Beginning a journey of knowledge management in a secondary school

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Abstract

Purpose – *Despite the fact that schools should be places where learning occurs, most schools have overlooked the importance of knowledge. In contrast, commercial firms have recognized knowledge as a strategic intangible asset and a key resource of the enterprises. Therefore, enterprises have already harnessed knowledge to a great extent with wide practice of knowledge management (KM). The purpose of this paper is to show that KM could be applied to the education sector similar to the practice in the business world for leveraging intellectual assets. This paper examines how schools can kick off the process of KM implementation. This paper also reports what have been done and what should be done in KM implementation better in a school. This can give insights for schools which will try KM in near future.*

Design/methodology/approach – *The paper uses a case study in a secondary school to explore how KM can be kicked off and sustained in a school setting. A KM system called knowledge base and a document management system called Digital Archive were developed to serve as the infrastructure for knowledge sharing. Lesson study and communities of practice (CoPs) were adopted to be the platforms for knowledge sharing among teachers in the school. A case study of the processes and lesson learned was done in this paper. Multiple sources of data, including observations, questionnaires and interviews, have been collected for evaluation.*

Findings – *In this paper, KM implementation was found to be effective through dual approaches: information-based and people-/interaction-based approaches. A knowledge base and a Digital Archive as knowledge repositories and lesson study and CoPs as platforms for knowledge sharing have been successfully established to facilitate sharing information/knowledge and nurturing a sharing culture and trust. Challenges faced and the related coping strategies during the process of implementation were shared and reflected. It was also found that building sharing culture is the critical turning point of the process of KM implementation. Breaking through the barrier of sharing was found to be very essential to KM implementation.*

Research limitations/implications – *This paper adopts case study methodology to report the process of KM implementation in a school. Although these results of the study conducted in one school may not be generalized to other school contexts, the lessons learned in the study will be a strong empirical evidence of research of KM implementation, especially in schools. Because of the limited number of prior studies and the importance of the pioneering work of launching KM implementation, this paper tries to address the research gap by using theory building from cases as a research strategy rather than theory testing research, especially in "how"and"why" in the steps of kicking off KM implementation in an unexplored research area.*

Practical implications – *This paper shows a case of KM implementation in a school with thoughtful procedures of implementing information-based and people-/interaction-based approaches. The paper is a showcase that will shed light on the processes and lessons learned and also helps to provide a model for schools who are interested in applying KM in their schools.*

Social implications – *Most people might think that KM can be applied only in commercial sector. This paper shows that KM can also be adopted in schools as well as other sectors.*

Originality/value – *This paper represents one of the pioneering work of implementing KM in a school. It hopes to make contributions for KM implementation also in the public sector within which are non-profit-making organizations.*

Keywords *School, Knowledge management, Knowledge sharing, Teacher learning, Information-based approach, People-/interaction-based approach*

Paper type *Case study*

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Introduction

In the past two decades, waves of education reforms have washed over the world to create competitive conditions for schools. Schools often face frequent changes in policy, so that educators need relevant knowledge to perform their tasks. Because knowledge management (KM) has been widely accepted as a promising strategy for facing challenges in the business sector (Barclay and Murray, 1997; Coleman, 2008), KM may be a solution for educators to manage changes. Although schools should be places where learning takes place, KM has been neglected in them (Sallis and Jones, 2002). Knowledge processes have not been attended to in schools (OECD, 2000, 2004). Many researchers and practitioners (Adhikari, 2010; Carroll *et al.*, 2003; Hannum, 2001; Petrides and Nodine, 2003; Thambi and O' Toole, 2012) advocate that KM should be used in schools to help educators face changes and also improve the school effectiveness as is the case in the commercial sector (Becerra-Fernandez and Stevenson, 2001; Bain, 2006). Moreover, few studies have been done to explore the feasibility of KM implementation in education, particularly in schools. This paper tries to explore the processes of kicking off KM in a school. The author hopes the experiences outlined in this paper can shed some light for educators, especially school administrators, on understanding what difficulties they might encounter and what solutions they could find. This paper also hopes that the findings can encourage further studies to explore the factors affecting KM implementation in schools and even develop a roadmap for various sectors to launch KM implementation in the near future.

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).

Knowledge management and knowledge management strategies

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. Then, "How can knowledge be effectively managed?" will be an important question for any knowledge-intensive organization. Alvarenga Neto *et al.* (2009) posit that knowledge can be managed by establishing the environment evidenced by the studies of 23 international firms providing enabling factors (enablers) to facilitate knowledge building and sharing in 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). Thus, in the present study, KM is the formulation of processes so as to establish an environment to foster organizational members to create, share, learn and use knowledge together for the organization's advantage.

KM strategies vary in their scope and attention among KM practitioners. One of the common classification of KM strategies 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. This study adopts Dalkir's (2011) KM strategies. It is similar to Hansen *et al.*'s (1999) classification but more comprehensive in covering most existing ways of KM implementation as in the following approaches:

- *Information-based approach*: This approach emphasizes explicit knowledge over tacit knowledge and favours the externalization process by establishing an electronic

platform (Handzic, 2011) for knowledge codification, storage, retrieval, presentation, sharing and updating and also other KM processes/activities as well.

- *People-/interaction-based approach*: 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 favouring the socialization process (Jeon *et al.*, 2011).

Knowledge management in schools

Because of the crucial nature of knowledge in any organization (Nonaka and Takeuchi, 1995; Nonaka and Toyama, 2005; Grant, 1996; De Long and Fahey, 2000), KM is regarded as an advanced management strategy in the business world for leveraging intellectual assets. Although the knowledge flowing within organizations in various sectors is of different type and is used in different ways and for different purposes, there are commonalities in knowledge across the sectors, especially knowledge-intensive organizations. The knowledge which is most common across sectors is that for daily operation. Such knowledge should be effectively managed by sharing, transfer, storage and retrieval, so that necessary knowledge should be conveniently accessible to organizational members (Davenport, 2005; Davenport and Prusak, 1997). Furthermore, in knowledge-intensive organizations, most employees are knowledge workers (KWs), who are required to accomplish their work with a high level of personal expertise and independent judgement (Margaryan *et al.*, 2011). KWs need knowledge for their work. However, schools, which are surely knowledge-intensive organizations, seem to be lagging behind in ignoring the importance of knowledge and also introducing KM as a practice to enhance knowledge flow. Therefore, there have been more voices advocating essential KM application in schools. For example, the Organisation for Economic Co-Operation and Development was concerned (OECD, 2000, 2004) that few school teachers were found to share knowledge freely with their colleagues. Sallis and Jones (2002) urge schools to 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 business organizations which benefit from KM implementation (Becerra-Fernandez and Stevenson, 2001; Bain, 2006). Thus, this paper believes that KM can be applied in schools.

Methodology

This paper attempts to explore how the implementation of KM can be kicked off in a secondary school. This study adopts case study methodology to report the process of KM implementation in a school and also reflects on the process to demonstrate what the school has achieved and what the school should improve. Because of the limited number of prior studies, "lack of plausible existing theory" for this study and the importance of the pioneering work of launching KM implementation, this paper tries to address the research gap through a single case study by using theory building from cases as a research strategy rather than theory testing research (Eisenhardt and Graebner, 2007). This paper hopes to contribute theory building by using this case to address "how" and "why" in the steps of kicking off KM implementation in an unexplored research area (Eisenhardt, 1989; Eisenhardt and Graebner, 2007).

