9, where teachers agreed that developing, storing and sharing teaching resources should be continually implemented in 2012-2015. The second highest score (3.74, 72.3 per cent of Agree and Strongly Agree among all respondents) could be found for Q.8, where teachers agreed

Table VI Part of results of school-based teacher questionnaire 2011-2012

School year 2011-2012	No. of respondents 5	4	3	2	1	Average	Rank order
I am satisfied with setting up KM Core Team in 2011-2012	1	14	49	1	0	3.18	9
I am satisfied with building a knowledge sharing platform on intranet in 2011-2012	4	28	31	2	1	3.48	6
I am satisfied with promoting knowledge sharing in our school in 2011-2012	4	29	30	2	1	3.50	5
I am satisfied with developing, storing and sharing teaching resources in 2011-2012	5	37	21	2	1	3.65	4
I am satisfied with forming Communities of Practice (CoP) in 2011-2012	2	16	43	3	1	3.18	9
I think that setting up a KM Core Team should be continually implemented in 2012-2015	1	23	38	3	0	3.29	8
I think that building up a knowledge sharing platform on intranet should be continually implemented in 2012-2015	6	36	22	1	0	3.67	3
I think that promoting knowledge sharing in our school should be continually implemented in 2012-2015	7	40	16	2	0	3.74	2
I think that developing, storing and sharing teaching resources should be continually implemented in 2012-2015	12	42	11	0	0	3.95	1
I think that forming Communities of Practice (CoPs) should be continually implemented in 2012-2015	3	27	31	4	0	3.39	7

Notes: Strongly agree 5; agree 4; neutral 3; disagree 2; strongly disagree 1

Figure 5 Part of results of school-based teacher questionnaire 2011-2012



Notes: Strongly agree 5; agree 4; neutral 3; disagree 2; strongly disagree 1

that knowledge sharing in the school should be continually implemented in the next three years. The third highest score (3.67, 64.6 per cent of Agree and Strongly Agree among all respondents) could be found for Q.7, where teachers agreed that a knowledge-sharing platform on the intranet should be continually implemented in the coming three years. This KM initiative was highly anticipated among teachers. About half of the respondents agreed that the School's performance in "Building up a knowledge-sharing platform on intranet" (average = 3.48, 49.2 per cent of Agree and Strongly Agree among all respondents) and "Promoting knowledge sharing in our school" (average = 3.50, 50.8 per cent of Agree and Strongly Agree among all respondents) were satisfactory in 2011-2012. Nevertheless, some teachers seemed to have reservations about the School's performance in setting up a KM Core Team (Q.6 with rank order 8, average = 3.18, 23.0 per cent of Agree and Strongly Agree among

all respondents) and forming CoPs (Q.5 with rank order 9, average = 3.18, 27.7 per cent of Agree and Strongly Agree among all respondents) in 2011-2012. On the other hand, the two initiatives, setting up the KM Core Team (average = 3.29) and forming CoPs (average = 3.39) should be sustained in 2012-2015.

Evaluation of knowledge sharing

Lewis *et al.* (2006) categorize teacher knowledge shared in schools into different types as below:

1. Knowledge and capability gained for individuals or groups:
   - knowledge of subject matter (CK);
   - knowledge of instruction (IK);
   - capacity to observe and understand students (SK);
   - connection of daily practice to long-term goals (LTGK);
   - new knowledge (NEW);
   - current capabilities enhanced to a higher level (EN); and
   - current capabilities integrated with a new dimension (DIMEN).
2. Teachers' commitment and involvement in community:
   - motivation to improve (MOTI);
   - connection to colleagues who can provide assistance, fostering building relationship, trust, reciprocity and shared values (CON); and
   - sense of accountability to valued practice community (ACC);
3. Learning resources and organizational capability:
   - lesson plans that reveal and promote student thinking (LP);
   - tools that support collegial learning during CoPs (TOOL); and
   - organizational capabilities for performing school functions (ORG) (including explicit and tacit).

Analysis of knowledge shared in Lesson Study and Communities of Practice

The author adopts Lewis *et al.*'s (2006) typology knowledge framework to analyze knowledge sharing. The teachers' feedbacks, collected from the reflection forms after they finished their Lesson Study, were analyzed with reference to Lewis *et al.*'s (2006) classification system of teacher knowledge. Details of the teachers' feedback regarding Lesson Study will be provided on request (Table VII and Figure 6).

Feedback from participating teachers revealed that most felt the researched lessons were effective and fulfilled the lesson objectives. The setting of Lesson Study has helped teachers tackle better the difficult point of the lessons; motivate and engage students better in the learning process; create more effective teaching strategies, activities or materials; and enhance teaching efficacy. Moreover, a mathematics teacher noted that he could learn more about his colleagues' teaching and lesson rationale. On the other hand, teachers also noticed where there was room for improvement, such as in focusing on the main concept; revising teaching strategies; changing teaching activities and processes; modifying PowerPoint presentations, notes or worksheets; and also adding more exercises.

Table VIII shows the analysis of the participants' reflections on the process of CoPs with reference to the compiled framework mentioned above.

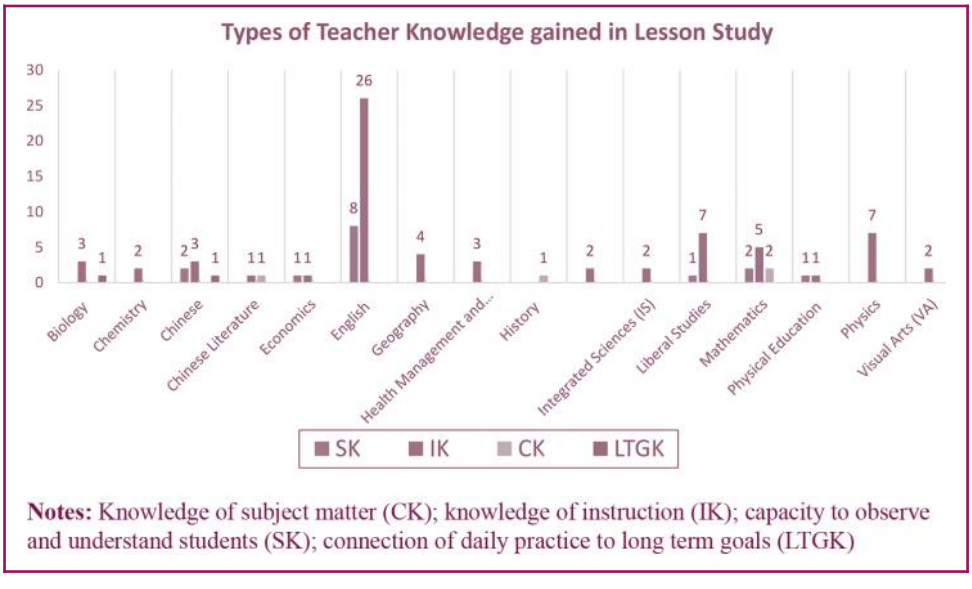
From the results of the Table VIII showing the feedback of teachers participating in CoPs (covering a range of topics of sharing beyond teaching), they reflected that they shared

Table VII Types of teacher knowledge shared in Lesson Study

Subjects of lesson study	*Types of teacher knowledge gained in lesson study*
Economics	(SK), (IK), (IK)
Chemistry	(IK), (IK)
Liberal studies	(SK), (IK), (IK), (IK), (IK), (IK), (IK), (IK)
Physics	(IK), (IK), (IK), (IK), (IK), (IK), (IK)
Mathematics	(CK), (IK)
English	(IK), (SK), (SK), (SK), (SK), (SK), (SK), (SK), (SK), (SK)
Physical education	(IK), (SK)
Information and communication technology	(IK), (IK)
Chinese	(IK), (IK), (SK), (SK)
Visual Arts (VA)	(IK), (IK)
Geography	(IK), (IK), (IK), (IK)
Chinese literature	(CK), (IK)
History	(CK),
Chinese	(LTGK), (IK)
Biology	(IK), (IK), (IK), (LTGK)
Health management and social care (HMSC)	(IK), (IK), (IK)
Mathematics	(SK), (CK), (IK), (IK), (IK) (IK)
Integrated sciences (IS)	(IK), (IK)

Notes: Knowledge of subject matter (CK); knowledge of instruction (IK); capacity to observe and understand students (SK); connection of daily practice to long term goals (LTGK)

Figure 6 Types of teacher knowledge shared in the Lesson Study



Notes: Knowledge of subject matter (CK); knowledge of instruction (IK); capacity to observe and understand students (SK); connection of daily practice to long term goals (LTGK)

their knowledge in various types of knowledge, including knowledge not only relevant to teaching but also related to other duties besides teaching, such as new knowledge (NEW), current capabilities enhanced to a higher level (EN), current capabilities integrated with a new dimension (DIMEN) and connection to colleagues who can provide assistance, fostering building relationship, trust, reciprocity and shared values (CON) and organizational capabilities for performing school functions (ORG). On the other hand, it can be noted that the knowledge that teachers shared in Lesson Study is mainly related to

Table VIII Types of teacher knowledge shared in CoPs

CoPs	*Knowledge and capability gained for individuals*	*Teacher commitment and community*	*Learning resources and organizational capability*
Handling students in difficult situations	We acquired some tips for dealing with students in crisis and difficult situations, through several sharing sessions and hands-on experiences. (SK, EN) very useful skills in handling cases, e.g. What I can do if a student tells me that she is pregnant; and How to handle a student who is contemplating suicide, etc. (SK, EN, NEW); acquired some of the basic principles in handling cases, e.g. Criteria for "Keeping secrets of students", (SK, EN), learned not only how to handle the unusual behaviour of students, but also some background information and procedures that teachers should be aware of, especially what teachers should do and should not do (SK, EN, NEW, LTGK, DIMEN), learnt the ways to handle students in crisis and difficult situations (SK, EN, NEW, DIMEN), developed knowledge on legal issues related to handling students (NEW, SK, DIMEN), learnt useful and practical strategies in handling crisis and increased their awareness about the Do(s) and Don't(s) in handling crisis (NEW, EN)	We had sharing by experienced teachers, and discussion with fellows (CON), learning from and with others is a more effective way of learning. (CON). The CoPs were generally conducted in a relaxing manner which could effectively encourage participants to share their viewpoints, and more importantly, experience in handling similar predicaments (CON), gained and learned more through sharing from experienced colleagues (CON); the CoPs could serve as platform of teacher sharing for fostering teacher professional development (CON)	We learnt useful and practical strategies in handling crisis and increased their awareness about the Do(s) and Don't(s) in handling crisis (ORG), handling "cases" was definitely an "asset" of our school (ORG)
	Summary: SK (5), EN (6), NEW (5), LTGK, DIMEN (3),	*Summary:* CON (5)	*Summary:* ORG (2)
iPhone and iPad Apps sharing	We learnt many useful and practical apps for personal use (CK, LTGK)	It was a good practice to have this kind of sharing (CON)	
Reflection on pedagogy	The case of learning and teaching could be applied in many other contexts not only in one subject but also in other subjects. (IK, DIMEN), learnt the importance of having reflection on teaching (EN), understand more the needs of students and their difficulties in studies (SK)	A good opportunity to share experience with teachers of other subjects (CON), a good beginning to develop this culture (CON), teachers could participate in the sharing in a relaxing way (CON)	
	Summary: IK, SK, DIMEN, EN	*Summary*: CON (3)	

(*continued*)

Table VIII

CoPs	*Knowledge and capability gained for individuals*	*Teacher commitment and community*	*Learning resources and organizational capability*
Motivating class spirits	We tried some of the good practices from the sharing of colleagues in the coming future (EN), learnt some practical ways to have better team spirit in class (EN), acquired the knowledge of motivating class spirit and enhancing cohesiveness and the difference in handling classes of junior and senior forms. (EN, DIMEN), there was no one "best" way of motivating a class. Different teachers have different styles in handling class affairs and creating class spirit. (DIMEN), "Especially the one about how a teacher has to be a role model for our students. If we want our students to put in effort, we have to show them we are putting in double the share. Fairness is also equally important but strictness can be adjusted in different cases. Being a class teacher is like being a "second mum" for our students. We have to grow with them, give them advice and express our love and care to them". (DIMEN), learned skills in motivating the class, the role of a class teacher and the struggle of the class teacher and the ways to resolve the struggle. (EN, DIMEN) numerous ways to boost class spirit (EN, DIMEN). Each class teacher should have his or her own personal style to find the best for his or her class. (EN)With lots of patience and care, class spirit can be established. (EN), The knowledge and experience acquired in the CoPs could not be obtained from pre-service training (NEW)	A good practice to have this kind of sharing (CON), the experience of joining CoPs was pleasant and useful (CON), a chance to discuss and exchange opinions in a more relaxed way, with tea and refreshments (CON)	The CoPs were quite relevant to their practice and the experience shared was based on our school context, relevant to their daily work (ORG), CoP was a good platform for the colleagues to share our experience in teaching and working. (ORG)
	Summary: EN (7), DIMEN (4)	*Summary:* CON (3)	*Summary:* ORG (2)

Notes: Knowledge of subject matter (CK); knowledge of instruction (IK); capacity to observe and understand students (SK); connection of daily practice to long term goals (LTGK); new knowledge (NEW); current capabilities enhanced to a higher level (EN); current capabilities integrated with a new dimension (DIMEN); connection to colleagues who can provide assistance, fostering building relationship, trust, reciprocity and shared values (CON); organizational capabilities for performing school functions (ORG)

teaching, such as knowledge of subject matter (CK), knowledge of instruction (IK) and capacity to observe and understand students (SK). The researcher concluded that the knowledge shared in CoPs was found to be more diverse in types of knowledge defined by Lewis *et al.* (2006). The knowledge shared was found to be not limited to the category of "knowledge and capability gained for individuals", but also comprised that of "teacher commitment and community" and "learning resources and organizational capability". Teachers were found to share their knowledge not only in their teaching experience but also in other areas of their duties so as to enhance their job effectiveness. Furthermore, the researcher noticed that the knowledge-sharing culture has been enhanced to a large extent during the sharing process.

Evaluation of leadership

In this study, the principal played the role of a knowledge leader. This study would like to note the impact of the principal's leadership in KM implementation in the researched school. Since Fullan (2002) has proposed principals as the knowledge leaders, there have been few empirical studies to verify Fullan's proposition. From the result of this study, the researcher agrees with Fullan's view that the principal should play the roles of a knowledge leader exerting deeper and more lasting impact than focusing just on higher standards. In this study, KM leadership is conceptualized to consist of three aforementioned components: knowledge vision builder, knowledge enabler builder and knowledge role model. The author agrees with Printy's (2008) advocacy that principals should serve as knowledge brokers, allowing teachers to emphasize teaching and learning, encouraging innovation, shaping teacher learning and providing adequate resources for teachers' work. Printy's (2008) concept of principals as knowledge brokers is consistent with the KM Leadership Conceptual Framework in this study. In this part, the author will use the KM Leadership Conceptual Framework to validate the principal's KM leadership in this study. The principal's performance was evaluated for the effectiveness in performing these three roles and also the fitness of these roles in knowledge leadership based on the principal's observation and the principal's action and also on the results of interviews with teachers by the outsider interviewers.

Knowledge vision builder

Knowledge vision builder makes sense of the organizational context to identify the knowledge needs or the gaps that require additional learning and set the direction of organizational development and also the relevant knowledge-creating and -sharing processes (Lakshman, 2008; Viitala, 2004).

The principal promoted KM implementation by establishing vision, strategies and goals for the organization. From the results of the principal's field notes and the interviews with teachers by outsider interviewers, it was found that the principal in this study articulated the knowledge vision and communicated it throughout the school even though teachers were reluctant to change. The principal first used his very best efforts to gain the teachers's trust, so that they believed that the principal was doing something beneficial for the school before any changes were introduced. Then, the principal convinced the teachers of the necessity for the changes to be introduced because of growing demands, threats and challenges that the school would face in the near future, so that the principal served as the knowledge vision builder by making sense of the school context in the here and now, and even in the near future, to identify the knowledge needs or the gaps that required additional learning.

Analysis of the leadership process on knowledge vision. The principal proposed the knowledge vision to his staff, and allowed the staff to discuss the vision to create a shared vision for school development (DuFour, 2006). Principals can encourage teachers to work together (Murphy and Lick, 2005). The principal performs the role of an agenda setter, who establishes direction and ensures that KM goals and other relevant expectations were met. Such knowledge vision gave direction to teachers about how the school and its knowledge

base were going to be developed in the future, and also how the knowledge will be evaluated so as to sustain the competitiveness of the school. As a principal, the researcher found that teachers needed strong leadership to guide them to develop and share knowledge, otherwise teachers only maintained their habits in their daily practice, and it would be difficult for them to contribute and share their knowledge with others. The principal as a knowledge vision builder has been making sense of the context of the school, i.e. the challenges the school has to face, outside or inside, in the present and future moment, to identify the knowledge needs or the gaps that require additional learning; setting a direction for school development and also the relevant knowledge-creating and -sharing processes; and defining the value system that evaluates and justifies the quality of the organizational knowledge.