The researched school

The School is a fully government-subsidized secondary school in Hong Kong with Grades 7-12. It has a population of around 1,000 students, 30 classes, 60-65 teachers and 30

support staff. The KM model is adopted to promote and initiate the implementation of KM in the School, especially enhancing the enabling context of knowledge sharing.

Data collection

The study uses multiple sources of data including both qualitative and quantitative. Data were collected based on a triangulation of methods. Examples include the use of the researcher's observation and field notes, surveys and interviews by outsider interviewers. The raw data consist of everything in the research log: the field notes, MP3 recorded interviews, interview transcripts and the results of questionnaires. The field notes contain the researcher's own impressions and hunches of emergent findings, as well as questions and areas to be explored in the study. For MP3 recordings transcribed by a professional, the researcher proof-listened to the recordings and read the transcripts to ensure their accuracy. Interviews with teachers were conducted by two outsider interviewers invited by the researcher. They compiled the data and presented it to the researcher in regular meetings. The transcription of interviews was performed by the researcher and a professional transcriber. The transcripts provided the bulk of the material for subsequent interpretation of the meaning.

Data analysis

Analysis is a search for patterns and meaning from data (Spradley, 1980). Because the single case study approach was adopted in this paper, within-case analysis was used with detailed write-ups of the events and insights generated from them (Eisenhardt, 1989) so as to search any emerging pattern. Qualitative data analysis followed Miles and Huberman (1994)'s 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 and reorganized by coding keywords, and codes were then organized relating similar concepts. Similar concepts were organized further to produce categories. The process of analysis consists of several stages, and the process was ongoing throughout the research.

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 formulating action plans to fulfil the needs of the school.

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. The pilot study was conducted at the School. The pilot study identified 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, strategies for KM implementation were devised and implemented.

Problem identification and proposing actions

From the result of the pilot study and the researcher's observation, the problems in managing knowledge were listed in Table I with proposed solutions and the type of related issues.

Table I Problems identified and solutions suggested after the pilot tests and preliminary interviews and observation

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

Note: pp. 3-4

Based on the identified problems, the researcher proposes the corresponding actions to address the problems. The solutions for these problems can be classified as two approaches: infrastructure and people. For infrastructure, the School would build a well-defined and organized knowledge repository or platform to store knowledge with clear classification for later search and retrieval. Moreover, the School would organize knowledge-sharing activities for teachers to enhance their professional knowledge and nurture a sharing culture.

Lesson learned in the stage of diagnosis and action planning

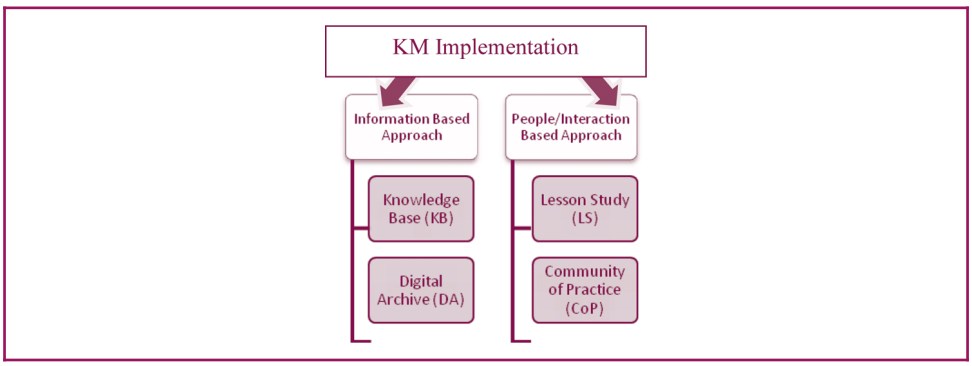
Before initiating any change (i.e. kicking off KM in this case), the leader (in this case a principal) needs to assess the current situation (staff, practices, facility) before making change (Chu, 2015; Chu *et al.*, 2011, 2009). The principal should evaluate the readiness of people and infrastructure and also identify the gap between the need and the current situation. Then, the action planning can be more focused to formulate to meet the gaps identified.

Proposing framework of actions

The framework shown in Figure 1 was proposed to address the above-mentioned problems.

The framework consists of the two main approaches proposed by Dalkir (2011): information-based (codifying and storing content) and people- or interaction-based KM (connecting knowers). Both approaches were implemented in the two stages of intervention in the School during 2010-2011 and 2011-2012.

Figure 1 Framework of knowledge management implementation



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, as shown in Table II.

Lesson learned in Stage 1

After the researcher had evaluated the implementation at this stage, he found that both approaches (information-based and people-/interaction-based) had been implemented with only little effect. Moreover, teachers' feedback about the implementation when it was first proposed was quite negative. It seems that teachers had resistance to KM implementation, which matched with what Lines (2004) found during the process of strategic change implementation. This response made the researcher decide to postpone the KM process and strengthen the leadership-driven aspects of the KM program.

The knowledge base should be improved 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. As Handzic (2004) suggested, an ideal knowledge repository should be structured as corporate memories. 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 needed to install a system to facilitate the knowledge storage and sharing. As well, the school needed to promote teacher sharing in face-to-face circumstances, so that an enriched sharing culture could be developed among teachers. The researcher thought about implementing CoPs and launching a full-scale version of lesson study among teachers to facilitate sharing among teachers. Dalkir (2011) and Handzic (2011) suggested that a personalization approach should be integrated with IT infrastructure to enhance KM implementation.

Table II Analysis of implementation in Stage 1 of intervention

Issues	*Explanation of actions of the implementation*
Teacher readiness, acceptance to KM (people-based approach)	The researcher was trying to initiate changes in School B 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
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 unwilling to participate in any KM initiative
Implementing Lesson Study Taster Scheme (people-/interaction-based approach)	To minimize the resistance from teachers, the researcher introduced a Lesson Study Taster Scheme to invite teachers to join voluntarily to facilitate teacher sharing Because lesson study was related to Teaching and Learning, teachers would be more willing to try the Taster Scheme
Developing the knowledge base (information-based approach)	The School needed to develop a platform with integrating different functions in single portal to fully satisfy all the needs for 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 staff member because the school had no experience in system development. The process of system development has been a learning process not only for 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 the task quality; the school assigned the IT Committee chairman as the supervisor

Note: p. 5

Therefore, the researcher made some changes for Stage 2:

- 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 to adopt initiatives that he launched. He became confident in dealing with resistance in the process of launching new programmes in Stage 2, as shown in Table III.