Teachers' perspective collected by the outsider interviewers. From teachers' interviews evaluating KM and CoPs performance in the school, many participating teachers thought that the principal was critical for CoP launching in the school (Critical Agent):

> Principal brings CoP to school. He encourages some colleagues to join KM training course. He himself also goes to other schools to promote and share. He believes KM that can make impact. He pays a lot of effort to share CoP, he recognize CoP and always motivate staff to join CoPs. Colleagues will just observe and try. Some colleagues will join the CoPs and also motivate other colleagues to join together.

Teachers strongly feel that the principal brings his own vision of launching CoPs in the researched school. They understood that the principal brings KM to the school because KM can bring benefits to the school (Initiation of Vision):

> Principal is very enthusiastic to initiate KM. Although he would like us to join, he only encourages us but not forces us to join. He allows us to determine to join the CoP by ourselves.

> Principal has clear vision on CoPs.

> Principal has his heart on KM. He really knows KM.

Teachers appreciated the principal's strong and clear visions on KM (Strong and Clear Vision):

> Principal is very enthusiastic to initiate KM. Although he would like us to join, he only encourages us but not force us to join. He allows us to determine to join the CoP by ourselves.

Teachers further expressed it much better if the principal showed strong leadership in guiding the direction of the development of CoPs (Guiding Direction):

> Principal pays a lot of effort on pushing CoPs. He actively encourages colleagues to join CoP in the Staff Meetings. He explains the rationale of CoPs to the staff. He certainly participates in all CoPs, and gives feedback. He acts as a leader and serves as a role model. He is very positive towards CoPs.

Teachers also felt that the principal encouraged them to join CoPs. The principal paid much effort in encouraging, but did not push, the teachers to join CoPs. He took many opportunities to help the teachers understand the rationale of KM and its benefits to school so as to persuade them to join without forcing them (Force of Encouragement):

> Principal usually encourages colleagues to join CoPs. He pays a lot of effort to implement CoPs. I know that he attended many KM related seminars, and he gave us a talk on KM on a staff development day last year to explain benefits of KM to us.

> Principal pushes CoPs at school, pay a lot of effort to share CoPs, he knows CoPs and always motivate staff to join CoPs.

Several key ideas can be identified from the teachers' interview results shown above: Critical Agent, Initiation of Vision, Strong and Clear Vision, Guiding Direction and Force of Encouragement. They are inter-related. These key ideas can give some insight into how the principal can have knowledge vision.

Evaluation of knowledge management leadership in knowledge vision

The principal demonstrated his capability for building a school knowledge vision in this study by articulating the major concerns of school development and illustrating the vision to teachers in staff meetings and other occasions. As a knowledge vision builder, he made sense of the school context to identify the knowledge needs. He gave direction to the process of creating, developing and storing knowledge for organizational development. Teachers recognized the principal's passion and effort in leading KM implementation in the school and appreciated the principal's respect for teachers' self-interest in KM.

The principal promoted KM implementation by establishing vision, strategies and goals for the organization. From the results of the researcher's field notes and the interviews with teachers by outsider interviewers, it was found that the principal in this study articulated the knowledge vision and communicated it throughout the school even though teachers were reluctant to change. The principal first used his very best efforts to gain the teachers' trust, so that the teachers believed that the principal was doing something beneficial for the school before any changes were introduced. Then, the principal convinced the teachers of the necessity for the changes to be introduced because of growing demands, threats and challenges that the school would face in the near future, so that the principal served as the knowledge vision builder by making sense of the school context in the here and now, and even in the near future, to identify the knowledge needs or the gaps that required additional learning. Teachers appreciated the principal's knowledge vision by defining the knowledge the school needs, especially in teaching and administration. Teachers also recognized that the principal had a clear vision and could give direction in the knowledge-creating process and the knowledge created by it, and could determine how the school and the knowledge base of the school is developed. Teachers liked the direction set for school development and also the relevant knowledge-creating and -sharing processes. Teachers welcomed the principal bringing KM to the school and acknowledged that KM has made an impact on the school. But, the principal of the School should think of more steps for further development. The blueprint of the Long-Term Development Plan should be discussed with the teachers, so that more effort and participations from staff could be engaged.

Knowledge enabler builder

The second essential element of KM leadership is the procurement of enablers, or enabling conditions, to facilitate KM implementation in the school. Knowledge enabler builder can promote KM by providing the four enabling conditions proposed by Choo and Alvarenga Neto (2010), such as:

- social/behavioural conditions;
- cognitive/epistemic conditions;
- infrastructure conditions; and
- organizational conditions

From the results of the principal's field notes and interviewing with teachers by outsider interviewers, it was found that the principal in this study gave teachers space: physical space, virtual space and/or mental space. The principal was aware of the teachers' reluctance for the changes because of the perceived extra workload and the extra worries. The principal provided supporting conditions for teachers to minimize their resistance to such changes. The principal endeavoured to build mutual trust and a good working relationship within the school with strong morale. He also tried to instil some ideas and relevant values of school development so as to nurture a positive culture for KM as Nonaka *et al.* (2000) suggest. The principal upgraded the school infrastructures to facilitate KM implementation. The principal promoted KM by conducting several workshops on KM, Lesson Study and CoPs to create a common language and understanding among staff. During the processes of KM implementation, the sharing culture among staff within the

school was found to be enriched. Teachers began to share more readily. Collaboration across departments and committees has been increased over these two years.

Analysis of insider researcher's observation on knowledge enabler

The principal became a knowledge enabler by providing enabling conditions to teachers, so that more sharing could occur in the school. One of the main functions of leadership was to allocate resources. The aforementioned four enabling conditions suggested by Choo and Alvarenga Neto (2010) summarized most of the requisites for KM implementation: social/behavioural, infrastructural, cognitive/epistemic and organizational conditions. These conditions could change the atmosphere among teachers so that the culture of sharing could be enhanced. The principal supported CoPs to enhance both organizational and individual learning, and provide opportunities to all teachers to access information and knowledge by using the information technology (IT) infrastructure in a better manner. The principal provided spaces that were either physical (meeting rooms) or virtual (a computer network) or mental ones (common goals). Moreover, being the knowledge leader, the principal promoted the use of technology and people in establishing knowledge networks to support staff in the processes of reflecting on their experiences in their practice, especially in Lesson Study and CoPs.

Teachers' perspective collected by the outsider interviewers. The teachers participating in the CoPs expressed their views concerning the principal's KM leadership as a knowledge enabler builder.

Teachers anticipated a better Document Management System for facilitating knowledge sharing in school. Teachers expressed their needs to have a platform to share knowledge with others or retrieve knowledge from others. The school needs to build up a platform to store knowledge and allow teachers to obtain knowledge. This teacher's view matched with "infrastructure conditions" (Choo and Alvarenga Neto, 2010) of provision of infrastructures such as IT systems or information systems for better effective communication:

> Better Document Management System can facilitate teachers using the documents, such as parents' letter, notes, etc.
>
> I would not like to share my stuff which is my privacy and my belonging. However, I think the shared repository is important because I can know where I can get the things I want and who I can ask. I would like someone who are willing to share. For example, I can learn how to do things when I ask my colleague. I hope that I could use less time to explore how to do somethings new and make things smooth.

The teachers appreciated the principal's commitment and action in enhancing organizational culture, organizational structure, organizational and inter-organizational processes, human resources management and organizational learning initiatives/projects for launching CoPs and even KM in a broader sense. Teachers believed that CoPs were an interesting approach to facilitate sharing among teachers. They would be willing to join. This teacher's view matched with "organizational conditions" (Choo and Alvarenga Neto, 2010), depicting commitment and action of the management in enhancing organizational culture, organizational structure, organizational and inter-organizational processes, human resources management and organizational learning initiatives/projects for launching CoPs and even KM in a broader sense:

> Principal leadership is critical for the implementation on CoPs. He is a good leader but he cannot motivate the staff by himself alone. If all the top management can join together, it would be better. More participants join, more successful the CoP will be. It is difficult for only one or two persons. Although not all top management knows KM too much, they need to support KM to make the implementation successful.
>
> Although there are colleagues designated for all CoPs, principal still attend all CoPs to show his concern and support to CoPs. On the other hand, even though there is not too much extra

> resource, school still supplies some drinks and snacks for all CoPs. This gives the participants a warm feeling of support and care. We also feel that principal supports and cares about CoP.
>
> Before Principal introduced CoP, I had no knowledge of that. Principal introduced CoP at one of the Staff Development Days. I feel that CoP is quite interesting and useful. Teacher development should not be only limited to teaching. CoP can provide more opportunities for teachers to share the other knowledge related to teaching. It would be more interesting to teachers, so that teachers might feel that it will be not so boring. Teachers can choose their interesting topics to join and they would have stronger sense of involvement. I feel that there are some core members met in the three CoP activities that I attended. I think that it might be the opportunities to invite more teachers to join, or even CoP could be applied to students. The school can share knowledge from one to many.

The principal organized the talks by inviting experts to explain CoPs. The teachers appreciated the principal's introduction of the CoPs concept and its uses to teachers so that they could understand CoPs. It facilitated communication among teachers with a common language. It also encouraged sharing among teachers. This finding matched with "cognitive/epistemic conditions" (Choo and Alvarenga Neto, 2010), with these conditions facilitating understanding of the processes and communicating during the processes of KM implementation related to common knowledge or shared epistemic values and commitments among organizational members:

> Principal has invited an expert to share what CoP is on the staff development day, and the PowerPoint slide have been uploaded to the intranet for reference for teachers. Chinese department has also sharing among teachers within the department. I tried to share some PPT slides and informed colleagues to view in my share folder when the new curriculum was implemented. When teachers attend seminars, they will share what they have learnt outside to other teachers.

The teachers felt that the principal was very enthusiastic about CoPs. He promoted CoPs during the first staff meeting to encourage the teachers to join. It might be the social/behavioural conditions mentioned by Choo and Alvarenga Neto (2010) to the group and even the organizational level with factors that foster relationship building and enhance interactions among organizational members to create a fertile ground for knowledge creation, sharing and use:

> Promotion of CoP is important. Principal is enthusiastic for CoP. Principal promotes CoP at the beginning of the school year and also there was the first staff development day to introduce CoP. Principal promotes CoP in the staff meetings and encourages colleagues to join. When teachers hear more from CoPs, they are more willing to join.
>
> Principal is enthusiastic for CoP. Principal promotes CoP in the first staff meeting and also the staff development day.

Some teachers might worry about that there would be too much change when not only CoPs but also Lesson Study were going to be to be launched at the school, and it would bring extra workload but without additional resources.

The key ideas can be identified from the teachers' interview results shown above: social/behavioural conditions, cognitive/ epistemic conditions, infrastructure conditions and organizational conditions, matched with the four requisites for KM implementation. These key ideas can give some insight into how the principal can provide knowledge enabler conditions.

Evaluation of knowledge management leadership in knowledge enabler

The principal realized his role as a knowledge enabler builder in this study by providing social/behavioural, infrastructural, cognitive/epistemic and organizational conditions. He provided additional resources to facilitate both organizational and individual learning, and created opportunities for all teachers to obtain information and knowledge internally and externally by using information networks in a better manner. The principal fostered all four

modes of knowledge conversion (externalization, socialization, combination and internalization) on different organizational levels of the school. The teachers recognized the principal's support and the extra resources provided by the school for building enabling conditions to enhance knowledge processes. The teachers seemed to anticipate top management support and the promotion of a sharing culture and atmosphere in the school.

From the results of the researcher's field notes and interviewing with teachers by outsider interviewers, it was found that the principal in this study gave teachers space: physical space, virtual space and/or mental space. The principal was aware of the teachers' reluctance for the changes because of the perceived extra workload and the extra worries. The principal provided supporting conditions for teachers to minimize their resistance to such changes. The principal endeavoured to build mutual trust and good working relationship within the school with a strong morale. He also tried to instil some ideas and relevant values of school development so as to nurture a positive culture for KM as Nonaka *et al.* (2000) suggest. The principal upgraded the school infrastructure to facilitate KM implementation. The principal promoted KM by conducting several workshops on KM, Lesson Study and CoPs to create a common language and understanding among staff. Teachers appreciated the principal's effort in offering the knowledge-enabling conditions. Teachers expressed their needs for strong support from the top management and acknowledged that they experienced positive reinforcement because of the principal's full participation in the CoPs. The teachers welcomed the principal's presence in the CoPs because he showed his strong commitment to enhancing organizational culture, organizational structure, organizational and inter-organizational processes for implementing CoPs and even KM in a broader sense. Teachers appreciated the principal's introduction of the CoP platform and its uses to teachers. It facilitated communication among teachers by providing a common language and encouraged sharing among teachers. Teachers were found to be willing to join the process. During the KM implementation processes, the sharing culture among staff within the school was found to be enriched. The teachers began to share more readily. Collaboration across departments and committees increased over these two years. Teachers felt that the principal was very enthusiastic for CoPs. Teachers recognized the principal's effort in promoting CoPs to encourage teachers to join, and building up the social/behavioural conditions mentioned by Choo and Alvarenga Neto (2010) at the group and organizational levels for fostering relationship building and enhancing interactions among organizational members to establish a fertile ground for KM implementation. Nevertheless, some teachers might still think that the principal's effort in the promotion of CoP was not enough. The principal was asked to be more explicit in motivating teachers through the ways that KM and CoPs could help their practice.

Knowledge role model

Leaders as role models set the example to signal their subordinates that the open sharing of ideas and information is important and valuable. As a result of this role modelling, their subordinates are more likely to correspond and share their expertise and knowledge with their colleagues.

The principal did depict his position as a knowledge role model builder in this study by serving as an example, sharing information with both staff and outsiders. The principal set the example by sharing some inspiring messages and PowerPoint slides that he had received from outside sources and materials that he collected from colleagues. The principal advocated that knowledge sharing was paramount and valuable for their subordinates on many occasions, such as staff meetings and during the Staff Development Programme. Because knowledge sharing in teams was not automatic, the principal's active participation in knowledge sharing was found to be useful to stimulate teachers to share their practice as Srivastava *et al.* (2006) and Carmeli *et al.* (2010) suggest.

The principal regards knowledge role model as imperative in leading KM implementation in the school because most teachers do not have much confidence in KM implementation. They observe whether there is somebody willing to begin. They may be afraid of the challenges or difficulties ahead of them.

Analysis of insider researcher's observation on knowledge role model

The principal served as a role model and used his own behaviour to inform staff what he anticipated them to do regarding KM implementation. If teachers were open to KM implementation, they would gradually follow the principal or other colleagues' behaviour, because the behaviour would become the social norm or a common pattern of behaviour among the staff. Some teachers might not know what behaviour the school administrators preferred. The principal and the school administrators were role models in knowledge sharing. They encouraged teachers to follow their examples. To a certain extent, some teachers learned that knowledge sharing was appreciated, and it helped them gain recognition and appreciation from their peers.

Teachers' perspective collected by the outsider interviewers

From the teachers' interviews evaluating KM and CoPs performance in the school, many participating teachers acknowledged that the principal was critical for CoPs' launch at the school. The following were the teachers' feedback on the aspect of principal as knowledge role model builder:

> Principal is a good role model. He cares much about CoP. He is enthusiastic. I hope that he will not add too much extra workload to teachers. If it is OK, I think teachers will cooperate with principal and support to the CoP. However, it might be not very effective in promoting CoPs.

> Principal does not just talk. He observed what we are doing. For example, when I made a PowerPoint that may be useful to S.1 Class Teachers, he requested us to give him to share with other colleagues. I realised that some colleagues did use the PowerPoint. Principal has walked what he talked.

The result of teacher interviews on the aspect of principal as role model matched with Payne and Wolfson's (2000) experience in serving as a role model for teachers' professional development. Payne and Wolfson were both principals of two high schools in the USA. They demonstrated a commitment to on-going learning and served as role models for setting an example for lifelong learning, and helped establish the culture of the school as a learning organization where on-going professional development is the norm. Payne and Wolfson (2000, p. 15) claim that "When the principal models continual learning, the support staff is more likely to focus on their own professional development":

> Principal pays a lot of effort on pushing CoP. He actively encourages colleagues to join CoP in the Staff Meetings [. . .]. He certainly participates in all CoPs, and gives feedback. He acts as a leader and serves as a role model. He is very positive towards CoP.

The principals learned together with the teachers, and shared with them the joys and frustrations of learning new skills. They discussed new ideas and possible ways of improving the school and increasing student achievement through the growth of knowledge and skills of the entire staff. Both the principal and the teachers were found to benefit from learning together:

> Principal likes to share his experience and ideas to staff, so that staff can understand more about him. He did not say too much, and just up to the point to allow us think. He also allows us to know how open he is, and we can understand how to get along with him, better relationship can be anticipated.

The key ideas identified from the teachers' interview results of the knowledge role model can be summarized as showing examples by joining and being involved actively in KM activities. Teachers followed the principal's example to join KM activities. The key ideas can give some insight how principals can become knowledge role model.