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

Issues	*Explanation of actions of the implementation*
Launching knowledge base (information-based approach)	Knowledge base was successfully launched, integrating different types of useful information such as students' information, including students' attendance and lateness, homework submission and school uniform irregularity records as well as students' academic results and their comparison in defined periods in a single portal so as to facilitate information flow and access among teachers
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. As the requirement of functions were so sophisticated that 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 proposal has received strong rejection from middle managers. The school had to search the way out and the school identified that there was an add-on module of existing e-learning platform called Digital Archive that can 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 store documents with functions of searching, categorizing and version tracking so as to facilitate knowledge sharing and perform KM processes As 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 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)
Expanding lesson study implementation (people-/interaction-based approach)	The scale of 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 lesson study
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 CoP in enhancing knowledge sharing among teachers in the different channels of evaluation

Note: p. 6

Functionalities of knowledge base

In Stage 2, knowledge base was developed to compile all the information that teachers need so as to facilitate information sharing among them. There are several functions: academic analysis, check mark, students' photo, teachers' notices, students' punctuality, students' homework submission record, students' uniform, school documents templates, room reservation, etc.

Academic analysis. This module is to help teachers retrieve the students' academic results in one subject or all subjects in one certain period or all periods for comparison. The layout of this module is shown in Figure 2. This can assist teachers to observe the progress and the needs of students.

Students' homework submission record. This module is to help teachers access the students' homework submission record. The layout of this module is shown in Figure 3. This can assist teachers to know whether students submit their homework properly or not.

Figure 4 shows the performance of the whole class (1B). The class teacher can better understand individual performance.

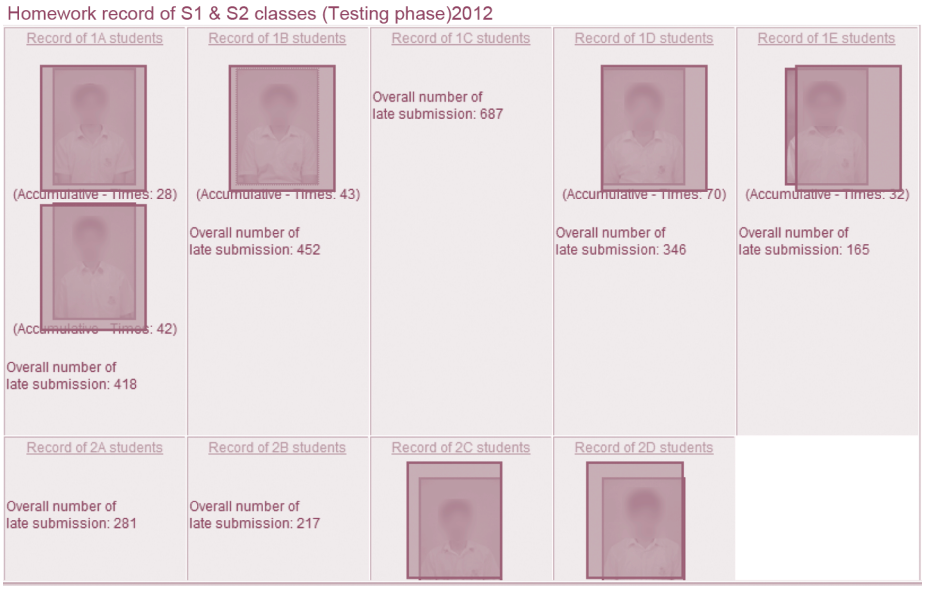
Students' performance in punctuality (Figure 5) and compliance with the requirement of school uniform (Figure 6) are two other modules similar to the system of homework submission record shown above. Teachers, especially class teachers, can track tightly students' performance and give them timely help.

Figure 2 The academic analysis function of knowledge base

Year: 2012-2013, Class: 3A		English Language - Junior	
		2011-2012	
	Class	T1	T2
1	2C	64.9 [86/181]	64.8 (↓0.2%) [107/181]
2	3B	56.3 [172/188]	53.7 (↓4.6%) [182/188]
3	3C	53.5 [184/188]	52.1 (↓2.6%) [185/188]
4	2A	68.7 [71/181]	72.1 (↑4.9%) [74/181]
5	2C	49.3 [165/181]	52.5 (↑6.5%) [164/181]
6	2D	57.3 [123/181]	58.7 (↑2.4%) [137/181]
7	2C	64.3 [89/181]	63.7 (↓0.9%) [109/181]
8	**2D	57.3 [123/181]	58.9 (↑2.8%) [136/181]
9	2E	67.6 [75/181]	66.9 (↓1.0%) [97/181]
10	3B	51.4 [187/188]	48.1 (↓6.4%) [188/188]
11	2E	62.8 [95/181]	71.5 (↑13.9%) [79/181]
12	2D	62.1 [99/181]	60.2 (↓3.1%) [124/181]
13	2D	47.9 [170/181]	52.3 (↑9.2%) [165/181]
14	2C	60.7 [108/181]	59.6 (↓1.8%) [128/181]
15	**2D	52.5 [153/181]	57.1 (↑8.8%) [142/181]
16	2E	58.3 [116/181]	66.8 (↑14.6%) [98/181]
17	**2E	58.1 [118/181]	59.4 (↑2.2%) [130/181]
18	2E	51.6 [157/181]	51.2 (↓0.8%) [167/181]
19	**2C	56.1 [130/181]	60.6 (↑8.0%) [122/181]
20	2D	57.6 [121/181]	56.1 (↓2.6%) [149/181]
21	**2E	65.7 [80/181]	70.4 (↑7.2%) [84/181]
22	2A	62.3 [98/181]	67.0 (↑7.5%) [96/181]
23	2D	58.7 [114/181]	57.7 (↓1.7%) [138/181]
24	2E	60.3 [110/181]	65.3 (↑8.3%) [105/181]
25	2C	58.7 [114/181]	59.6 (↑1.5%) [128/181]
26	2C	54.8 [133/181]	56.2 (↑2.6%) [148/181]
27	2D	73.4 [36/181]	77.7 (↑5.9%) [38/181]
28	2D	58.3 [116/181]	63.6 (↑9.1%) [110/181]
29	2C	61.7 [102/181]	59.0 (↓4.4%) [135/181]
30	2C	54.4 [139/181]	54.5 (↑0.2%) [156/181]
31	2D	53.1 [147/181]	47.0 (↓11.5%) [171/181]
32	2C	51.3 [158/181]	53.5 (↑4.3%) [161/181]
33	2D	61.2 [106/181]	59.1 (↓3.4%) [134/181]
34	2E	53.4 [144/181]	54.9 (↑2.8%) [154/181]