Evaluation of knowledge management leadership in knowledge role model

The principal did depict his position as a knowledge role model builder in this study by serving as an example, sharing information with both staff and outsiders. The principal set the example by sharing some inspiring messages and PowerPoint slides that he received from outside sources and materials that he collected from colleagues. The principal advocated that knowledge sharing was paramount and valuable for their subordinates on many occasions, such as staff meetings and during the Staff Development Programme. Because knowledge sharing in teams was not automatic, the principal's active participation in knowledge sharing was found to be useful to stimulate teachers to share their practice as Srivastava *et al*. (2006) and Carmeli *et al*. (2010) suggest. The teachers observed that the principal encouraged the teachers to join KM initiatives, such as CoPs, and share their knowledge with colleagues. The teachers recognized the principal's support and active participation in KM activities in the school. The teachers experienced trust in the principal during knowledge activities. The teachers were likely to correspond and share their experiences and knowledge with their colleagues. The teachers appreciated that the principal learned together with them, sharing their practice, and discussed new ideas and possible ways to improve the school and enhance students' achievement.

To conclude, the principal's leadership in the three abovementioned roles was recognized by not only by the researcher but also the teachers in the school.

Analysis of knowledge management leadership in the process of implementation

The researcher analyzed the leadership with the framework in the process of implementation in the Stages 1 and 2 (Tables III, IV, IX X and XI; Figure 7).

From the frequency of occurrence of knowledge leadership shown in Table IX it was found that enabler builder – organizational condition became the dominant leadership role in Stage 1. This is because of the strong requirement of support from top management to provide enabling conditions for KM implementation in the following areas: organizational culture, organizational structure, organizational processes, human resources management and organizational learning initiatives/projects, etc. especially for the processes requiring change. Other kinds of knowledge leadership were found to be recessive in Stage 1 because there were only a few initiatives for KM implementation in Stage 1 at the beginning period.

There were some obvious differences identified between the two stages. The total frequency of the Stage 1 increased from 16 to 20. It can be roughly estimated that there was an increase in leadership from Stages 1 to 2. This result matched with the researcher's field notes that the principal has raised his level of leadership from Stages 1 to 2. The knowledge leadership from enabler builder –infrastructure was substantially increased from Stages 1 to 2. It may be because there was a greater demand for constructing infrastructure. Because of the many related problems related to infrastructure occurring during the process, the principal had more chances to exert his leadership to provide support in solving the problems.

The knowledge leadership of enabler builder – social/behavioural conditions was also found to be doubled from Stages 1 to 2. This is because of the implementation of more initiatives of the people-/interaction-based approach; there were many opportunities and needs to enhance social interactions and relationship building in Stage 2.

The knowledge leadership of role model was found to appear in Stage 2. As more KM activities were launched, the principal could have more opportunities to demonstrate his knowledge in applying in KM. On the other hand, the knowledge leadership of enabler builder – organizational condition was found to decrease greatly from Stages 1 to 2. It might be because the organizational conditions for facilitating KM implementation were already established to a certain extent, and the leadership has shifted to other areas such as infrastructure, the KM task force or social and behavioural conditions. It seemed that the

Table IX Analysis of KM leadership in implementation of Stage 1

Issues	*Implementation*	*Leadership*	*KM leadership*
Teachers' readiness, acceptance to KM	The principal was trying to initiate changes in the School for KM development and school improvement. The principal was sensitive to resistance to the process of implementation	The principal estimated teachers' readiness for and acceptance of KM to avoid teacher resistance and deterioration of working relationship	Enabler builder – social/behavioural
Teachers' resistance and workload	The principal sensed that teachers were very busy with the heavy workload (preparing the 40th anniversary activities)	The principal worried about the extra workload when KM was implemented	Enabler builder – organizational
Weak sharing culture	The principal did not feel comfortable initiating changes owing to the weak culture and atmosphere among teachers	The principal scaled back his initial ideas and spent time improving the sharing atmosphere	Enabler builder – organizational vision builder
Developing infrastructure for later stages	The main focus was implementing the information-based approach by establishing the necessary infrastructure for KM implementation in later stage	The approach would not trigger teachers' negative emotions: lack of direct impact on people reduced resistance	Enabler builder – infrastructure
Developing knowledge base	Several problems were encountered		
	The school needed to develop the platform by integrating different functions in single portal to satisfy the needs of the school	The principal had to make a leadership decision if Knowledge Base development continued or not	Enabler builder – organizational
	The school had to consider how to develop the platform: by employing staff or buying outsourcing service	The principal should examine the school context and needs matched with his vision for school development	Vision builder
	The school decided to recruit a programmer as staff member	The principal discussed with teachers The current staff did not have the time or expertise to do the programming successfully	Enabler builder – organizational
	The programmer needed monitoring and supervision to ensure the task quality	The principal assigned the IT Committee Chairman to supervise the programmer. The principal also monitored and supervised	Enabler builder – organizational
The programmer resigned before completion	The school employed a part-time programmer to finish the project	The principal decided to employ another programmer to finish the job	Enabler builder- organizational
Encouraging KM	The principal gave a brief talk to introduce the basic concepts of KM	Having received some resistance from teachers, the researcher slowed down the process of KM implementation	Enabler builder – social/behavioural
Implementing Lesson Study Taster Scheme	The principal introduced a Lesson Study Taster Scheme	The principal judged the resistance from the teachers and made participation voluntary	Enabler builder – organizational

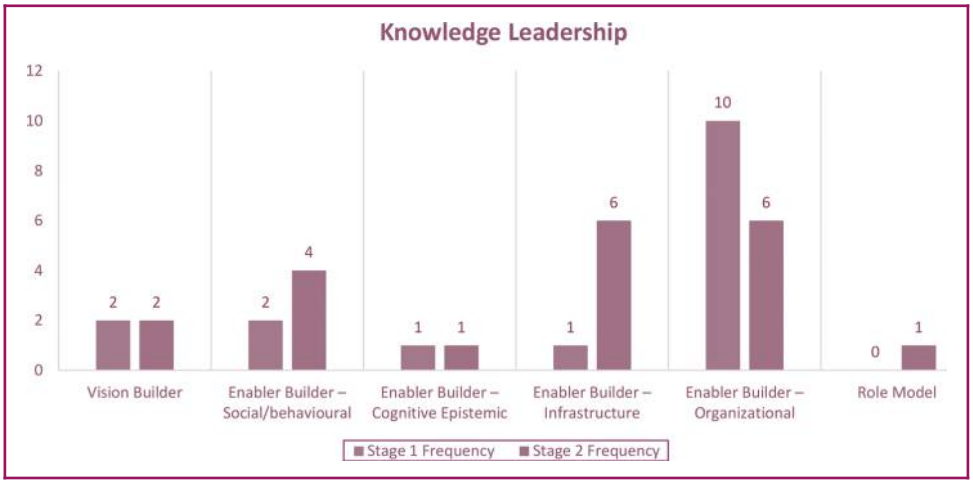
Table X Analysis of KM leadership in implementation of Stage 2

Issues	*Implementation*	*Leadership*	*KM leadership*
Launching Knowledge Base	The Knowledge Base was successfully launched so as to facilitate information flow and access among teachers	The principal had the vision for the platform. The principal also specified the kinds of the information the school needed to put on the platform The principal encouraged teachers to use such information	Enabler builder – organizational Enabler builder – infra- structure, vision builder
Considering the launch of SharePoint	The middle managers rejected the SharePoint proposal	The principal was aware that the school system should not be changed too frequently,	Enabler builder – organizational Enabler builder – social/behavioural
Considering the launch of the Digital Archive	The Digital Archive adopted as the School Knowledge Repository. Since Digital Archive was a commercial product designed for common uses of schools, its functions might not suit the school's needs. The school had to customize the function and interface of the system	The principal advocated for the use of a Digital Archive to consolidate KM	Enabler builder – infrastructure
Launching the Digital Archive	Teachers were more willing to use the old system with some additional functions in their familiar interface Middle managers needed to be able to understand the needs of the school at all levels to have an effective platform for storing documents and knowledge and facilitating the sharing of knowledge	The principal applied a lesson in change management, seeing that the teachers were reluctant to use a new system because they needed to learn new skills Middle managers knew the school needs and could the reasons for the school development	Enabler builder – organizational Enabler builder – infrastructure
Customizing Digital Archive	The school needed to customize the Digital Archive to suit the school's needs. The school developed a taxonomy to unify the file structure to facilitate sharing	The school leadership had to consider the problems and advantages of customization and maintenance of the system The principal needed to have vision and insight to provide taxonomy direction	Enabler builder – infrastructure vision builder
Expanding Lesson Study implementation	Lesson Study was expanded and more departments and groups of teachers became involved Teachers still had the freedom to choose their degree of participation	The principal saw that sharing culture was developing; teachers were more willing to share The principal gave freedom to teachers	Enabler builder – social/behavioural
Trial of CoPs	Several CoPs were tried to provide opportunities for teachers to share their knowledge	The principal was a model for the promotion of KM and CoPs. Since the improvement of sharing culture, CoPs were much easier to promote	Role model
Activated KM task group and encouraged teachers to receive training in KM	KM task group had difficulties because its members knew little about KM theory and practice. The members attended the CKP course. Since then, they have given much input in suggestions for KM activities	The principal alone could not bring about all the change. The principal built up the team and encourage their further education in KM, to the benefit of the team and the whole school	Enabler builder Organizational cognitive/epistemic Social/behavioural

Table XI Comparison of leadership in implementation in Stages 1 and 2

Knowledge leadership	*Stage 1 frequency*	*Stage 2 frequency*
Vision builder	2	2
Enabler builder – social/behavioural	2	4
Enabler builder – cognitive epistemic	1	1
Enabler builder – infrastructure	1	6
Enabler builder – organizational	10	6
Role model	0	1
Total	16	20

Figure 7 Comparison of leadership in the implementation in Stages 1 and 2



leadership-driven KM implementation with strengthened leadership applied during the process achieved a certain extent of success. It was also found that the principal's leadership in the three aforementioned roles was shown during the process of implementation.

Impact of knowledge management on organizational performance

The evaluation of KM should not be limited only to the process and the participants' feedback but also to the impact on organizational performance. Because of knowledge leadership, the School can implement KM successfully and smoothly, and in turn, the performance of the School improved. The school performance can be evaluated by an external school review, the students' academic achievement and the awards of KM achievement.

On 18, 20-22 and 27 February 2013, members of the External School Review (ESR) team of the Hong Kong Education Bureau visited the School and conducted an ESR of the School. The ESR is a comprehensive school inspection to judge the School's overall performance in every five to six years. The ESR team is comprised five members: a senior inspector as the leader, three team members as inspectors, and one serving principal from another school to give professional judgement after the inspection. They inspected school documents; conducted interviews with school directors, teachers, parents and students; and conducted lesson observation to examine and double-check the result of the School Self Evaluation Report of the School. The ESR team gave their comments on the overall school performance. The ESR team recognized and acknowledged that the School had made good progress compared with that in the previous ESR in 2005. The ESR team agreed with the school administrators that knowledge sharing is vital for the

School's development. The ESR team noted that the School adopted KM for systematically organizing school documents on the school intranet and utilizing Digital Archive module of eClass so that documents could be retrieved easily by teachers and the sharing of documents could be enhanced. Lesson Study, Peer Lesson Observation and sharing at Staff Development Days and in CoPs have been organized well and have become fruitful channels through careful selection of topics relevant to teachers' daily practice, alignment with the priorities of major concerns, matching experts and teachers and equipping teachers with relevant knowledge. They declared, with no reservation, that Lesson Study and CoPs should be the major strategy for fostering teachers' effectiveness. Both Lesson Study and CoPs will allow teachers to share students' learning difficulties that they encountered during their teaching process. Teachers' self-reflection on and from the process and outcomes of Lesson Study and CoPs were important. The ESR team appreciated the School for starting the Lesson Study scheme because of the evidence for it making a positive impact on classroom teaching. They appreciated that Department Heads are able to formulate effective strategies and assessment, and that students' learning has been consolidated. The School has shown improvement in management, staff and student development. They agreed with the School on all the new initiatives that are putting the school on the right track in different domains. In short, the ESR team, functioning as an external expert team, recognized the School's achievements and school improvement by adopting KM. Generally speaking, KM can enhance the School's organizational learning so that most teachers could enjoy professional development for the whole school. After the School introduced KM, the school performance in all domains showed significant improvement of both the information-based approach in organizing documents and the people-/interaction-based approach in engaging sharing among teachers in the school community. Because KM has been implemented for several years, the culture of change and knowledge sharing in the school has been established.

Leithwood *et al.* (2009) reviewed the literature and suggested that a successful principal should establish conditions for effective teaching and learning so that student achievement could be enhanced. The School's results in the 2012 and 2013 public examinations for the Hong Kong Diploma of Secondary Education (HKDSE) showed a noticeable improvement in students' achievement. Table VII is a comparison of the students' achievement in HKDSE in 2012 and 2013 (Table XII and Figure 8).

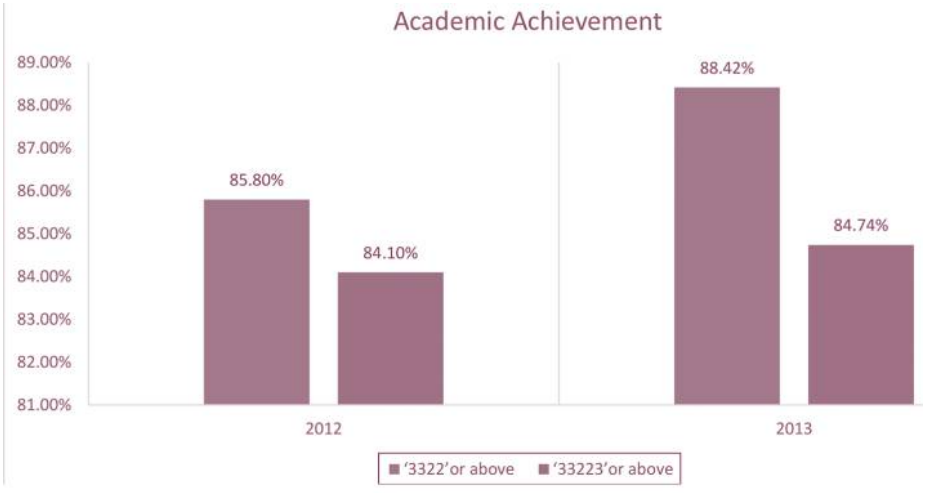
The School is a high performing school with excellent performance in students' academic achievement. Generally speaking, it was difficult to show significant improvement in students' result in HKDSE because they were already doing well, but the School has improved further to a certain extent. In 2013, the School had a student who obtained the highest level, 5**, in all subjects. Moreover, the proportion of students attaining level "3322" and "33223" or above has risen to 2.62 and 0.64 per cent, respectively. The students' achievement was found to be directly related to their teachers' capability in teaching and the student's competency in learning, directly and indirectly, was related to the teachers" knowledge within the School. The excellent performance of the School came from fostering teachers' sharing of their tacit knowledge so that students could perform better.

Table XII Comparison of students' achievement in HKDSE in 2012 and 2013

Academic achievement	*2012 (%)*	*2013 (%)*	*Rise/drop (%)*
% of students attained with level "3322" or above[a]	85.8	88.42	2.62
% of students attained with level "33223"or above	84.1	84.74	0.64

Notes: [a]3322 means if students get their core subjects with level 3322 in Chinese, English, Mathematics and Liberal studies in HKDSE, respectively; 33223 means if students get results of 3322 and an elective subject with Level 3 or above in HKDSE, which is the basic admission requirement to the local universities in Hong Kong)

Figure 8 Comparison of students' achievement in HKDSE in 2012 and 2013



Notes: 3322 means if student gets results of their core subjects with level 3322 in Chinese, English, Mathematics and Liberal Studies in HKDSE, respectively; 33223 means if students gets results of 3322 and an elective subject with Level 3 or above in HKDSE, which is the basic admission requirement to the local universities in Hong Kong

Because of the pioneering contribution in promoting KM in education, the School was awarded the top winner of The Hong Kong Most Admired Knowledge Enterprise (HK MAKE) Award 2014, the Asian Most Admired Knowledge Enterprise (Asia MAKE) Award 2014 and the Best Knowledge Culture Award (HK MAKE) 2014, and also the winner of HK MAKE in 2013, depicting the School's outstanding performance in KM implementation. The School in this paper has been the first school in Asia to receive this award. These awards could further prove the effort of the school to achieve KM, especially in creating and sustaining the sharing culture among staff. The sharing culture among teachers has been improved, and the acceptance to KM, the mutual trust between the principal and teachers and the respect for the principal from teachers also increased in the process of KM implementation.

After exerting the knowledge leadership, the School evidenced substantial improvements in school performance under the KM implementation recognized by both staff internally and experts externally, such as EDB's ESR appreciation of the progress compared with the last ESR in 2005, the improvement in students' academic achievement and the recognition of the MAKE Awards.

Discussion

This study shows a process of managing change in a school. Although most teachers are professional, industrious and willing to help their students, they were reluctant to be changed as Lines (2004) notices the common pattern among organizational members during the changing process. It is not easy for the teachers in this school to adapt to the changes because of KM implementation. The resistance to change may be very common to most organizations (Piderit, 2000). During the process of KM implementation, the principal demonstrated his leadership in inducing teachers' readiness and willingness in kicking off the process of KM implementation.

This study tries to provide empirical evidence of Fullan's (2002) proposition that KM can be applied in the education sector and principals should become knowledge leaders to leverage knowledge by KM implementation so as to optimize school effectiveness. Furthermore, it was found that the success of the KM implementation was mainly attributed to the execution of the

principal's leadership during the process. The principal thought about the process from the position as a principal and from a principal's role as a knowledge leader. As the knowledge leader, the principal promoted and implemented KM by instilling the knowledge vision, built a context favouring KM implementation and served as the role model of a knowledge worker in the school. The principal reflects several aspects of the principal's knowledge leadership, which is the spirit of the KM implementation.