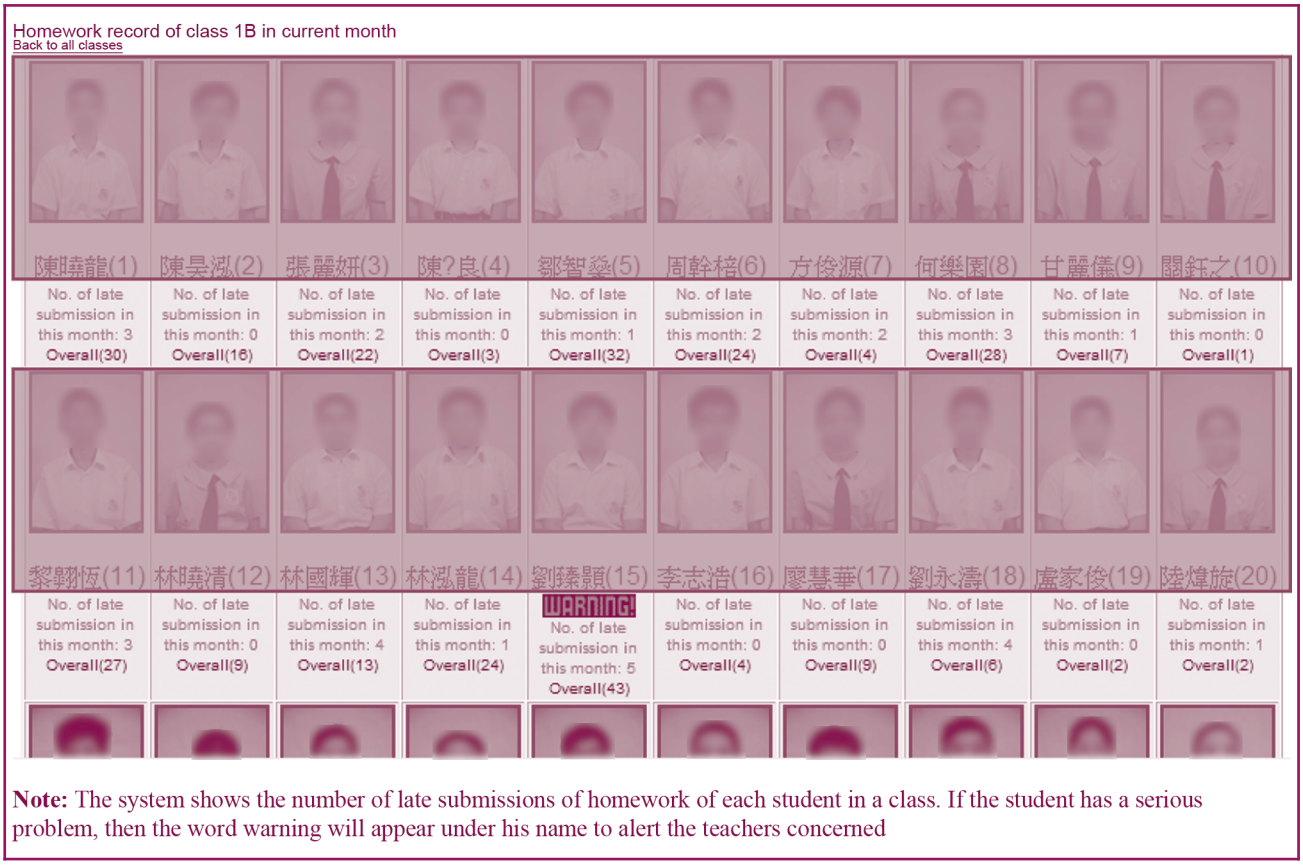
Notes: The system shows the improvement (↑) or decline (↓) of student's academic performance individually or in class or in form and also in each subject or in all subjects by pooling all student's results into the system

Figure 3 Students' homework record of the forms of knowledge base



Note: The system shows the number of late submissions of homework in each class in the whole form

Figure 4 Students' class homework record of the class of knowledge base



Note: The system shows the number of late submissions of homework of each student in a class. If the student has a serious problem, then the word warning will appear under his name to alert the teachers concerned

Figure 5 Students' class lateness record of knowledge base

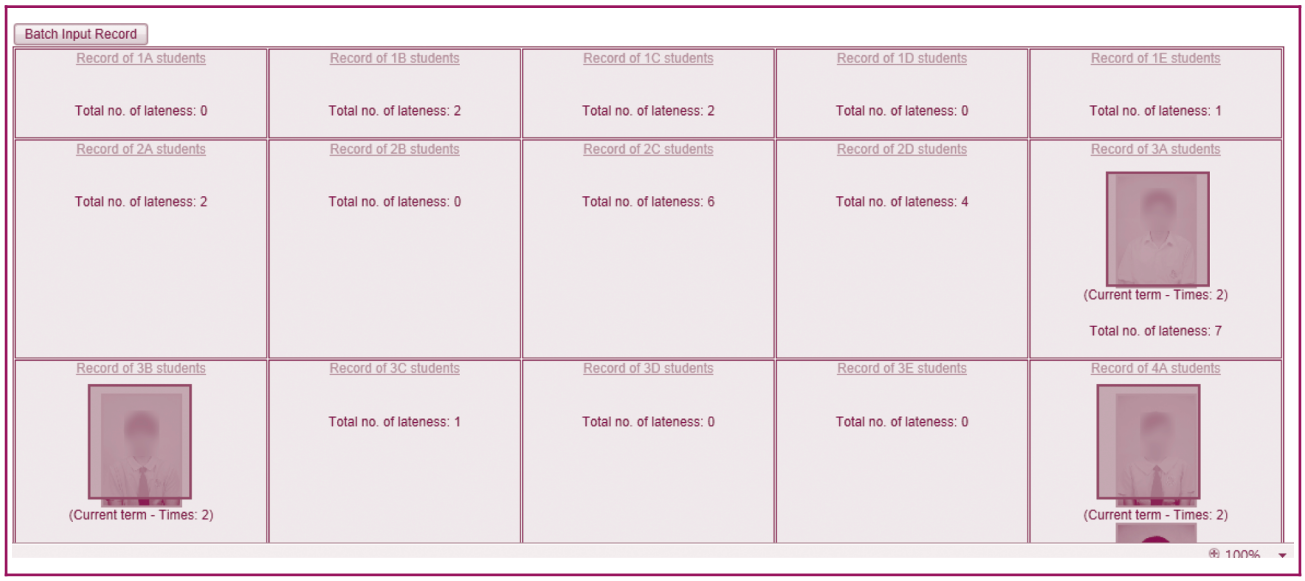
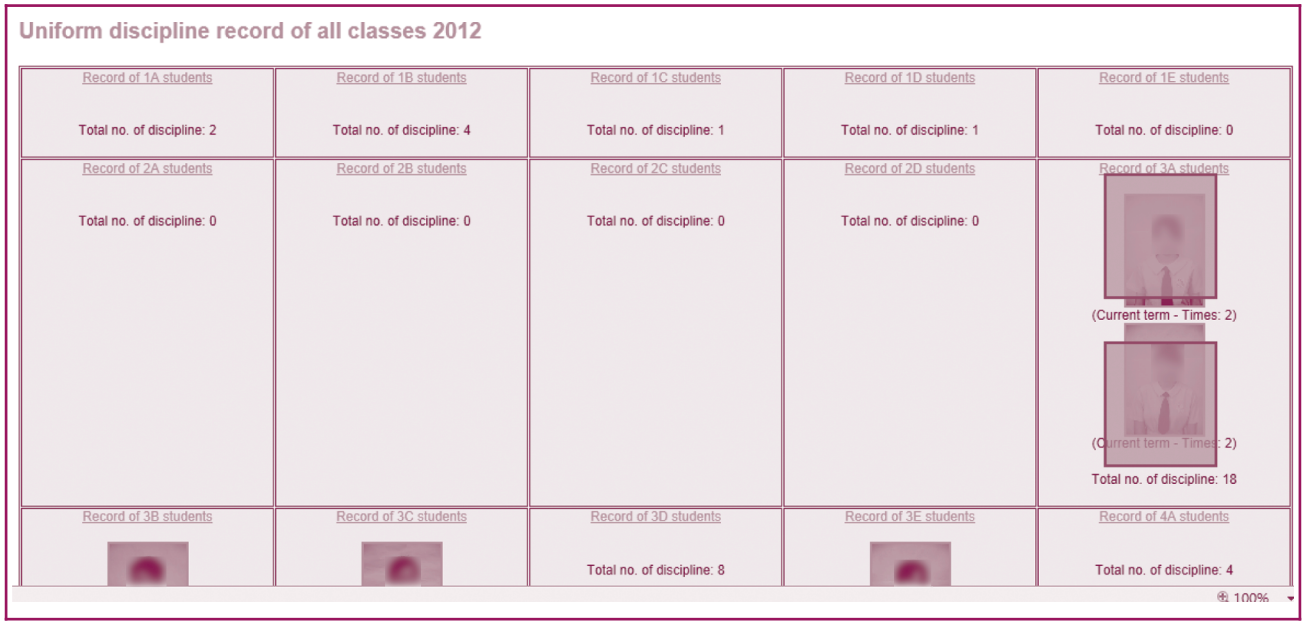