From the reflection on the leadership issue of the two stages of the intervention, the researcher found that the performance of Stage 2 was better than that of Stage 1. It may be because of the lack of trust and respect perceived by the principal and the strength of the principal's leadership in Stage 1. The researcher reflected that the leadership is not related to only the leader but also his subordinate. The principal in this study was very sensitive to the teachers' response and cared for their feeling. The principal's perception affected his leadership behaviour in the process. He has substantially delayed the speed of the progress. On the other hand, the principal cared for his relationship between the teachers. It might show that the principal is a people-oriented leader rather than a task-oriented leader. (People-oriented leaders would care for interpersonal relationship and task-oriented leaders would only care for the task accomplished.) The researcher observed that the principals have changed teachers' attitude and teachers showed much acceptance to KM. Therefore, Stage 2 had better performance than Stage 1 because of more trust from teachers to the principal and more of teachers' acceptance of KM.

During the process, the principal has applied the knowledge leadership framework in this study: knowledge vision builder, knowledge enabler builder and knowledge role model. The researcher noticed that the principal has been using different components of knowledge leadership in different stages because of the distinct needs in the two stages. Therefore, the researcher found that not only the principal's leadership was essential to the success of KM implementation but also the distinct needs of leadership roles and tasks were required in different stages to maximize the effectiveness.

On the other hand, the researcher also noticed that the principal has used suitable KM strategies with developing infrastructure at the beginning to avoid possible resistance to KM. On the other hand, the researcher found that the principal did not rely only on the information-based approach, and the principal also included the people- or interaction-based approach with the implementation of Lesson Study and CoPs.

After this study, the principal's strong leadership was recognized by the researcher, teachers and outsiders. The sharing culture among teachers has been improved, and the acceptance to KM, the mutual trust between the principal and teachers and the respect to the principal from teachers also increased in Stage 2. After the principal has initiated some changes in Stage 1, the researcher noticed that there were corresponding changes in Stage 2. It might be because of the positive consequence of the principal leadership.

After exerting the strong leadership in KM implementation, the principal has seen substantial improvements in the school. The researched school was the first school in Hong Kong to be awarded one of the winners of the Hong Kong MAKE Award 2013, 2014 and 2015 demonstrating the effort of the researcher and the school management in launching KM implementation. Moreover, the School's result in the public examination (HKDSE 2012 and 2013) showed a noticeable improvement in students' achievement mentioned in the part of the Impact of KM on Organizational Performance. In addition, the ESR team recognized the principal's leadership in the continuous development through promoting sharing and progressively introducing policies. They noted the School's progress since the previous ESR in 2005 because of the principal's leadership in improvement in management, staff and student development. They

agreed with the school on all new initiatives that have been developed as being on the right track in different domains.

Leung (2010) posits leadership to be an influential factor affecting KM in schools. Leung (2010) has done a qualitative study to investigate the critical factors of implementing KM in a school environment by interviewing 65 teachers from 23 schools in Hong Kong. Leung's (2010) result shows that the key for KM implementation is found to be strong leadership by the principal. This leadership behaviour is not general leadership but specific in the domain of KM. Leung's (2010) finding is similar to that of this study. The principal claims that such knowledge leadership should be exerted by the principal who would like to promote KM in their schools.

The results of this study were found to match quite well with those of Leung (2010) where he suggested tasks of the principals for implementing KM. From the results of the interviews with teachers by the outsider interviewers, it was found that the principal in this school demonstrated the features of the components of the framework of knowledge leadership. The principal showed that he was a vision builder because he had sound theoretical foundation of KM and a strong vision of promoting KM in this school. The principal showed that he was an enabler builder because he gave talks to introduce KM to staff and also invited an expert from the university to give a talk on the theory of CoPs along with a practitioner on the practice of Lesson Study. He also mentioned rationales of KM and CoPs several times to inspire the teachers about their importance for school enhancement. Teachers also appreciated the principal's enthusiasm in kicking off the many KM initiatives, such as establishing the "Knowledge Base" and the Digital Archive as Knowledge Repositories, promoting Lesson Study and encouraging the CoPs formed in the school. He also served as a role model to participate actively in most CoPs to show his support and attention. Furthermore, he also reminded teachers to think about school problems in new ways and try to use KM to solve the old or new problems.

The results of this study were found to agree with those of Lakshman's (2008) study that a knowledge leader, who recognizes the importance of KM more than others and provides the necessary conditions for KM implementation, such as technology and human network, can enhance the school's effectiveness. Furthermore, the knowledge leader should also act as an example to participate in the processes of knowledge sharing to produce a promising result. All the three components of knowledge leadership, i.e. knowledge vision builder, knowledge enabler builder and knowledge role model, have been found to be equally important to KM implementation. Lack of any component of the knowledge leadership will lead to incompetency and failure.

The principal has encouraged and reinforced teacher sharing by performing the roles of the knowledge leader. As a knowledge vision builder, the principal has valued knowledge and managed it, sharing it broadly among members in the school. Knowledge leaders cannot mandate that employees share or develop knowledge. As a knowledge enabler builder, the principal has created a workplace environment to provide the necessary conditions and select knowledge-based activities that are closely aligned with their organization's identity, culture, strategy and management systems for KM implementation. He also acts as a knowledge role model to encourage teachers to join the journey. These factors all interact to determine the types and mix of knowledge-based initiatives that are most likely to be successful in a given organization (Cavaleri and Seivert, 2005).

This paper posits that the three roles of knowledge leadership, namely, vision builder, enabler builder and role model, are essential to KM implementation in the school. From the results of this study and the process of intervention, the author claims that all three roles should be put in place together. This is to mean that lack of one role from these three roles may lead to failure of KM implementation. The three roles of knowledge leadership are pertinent to the KM process. In addition, there seems to be a temporal

aspect of these roles – that is the leader plays the role of a vision builder to kick off the KM process by sparking the process and giving the direction of KM implementation, and then the leader plays the role of the enabler builder to provide enabling conditions for the organization to support the KM process. Finally, the leader plays the role of a role model to act as an example to encourage the staff to join and sustain the KM process. The importance of knowledge leadership can be evidenced by the difference in the performance of the two stages of the intervention in this study. However, owing to the limitation of time and the scope of this study, there remain some unresolved issues regarding knowledge leadership in this study. The interaction and the relationship among the three roles need to be studied in the future. The future research can investigate the following issues:

- Whether one person can fulfil the requirements of the aforementioned three roles of leaders?
- What factors affect a person to satisfy these roles?
- Is it necessary to fulfil all three roles for KM implementation to be accomplished?
- Is it adequate to have only one or two of the aforementioned roles of leaders to lead KM?
- Is there any optimal performance of knowledge leadership? How can it become optimal?
- How can these three roles be unfolded in alternative ways?

The paper hopes to propose a direction for further research in knowledge leadership using the aforementioned issues.

Conclusion

In this study, the principal played the role of a knowledge leader. This study would like to verify Fullan's (2002) proposition that principals should be knowledge leaders. This paper explores how a principal can become a knowledge leader and how the principal's leadership can have an impact on KM implementation in the researched school. This paper has tried to not only incorporate Fullan's (2002) idea of a principal as a knowledge leader but also further propose a workable model of knowledge leadership for principals to follow so as to help them become knowledge leaders. This conceptual model is consistent with Printy's (2008) advocacy that principals should serve as knowledge brokers, allowing teachers to emphasize teaching and learning, encouraging innovation, shaping teacher learning and providing adequate resources for their work. The KM Leadership Conceptual Framework in this study provides a plausible and feasible model of exerting leadership in three critical domains for those principals who would like to implement KM in their schools so as to achieve the mission of principals as knowledge brokers advocated by Printy (2008). The influence of the principal's leadership in KM implementation in the school was examined in this study to illustrate the impact of leadership in KM processes and the needs and conditions of the leadership for KM implementation in the education sector.

In this study, KM was successfully implemented in this school with both the information- and people-/interaction-based approach. In the information-based approach, the Knowledge Base and Digital Archive have been successfully launched to centralize storage and categorization with a well-organized and consistent taxonomy, so that staff could access, share and use their accumulated knowledge more effectively. The effectiveness of the people-/interaction-based approach of KM implementation as intervention with the Lesson Study and CoPs was evaluated by the extent of knowledge sharing, the improvement in the sharing culture and the participants' satisfaction. The people-/interaction-based approach was implemented to not only arouse teachers'

participation significantly and enhance sharing culture but also acquire knowledge. Teachers' knowledge was analyzed and classified in both the Lesson Study and CoPs.

From the results of evaluation of knowledge sharing, the researcher concluded that the knowledge shared in this school was found to be more prominent. During KM implementation, teachers shared knowledge both in the Lesson Study and CoPs. The researcher found that teachers shared knowledge with the largest proportion in instructional knowledge during the Lesson Study. That is the pedagogical content knowledge (Shulman, 1986), which was acquired from the reflection on the process of the Lesson Study. On the other hand, teachers were found to share knowledge extensively in CoPs not limited to the category of "knowledge and capability gained for individuals", but it also comprised that of "teacher commitment and community" and "learning resources and organizational capability". This study shows that teachers shared their knowledge in CoPs not only in their teaching experience but also in other areas of their duties so as to enhance their job effectiveness. Having mentioned that teachers used to perform their duties individually, the researcher speculated that the difference in teachers' sharing behaviour was because of the sharing culture of the school. The sharing culture was established because of the KM implementation in this school. This was because the principal in this school initiated the KM implementation to make a substantial impact on knowledge sharing among teachers.

From the result of this study, the researcher agrees with Fullan's view that KM "cannot" be implemented without the principal's effective knowledge leadership. This study has used the results to prove that the importance of the principal's leadership in kicking off the KM implementation in a school. If there was only little KM leadership, such as the leadership in Stage 1, launching KM was found to be difficult. After the awareness of the need of strengthening leadership in Stage 2, the principal exercised stronger leadership in pushing the KM process further, the school had more obvious KM outcomes. For example, the staff had more sharing and collaboration and effective school-based teachers' professional development by the implementation of the Lesson Study and CoPs. The Knowledge Base and Digital Archive were developed and deployed as more systematic Document Management Systems. Consequently, the School provided integrated and useful data and information for feedback, so that teachers could easily search for, share and retrieve knowledge. The School became a "knowledge school" to build up and use knowledge. Teachers felt more ownership of their work, and they had more sense of belonging to the School. Under the strong KM leadership by the principal, such improvement has further pushed the school to become a learning organization with innovation and change, so that the School can face the challenges of education reform and societal change with more confidence and competence.

Although knowledge has been recognized as a strategic intangible asset and a key resource in organizations in various sectors, including schools, most schools have overlooked the importance of knowledge in schools. Therefore, most principals have neglected their leadership in managing knowledge in their schools. The aim of the study is to examine how the principal's leadership can have an effect on the process of KM implementation and how the principal's leadership can be strengthened to facilitate the KM implementation, especially the kicking-off process in this study. As well, this study has also shown that KM could be applied to the education sector similar to the practice in the business world for leveraging intellectual assets.

This study has explored the impact of the principal's leadership in KM implementation in a school. The principal's strong and effective leadership enabled the school to face a number of challenges encountered in the process of KM implementation. If the principal's leadership was not strong enough, organizational members would not share knowledge, and then KM implementation could not be launched in the organization. The role of the principal was found to be critical for the school to face a number of challenges encountered in the process of KM implementation. The principal's leadership seems to be important for

the success of KM implementation. Executing leadership for breaking through the barrier of sharing was found to be essential to KM implementation.

Having mentioned that Fullan (2002) fails to offer any suggestion for principals to exert their leadership on their KM journey, the author explores a workable and feasible model of knowledge leadership for principals to follow so as to help them become knowledge leaders. From the results of this study, it was found that the framework of knowledge leadership, comprising a vision builder, enabler builder and role model, contributed substantially in promoting and sustaining KM implementation. The results of this study showed that a knowledge leadership framework has provided a clear guideline to execute and strengthen KM leadership in the specified area of implementation, so that the KM implementation could be more successful as evidenced by the substantial difference in the performance in KM implementation in Stages 1 and 2.

This study is a real case study to provide empirical evidence to prove Fullan's (2002) idea of a principal as a knowledge leader in the school. This paper also further proposes the KM leadership model comprising three components, knowledge vision builder, knowledge enabler builder and knowledge role model, as a template for principals to become knowledge leaders. This paper explores the influence of the principal's leadership in kicking off KM implementation and the following KM processes in the school to identify the impact of leadership in KM implementation and the needs and conditions of the leadership for KM implementation in the education sector. The author hopes the experiences outlined in this paper can shed some light for principals or school leaders on understanding what difficulties they might encounter and what solutions they might find. This paper also hopes that the findings can encourage further studies to explore the impacts of leadership affecting KM implementation in schools. This paper claims to have practical implication in shedding some light for practitioners on how leadership can be applied and strengthened during the process of KM implementation. This implication is believed to not only be limited in a school but also in other organizations in the public sector. Despite that only a single case has been used in this study limiting its generalization, this paper could be regarded as having theoretical implication because there is no existing theory to explain or guide how leadership can be executed or strengthened in the process of KM implementation, especially in the stage of the beginning of the KM journey. Therefore, more research in the impact of leadership in KM implementation should be conducted in the near future to provide more insights for KM practitioners not only at the start but also in other stages of the process.

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Appendix

KM readiness questionnaire

A survey on KM readiness was done at the School as a baseline study. A KM Readiness Questionnaire (Appendix) was administered to all teachers in the School, yielding a return rate of 97 per cent (65 of 67 questionnaires returned), to assess teachers' understanding of KM and their readiness of KM implementation. The followings are the details of the study.

Aim: to understand teachers' attitude to implementation of KM in the school (Table AI).

About half of respondents in Q.1 claimed that they knew KM well (52 per cent) or were even experts (4 per cent), while half of them (44 per cent) were humble to admit that they know very little about KM; 78 per cent of respondents in Q.2 reported that they knew the School was launching a KM project, while only 11 per cent did not know about the KM project. Further, 96 per cent of respondents in Q.3 and Q.4 believed that KM could have some benefits to the School and themselves, respectively. In Q.5, 92 per cent of respondents also believed that KM could help them transfer knowledge to a higher level, and 100 per cent in Q.6 agreed that collecting colleagues' ideas and experiences could facilitate improvement in the School. All respondents in Q.7 agreed that teachers should share knowledge in the school. Although 70 per cent of respondents in Q.8 expressed their optimism in KM implementation, 30 per cent still conscientious about the effectiveness of KM implementation. From the results above, there were favourable conditions for the launch of the KM implementation project, but there will also be some precautions for the project. Both the principal and researcher should be aware of such precautions.

Table AI Teachers' attitude to KM implementation

No.	*Teachers' attitude to KM implementation*	*0 (%)*	*1 (%)*	*2 (%)*	*3 (%)*	*4 (%)*	*Average*
Q.1	I know what KM is (4 = expert in KM, 3 = knows well, 2 = know very little, 1 = have no idea)	0	0	44	52	4	2.6
Q.2	I know the school is conducting a KM project (2 = yes, 1 = no)	0	11	78	0	0	1.67
Q.3	I believe KM is useful in school improvement (4 = certainly yes, 3 = yes, 2 = no, 1 = certainly no, 0 = no opinion)	0	0	4	70	26	3.22
Q.4	My professional knowledge can be enriched by joining knowledge-sharing activities, such as collaborating to prepare teaching materials or lesson plans or related activities	0	0	4	70	26	3.22
Q.5	The knowledge and experience shared in school can be transformed to knowledge at a higher level	4	0	4	81	11	2.95
Q.6	Collecting colleagues' ideas and experiences facilitates innovative ideas and ways for improvement for the school	0	0	0	78	22	3.22
Q.7	I agree that we should share knowledge in school	0	0	0	67	33	3.33
Q.8	I believe this KM project will succeed	15	0	15	63	7	2.47

Notes: 4 = strongly satisfactory; 3 = satisfactory; 2 = not satisfactory; 1 = strongly not satisfactory; 0 = neutral

About the author

Dr Kai-wing Chu is the serving Principal of a secondary school in Hong Kong. He finished his doctoral studies at the University of Hong Kong, with an endeavour of implementing knowledge management (KM) in his serving school. Through his leadership, his school has been awarded the top winner of The Hong Kong Most Admired Knowledge Enterprise (HK MAKE) Award 2014, the Asian Most Admired Knowledge Enterprise (Asia MAKE) Award 2014, the Best Knowledge Culture Award (HK MAKE) 2014 and the winner of The Hong Kong Most Admired Knowledge Enterprise (HK MAKE) Award 2013. This school has had the honour of being awarded the winner for two consecutive years, and they are the first school in Hong Kong to receive this award, demonstrating his achievement in implementing KM. He is very active in promoting KM in education sectors in Hong Kong. He has been invited by Education Bureau, HKSAR and other schools to deliver talks to share his experience in KM implementation. Kai-wing Chu can be contacted at: chukwalex@yahoo.com.hk