Figure 6 Students' class uniform discipline record of knowledge base

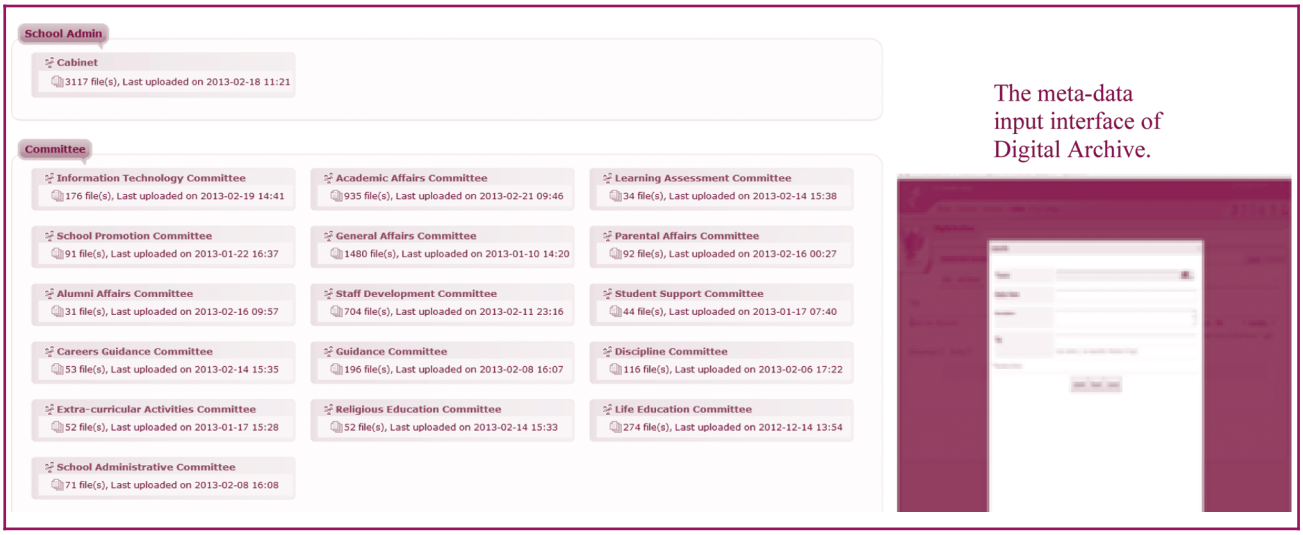


Functionalities of Digital Archive

In Stage 2, Digital Archive (Figure 7) was purchased from an outside developer and customized for the School's specific needs to store and retain all the important documents, including minutes of departments and committees, examination papers, development plans, annual programme plans, etc., in a central school repository with coherent taxonomy for teachers to retrieve items easily to facilitate document sharing.

Metadata input. The metadata of the document can be input with the document to enhance searching and retrieving. Before the file is uploaded, the system will prompt a user box to insert the metadata for the file such as Display Name, Description and Tag (Maximum ten tags allowed) for taxonomy. Users can access Digital Archive and search for the

Figure 7 Digital Archive layout showing directories of different groups at different levels (school level and committee level)



documents using keywords, upload date and creator name. The system will use the input metadata to search the database.

Version control. Documents are mostly prepared or edited in groups rather than edited individually, so version is necessary to track changes in the process of editing. All versions of documents can be traced, searched and retrieved. The function of version control can facilitate the sharing of documents.

Lesson learned in Stage 2. Eventually, there were 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 using the strategies that Lines (2004) suggested. The principal pushed KM implementation further by launching knowledge base, installing Digital Archive, 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, he 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 principal reflects by himself that the principal's power not only comes 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 it, either as a core group member or through a lesson observation to give comments. From the lesson study experience, the principal also launched CoPs, which are a typical approach to KM programmes in the commercial sector (Dalkir, 2011) as one of the initiatives to organize KM in this school. CoPs helped teachers share their knowledge in their interested topics across committees and departments. Although the concept of CoP was initially resisted by teachers, after implementation in the 2011-2012 year, CoPs became more acceptable to them. From this experience, the principal reflected that introducing a Lesson Study Taster Scheme, lesson study, and CoP as a series of steps of implementation for fostering a teacher sharing culture was entirely appropriate, especially suitable in this School which not had such a sharing culture. Dalkir (2011) stressed the importance of a sharing culture to facilitate knowledge sharing in an organization. Teachers have now broken through the barriers between them 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. The analogy has been made that teachers work independently similarly to eggs in an egg crate (Lortie, 1975).

When installing the Digital Archive, 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 successful, using the information-based approach as a structural part of the infrastructure is important to ensure that stored knowledge is available for later retrieval as Handzic (2004) posited. Middle managers expressed their opinion that the school administrators should not frequently change the system that they were familiar with; otherwise, staff would get confused. Inertia ensures that teachers prefer using established systems unless these were found to have too many problems. Teachers were generally reluctant to learn new interface features and techniques to access the new system. Lines (2004) pointed out the counteraction of people to change. An alternative system was considered of adding an additional module (Digital Archive) to the eClass system already in use. This satisfied the middle managers, and they agreed with the adoption of Digital Archive.

Evaluation of implementation

After the process of KM implementation, the principal made an evaluation of the effectiveness of the process of implementation from the teachers' views expressed in questionnaires and the interviews. The following tables show the approaches used in the steps of intervention for KM implementation. The principal analyzed the problems in the process of implementation, the approaches adopted, the problems tackled and the achievements accomplished as shown in Tables IV and V.

The principal has tried to address all problems mentioned in the stage of diagnosis and action planning with the implementation of KM. The extent of leadership in the process has been enhanced from Stage 1 to Stage 2, and there was a correspondingly better performance of KM in Stage 2.

Teachers' views expressed in questionnaires on the implementation of KM

The principal used a school-based teacher questionnaire that collected teachers' views related to KM implementation, such as KM team, storing teaching resources, lesson study, CoPs and knowledge sharing for evaluating KM efforts. Part of the data is shown in Table VI.

The principal administered a survey using a school-based teacher questionnaire that 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

Table IV Evaluation of the process of intervention for solving problems in Stage 1 of intervention

Stage 1 2010-2011	*KM approaches*	*Problems tackled*	*Evaluation*
Knowledge base development	Information based	Unsystematic document management system with little functionality in searching and retrieval	Partly achieved. A web-based database was designed for teachers, but need to be tried
KM talks	People-/interaction-based	Lack of awareness of knowledge as a key intangible asset of schools	KM theories and practice explained to teachers to arouse their awareness of using tacit knowledge, but teachers were not interested
Lesson Study Taster Scheme	People-/interaction-based	Failure to equip teachers with practical knowledge by promoting knowledge sharing	The taster programme has encouraged some teachers to share their knowledge about teaching. The sharing culture was still weak and need to be further nurtured

Note: p. 9

Table V Evaluation of the process of intervention for solving problems in Stage 2 of intervention

Stage 2 2011-2012	*KM approaches*	*Problems tackled*	*Achievements*
Launching knowledge base	Information based	Unsystematic document management	The web-based database was tried and improved from teachers' feedback
KM promotion	People-/interaction-based	Lack of awareness Lack of leadership	The principal promoted KM initiatives in a staff meeting and encouraged teachers to share their knowledge
Lesson study	People-/interaction-based	Lack of awareness Lack of leadership Failure to equip teachers with practical knowledge	The school management announced a clear vision and strong leadership regarding lesson study The Taster Scheme was successfully been expanded to encourage all teachers to join groups The sharing culture was improved
CoPs	People-/interaction-based	Lack of awareness Lack of leadership Failure to equip teachers with practical knowledge	The principal tried to launch CoPs Several CoPs were successfully tried to allow teachers to share their knowledge in their practice The sharing culture was further improved

Note: p. 10

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

School year 2010-2011	*5*	*4*	*3*	*2*	*1*	*Average*
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
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
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

Notes: Remarks: Strongly agree 5; agree 4; neutral 3; disagree 2; strongly disagree 1; p. 10

feedback. Of the 60 teachers, 42 (70 per cent) finished the questionnaire and returned it to the school office. All questionnaires were filled in anonymously to protect personal privacy. Table VI shows the result of the school-based questionnaire of the School regarding KM implementation in 2010-2011. From the results of the survey, most teachers (average = 3.50) agreed that the school had tried to develop, store and share resources for teaching resources. The knowledge base and Digital Archive had been built up for facilitating sharing knowledge resources among teachers. Moreover, most teachers (average = 3.45) agreed that colleagues would like to share their teaching experience and skills with others, which was gradually inculcating sharing culture. Finally, most teachers (average = 3.52) agreed that colleagues were trying to accumulate and categorize teaching resources for retrieval in the future.

A similar questionnaire was given to teachers in the 2011-2012 school year as shown in Table VII.

The school administrators conducted a similar survey of 19 questions in the 2011-2012 school year. 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, that is, 2012-2015. Of the 67 teachers, 65 (97 per cent) finished the questionnaire. Table VII shows the results of the questionnaire in 2011-2012. From the results of the survey, most questions received a positive response. From the evaluation of performance in 2011-2012, the highest score (3.65) could be found for Statement 4, in which teachers agreed that resources were developed, stored and shared in the school.

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

School year 2011-2012	*5*	*4*	*3*	*2*	*1*	*Average*
1. I am satisfied with setting up KM Core Team in 2011-2012	1	14	49	1	0	3.18
2. I am satisfied with building a knowledge sharing platform on intranet in 2011-2012	4	28	31	2	1	3.48
3. I am satisfied with promoting knowledge sharing in our school in 2011-2024	4	29	30	2	1	3.50
4. I am satisfied with developing, storing and sharing teaching resources in 2011-2012	5	37	21	2	1	3.65
5. I am satisfied with forming CoPs in 2011-2012	2	16	43	3	1	3.18
6. I think that setting up a KM Core Team should be continually implemented in 2012-2015	1	23	38	3	0	3.29
7. 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
8. I think that promoting knowledge sharing in our school should be continually implemented in 2012-2015	7	40	16	2	0	3.74
9. I think that developing, storing and sharing teaching resources should be continually implemented in 2012-2015	12	42	11	0	0	3.95
10. I think that forming CoPs should be continually implemented in 2012-2015	3	27	31	4	0	3.39

Notes: Remarks: Strongly agree 5; agree 4; neutral 3; disagree 2; strongly disagree 1; p. 11

This initiative should be continued in 2012-2015 (Statement 9, average = 3.95). Most teachers agreed that the school performance in "Building up a knowledge sharing platform on intranet" (average = 3.48) and "Promoting Knowledge Sharing in our school" (average = 3.50) was satisfactory in 2011-2012. Teachers also agreed that the two above-mentioned initiatives "Building up a knowledge sharing platform on intranet" (average = 3.67) and "Promoting Knowledge Sharing in our school" (average = 3.74) should be continued in 2012-2015, and there is also an increasing trend in sustaining the initiatives in 2012-2015. Nevertheless, teachers seemed to have reservations about the school performance of setting up KM core team (average = 3.18) and forming CoPs (average = 3.18) in 2011-2012. However, the two initiatives [setting up KM core team (average = 3.29) and forming CoP (average = 3.39)] should be sustained in 2012-2015.

Teachers' views expressed in interview on the implementation of KM

The following are the results of interviews conducted by the outsider interviewers interviewing 25 teachers, who were randomly selected, to solicit their views on KM implementation.

Because there were a large number of concepts or ideas among the interviewee's responses, the interviewee's answers were assigned to particular categories to facilitate data sorting. The results were reorganized by marking key points with a series of codes, and codes were grouped into similar concepts. Similar concepts were grouped further to form categories, which were the basis for the creation of a theory.

Two main concepts were identified from the codes found in the answers of the teachers participating in the KM implementation:

- *Benefits of KM*: Teachers appreciated that they had acquired knowledge from KM practice. The knowledge could be beneficial to their practice, not only in teaching but also in other job duties.
- *Need for improvement*: Teachers commented on the implementation of KM, and they pointed out the problems encountered during the process.

Benefits of KM:

- fostering reflections on practice;
- enhancing teaching effectiveness;

- facilitating understanding of students' learning;
- gaining practical knowledge;
- facilitating collaboration among teachers;
- nurturing a sharing culture in the school;
- creating new knowledge and keeping abreast of new knowledge;
- compiling expertise from teachers; and
- better document management.

Fostering reflections on practice. Teachers noticed that they needed opportunities to reflect on practice. When they listened to other teachers sharing their practice, they would also ask themselves about their own practice, and it would make them more sensitive to their teaching performance. One teacher said:

> When I joined the CoP, I found that I had an opportunity to think about my practice. Is my teaching effective? Are my skills effective for helping students? I realise that what I think about students' problem may not be the problem.

Another teacher noted that sharing could help them reflect on practice to evaluate whether there was any misunderstanding. The teacher said:

> Sharing could help us aware of some individual misunderstanding.

Enhancing teaching effectiveness. Teachers reflected that he/she could enhance teaching skills from the sharing in the CoPs. Owing to teachers' professionalism, schools seldom interfere with teachers for their teaching effectiveness. Even though schools would receive some complaints about teachers' incompetence, principals could not have done too much on the teachers concerned. Teaching effectiveness is teachers' own responsibility. Teachers should be aware of their teaching effectiveness. The teacher interviewed expressed that teachers could gain insight to motivate them to enhance teaching effectiveness as follows:

> Teachers have freedom in their pedagogy, so they can use their own teaching approach to teach. Schools cannot measure how teachers perform in teaching, even when some students are not satisfied with. Teaching effectiveness depends very much on teachers' self-awareness. Teachers could identify their areas for improvement when they learn about other teachers' experience.

Teachers reflected that KM is important to school and teachers for organizing materials so as to enhance the working efficiencies and effectiveness.

Teachers found that sharing could help teachers enhance teaching effectiveness from drawing colleagues' experience. They said:

> We like sharing with others and ask others' opinion how to teach better. They could share their experience in better teaching approach to make teachers learn better. We learn a lot from our colleagues.

Facilitating understanding students' learning. Teachers reflected that he/she could understand students' learning from the sharing in the CoPs. Another teacher also noticed that joining CoP could give them chances to reflect on their practice and foster them to be more sensitive to students' needs and understand students' problem. She said:

> When I joined the CoP, I found that I had an opportunity to think about my practice. Is my teaching effective? Is my skill effective for helping students? I realise that what I think about students' problem may not be the problem.

Gaining practical knowledge. Teachers reflected that he/she could gain practical knowledge and skills from the sharing in the CoPs. These knowledge and skills are very useful, and they learned in an inspiring and interactive way. He said:

> I learned much practical knowledge in the CoPs attended. I applied the knowledge what I have learnt in the CoP.

Teachers felt that they could apply this knowledge in their own practice. Teacher posited that CoP is a platform for sharing to gain different kinds of practical knowledge that are useful in practice.

Helping new teachers gain knowledge faster. Teachers noted that CoP could help new teachers gain practical and useful knowledge from the sharing in the CoPs, so that the new teachers could easily adapt to the school. One teacher said:

> When new teachers join the CoP, they could acquire more practical knowledge faster.

Facilitating collaboration among teachers. Teachers reflected that CoP could provide opportunities for teachers to have collaboration when they know that they are doing similar things during the process of sharing. She said:

> I do not prefer working alone, though the independent working is inevitable. I like sharing with others or acquiring knowledge from other teachers. I think that students might learn better from different teaching styles. I could apply other teachers' experience.

Teachers thought that they were in the same boat, and they were not alone. They experienced similar problems in their practice, and they could share their problems and their solutions with each others. It could enhance collaboration among colleagues. One teacher said:

> The most important thing in CoP was the trust without any worry, and the participants would like to share. When participants shared, I knew that most teachers had similar problems. Then we could find that we were not alone, and we were in the same team, so we had a strong sense of belonging. CoP can improve team spirit and build up the teamwork at school. It is good for us to share problems and experience among teachers across subjects. There would be more collaboration between us.

Nurturing sharing culture in the school. Teachers reflected that CoP could provide opportunities for nurturing sharing culture in the school. Teachers are more willing to share because they feel free to share with trust. The whole school could be benefited from the enhanced sharing culture. A teacher said:

> I think that CoP is a good platform for us to share certain topics. If the topics have common understanding and little differences among participants, the topics could allow more teachers to share their experience in their practice, e.g. "handling students"' behaviour'. We learn more about the skills of handling students' behaviour, not just discipline students. This would benefit students and the whole school as well.

Creating new knowledge and keeping abreast of updated knowledge. Teachers experienced that there was new knowledge of helping students brought from the CoPs. Teachers also anticipated that colleagues could renew their knowledge and keep abreast of updated knowledge, so that we could sustain competitiveness. One teacher said:

> I hope that colleagues could gain insights from the (KM) activities to renew their knowledge, so that they would not stay with the knowledge that was obsolete.

Compiling and sharing expertise among teachers. Teachers noted that CoPs did provide a platform that compiled all the expertise of the participants, because they could share their experience in their daily practice. Therefore, teachers participating in the CoPs could also gain experience from the sharing. They said:

> We think that CoP is very useful because it can compile all the expertise of the participants. If the participants shared what they have learnt in the CoPs, the people they shared to would also have benefits to learn something and to be excited.

Furthermore, teachers could share expertise and knowledge in teaching methods to enhance teaching. Lesson study could provide expertise for teachers to equip teachers with necessary skills. They shared about lesson study that:

> We think that Lesson Study platform has many benefits, for instance, sharing teaching methods, materials, and demonstration of teaching with teaching examples can make other teachers know that some teaching approach can help students learn better. Teachers could understand difficulties in learning and teaching through sharing and communication with colleagues. When teachers might not know how to do, we could ask some colleagues to help us, so that the practice could be smoother.

Teachers further noted that CoP could offer opportunities for them to learn from experts or some colleagues with outstanding performance. They said:

> When we joined the CoP, we could join the workshops that were led by some admiring colleagues, such as the Vice-principal. He cannot explain too much in staff meeting but he could share much in CoP.

Platform for managing knowledge. Teachers noted that CoP is a good platform for the school to manage knowledge. CoP could allow teachers to share and gain their knowledge in practice including teaching and students' development systematically. Teachers could also revisit their own knowledge when they received feedback from others. One teacher said:

> I think that CoP is very useful because it can help our school manages knowledge, especially in teaching and students' development. We can learn more freely in CoP sharing because we can receive feedback from our colleagues.

Better document management. Teachers expressed their need to establish a shared repository to store document centrally for facilitating sharing knowledge so as to save time and get things done effectively:

> 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 something new and make things smooth.

Some teachers expected that an organizational portal with single login and password would facilitate the sharing and retrieval of information within the school. They hoped that some important documents could be stored in a repository. It is expected that KM, especially the systematic storage of documents, is most helpful to the school so as to enhance both working and teaching efficiencies and effectiveness.

Needs for improvement:

- weak sharing culture;
- improper staff attitude;
- lack of resources;
- lack of follow-up work;
- insufficient time *and context to apply the knowledge gained*; and
- need to explain KM and CoP rationale more explicitly.

Weak sharing culture. Teachers noticed that they were not quite familiar with the teachers of other departments with less chance to work with each other. They felt that it was not so natural sharing between teachers from different subjects because of the weak sharing culture between different subjects. Such weak culture might reduce the effectiveness of knowledge sharing. Teachers expressed that the sharing culture among teachers is not strong enough as follows:

> The sharing culture is weak in the whole school and also in the same department and need to be strengthened.

> I think that CoP is a good platform for us to share certain topics. However, our school needs time for the culture to be nurtured.

Both school and departmental level are expected to strengthen sharing culture. Other teachers suggested the school to organize meetings across departments or even committees and also change seating arrangement in the staff room to enhance sharing culture.

Improper staff attitude. Although there were a number of teachers that joined the CoPs, there were still some teachers reluctant to join any CoPs because of improper attitude. Those who were active had expectations on others as follows:

> The participation in CoPs should be much active and voluntarily. If someone feels that he/she is quite good enough, he/she will not have much need to join CoP, and then CoP cannot be successfully launched. Some colleagues like to share with others some practical and workable knowledge. Some colleagues were afraid of refusing principal's invitation.

The school are expected to handle such poor staff attitude.

Lack of resources. Teachers expressed that human resource for supporting the launch of CoPs was enough and the hardware, documentation and time support should be improved. They said:

> The IT support and personal motivation should be strengthened.

> The infrastructure should be improved. For example, when teachers searched a number of resources, it was found that there was not enough space to store this resource, and it was more difficult for all teachers to store their resources at the same place. When some documents are retrieved, we usually did not know where the documents were classified and stored.

They need further improvement in infrastructure support, such as storage space, taxonomy and classification of stored documents, and its relevant searching engine for easy retrieval.

Lack of follow-up work. Some teachers expressed that the knowledge or experience shared in CoPs cannot be immediately implemented in the practice, so the knowledge gained from CoP may be easily lost. They said:

> There should be more follow up, which could be found from participants' reflection. For example, some participants would like to share or demonstrate their skills, so that learning from the CoP could be sustained.

However, teachers tended to make the process of reflection as simple as possible. They were reluctant to write too much things. They said:

> Participants need to write reflection after the CoPs for follow-up. Reflection could be written as simple as possible and as they like. How much they learn from CoP depends on their application.

Teachers questioned about the usefulness of writing post-it after the CoP. There would not be colleagues reading the post-it of reflection or its derivatives on the web.

Insufficient time and context to apply the knowledge gained. Teachers commented that they were not familiar to the rationale of CoP, so they might need much time to understand the context of using the knowledge and adapt the new knowledge, such as the knowledge of handling students' problems, motivating class spirit or teaching with reflection:

> Teachers feel bad because it has no chance for teachers to apply what they have learned when the CoP was organized at the end of the term.

Need to explain knowledge management rationales more explicitly. Teachers commented that they were not familiar with the rationale of KM and CoP, and they need to be explained more explicitly and concretely with examples. They said:

> KM could have broad meaning. The school should define and explain KM clearly.

> In order to implement KM smoothly, the school should explain KM more explicitly and clearly with special cases to compare the effectiveness of the difference with or without KM.

> I think that teachers did not know too much on KM, even though they have attended several meetings of CoPs. The school should explain explicitly the rationale of the CoPs.

Discussion

This study shows a change process in a school. Most teachers in the school are professional, industrious and willing to help their students, but 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 due to KM implementation. The resistance to change may be very common to most organizations (Piderit, 2000). During the process of KM implementation, the principal demonstrated patience in inducing teachers' readiness and willingness in KM implementation.

In this study, both approaches (information-based and people-/interaction-based) had been implemented in the school. Both approaches are mutually dependent (Dalkir, 2011). Both approaches are complementary to help the process to be implemented smoothly. If there is only an information-based approach with a KM system built without people to use, then the KM system cannot function well. If only a people-/interaction-based approach is adopted, then the knowledge cannot be retained and shared (Handzic, 2004). 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 and categorized for later retrieval (Handzic, 2004, 2011).

From the results of the current study, KM can be successfully implemented in this school. The results obtained from the interview were found to closely match with that of teacher views from the questionnaires. Both modes of data collection showed a consensus that most participants were satisfied with the KM implementation despite some room for improvement. Teachers recognized the school's effort in KM implementation to develop, store and share knowledge among teachers. Teachers agreed that KM implementation could stimulate teachers sharing, and teachers could share their knowledge with others and acquire knowledge from others. Moreover, more teachers were willing to share their teaching experience and skills with others, which gradually helps inculcate a sharing culture. Teachers found that KM implementation could help them gain practical knowledge, foster reflection on practice, enhance teaching effectiveness, facilitate understanding of students' learning, facilitate collaboration among teachers, nurture sharing culture in the school, compile expertise from colleagues and even create new knowledge and help keep abreast of new knowledge. The teachers also expected that the knowledge shared could be consolidated and stored somewhere, so that they could retrieve it when they needed. Teachers also expressed their suggestions for improvement in KM implementation. Teachers commented that the most critical factor of KM implementation is the sharing culture of the organization (Dalkir, 2011). Teachers were willing to share their knowledge in an atmosphere of being trusted and feeling safe. At the beginning of the KM implementation, there were only a few teachers willing to share knowledge, and other teachers stayed behind to observe what the majority would do. It is not difficult to understand that those teachers, who were willing to share, were not pleased to sense other teachers' reluctance to follow. However, after breaking through the barriers about sharing, more teachers were found to be willing to share, and in turn, more sharing would be anticipated. When more teachers were willing to share their knowledge, these teachers would have a demand for more resources and support for the change in their daily practice owing to KM implementation. They also needed the school to have arrangements to follow up and time and context to apply the knowledge gained. They thought that the knowledge they acquired was inspirational at that moment and that although they might not use or apply it at that moment, they thought that they might need such knowledge in the future. They did not know how to keep such knowledge for their own practice. Teachers expressed that they needed to further explain KM and CoP rationales more explicitly, so that they could fully implement KM in their practice.

Leung (2010) suggested that the principals of schools are the key players for implementing KM. In this study, it was found that the principal in the researched school demonstrated leadership with his commitment to KM implementation. The principal gave talks to introduce KM to staff and also invited an expert from the university to give a talk on the theory of CoP along with a practitioner in the area of lesson study. He also mentioned rationales of KM and CoP several times to inspire 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. This paper seems to depict that the principal's leadership is important for the success of KM implementation. However, owing to limitations of space in this paper, the role of the principal leadership in KM implementation needs to be explored in a future study.

Conclusion

This study is to share the experience in the KM implementation in a school. The aim of the study is to show that KM could be applied to the education sector in a similar way to the practice in the business world for leveraging intellectual assets. This paper also reports what has been done and what should be done better in KM implementation in a school. This paper provides a detailed description of steps and procedures of KM implementation and especially the kick-off process and also the difficulties, the challenges, as well as the tackling strategies that have been used. KM implementation was found to be effective through the dual approaches: information-based and people-/interaction-based approaches. Moreover, it was also found that building sharing culture is the critical turning point of the process of KM implementation. If the sharing culture was not strong enough, then organizational members would not share knowledge, and then, KM implementation cannot be launched in the organization. Breaking through the barrier of sharing was found to be very essential to KM implementation. Therefore, this paper will have practical implication in shedding some light for practitioners on KM implementation not only in a school but also in other organizations in public sectors. 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 KM implementation. The role of principal is 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. As knowledge leadership may be essential, more studies in the impact of leadership in KM implementation should be conducted in the near future to provide more insights for KM practitioners.

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About the author

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