# Knowledge management strategies for capitalising on school knowledge

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## Abstract

**Purpose** – This paper aims to explore the extent to which knowledge management practices, that is the process of developing and sharing organisational knowledge, can enhance intellectual capital (IC) in the context of school education.

**Design/methodology/approach** – A mixed-method approach was adopted as the research strategy. A cross-sectional quantitative survey was conducted to collect data from 445 teachers at 13 primary schools in Hong Kong. A structural equation model (SEM) was applied to confirm the predictive effective of knowledge strategies on school IC. Interviews were conducted in a case school to explore the process for capitalising the knowledge by Lesson Study.

**Findings** – The result of the SEM shows that personalisation and codification strategies are predictors of human capital and structural capital at schools. The findings from interviews with the principals and teachers show that personalisation and codification strategies could be put into operation as a Lesson Study to leverage knowledge for school development.

**Originality/value** – This paper contributes to the management practices of school organisation for enhancing their IC by conducting Lesson Study for the development of their schools effectively.

**Keywords** Knowledge management, Lesson Study, Knowledge strategies,
School intellectual capital

**Paper type** Research paper

## Introduction

Hong Kong schools have, for a number of years, been faced by challenges in terms of how they will move forward – these can include the city's very competitive education environment and changing education policies for schools. These issues include the decline in the number of students at schools, the increased involvement of parents in school choices and improving the quality of education at schools to be accountable to all stakeholders. Schools are required to formulate teaching development plans, and teachers have to plan education activities that take place inside and outside the classroom. They also manage information and knowledge to strengthen their teaching. Schools must enhance the achievements of their students to maintain the school's name in the eyes of their stakeholders and the parents of prospective students. In a similar way to many public organisations, schools have to demonstrate appropriate knowledge assets and accountability in supporting an evidently defined teaching development plan. Most school assets and resources are intangible, which means they can neither be easily measured nor managed. These assets and resources include staff competencies, organisation policies, structure and culture. For a school to be able to

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improve, it is critical to develop a new approach for managing these intangible assets so that they can cope with a competitive environment.

Literature reveals that intellectual capital (IC) plays an important role in facilitating the sustainable development of schools by making the most of knowledge resources by having them as knowledge assets for capacity building (Kelly, 2004b; Basile, 2009; Paletta and Alimehmeti, 2014). IC is a knowledge asset that can generate competitive sustainable advantages (Paletta, 2011). Schools are able to make the most of IC, which comes from the knowledge, experience and transferable skills of staff members; from the school's infrastructure policy and practices that innovate and manage change; and from the relationship between the school and its stakeholders. As the IC largely comes from within the organisation, the management of that IC can create maximum leverage when looking to improve the school and the effectiveness of its teaching (Basile, 2009) and student learning (Paletta, 2011). IC is at the core of what society considers the purpose and definition of successful schooling. It must be put to best use if schools are to operate at their fullest potential (Kelly, 2004a). The issue of managing and creating the knowledge resources of the school organisation has become a significant research agenda in school effectiveness and improvement, which must be addressed.

Knowledge management (KM) in schools can be conceptualised as strategic management activities that support school leaders and teachers to leverage and capitalise on the organisation's knowledge resources to plan and carry out teaching tasks effectively (Hansen *et al.*, 1999; Zack, 1999; Nonaka *et al.*, 2006; Cheng, 2015). Formulating effective strategies for implementing KM activities could be a promising management approach to create IC in schools. The study also aims to determine the extent to which Lesson Study, one of the typical KM practices in school, enhances school IC in the context of Hong Kong school education. Lesson Study is a KM approach that creates pedagogical knowledge through sharing, codifying and teaching knowledge for addressing students' learning difficulties (Cheng, 2015). The primary goal of Lesson Study is to effectively improve the overall quality of teaching through demonstrating and sharing of teaching knowledge with other teachers. Specifically, it examines the effects of Hansen *et al.*'s (1999) personalisation and codification knowledge strategies on Kelly's thinking capital (human capital) and non-thinking capital (structural capital). A mixed-method approach was adopted in the research strategy. Questionnaire surveys and qualitative interviews of a case study were conducted to collect data. A structural equation model (SEM) was applied to examine the predictive effects of KM strategies on school IC. The researcher identified effective KM practices for developing school IC by analysing the interview scripts of a case study.

## Literature review

IC has been described as the knowledge and knowing capability of organisations (Nahapiet and Ghoshal, 1998). IC has appeared in the business sector to reflect the non-accounting value that will not appear in any financial reports of a company (Edvinsson and Malone, 1997; Stewart, 1997). IC management plays an important role in facilitating innovative processes and creating value in social enterprises. IC management takes the resource-based view on organisations which should incorporate specific resources, capabilities and endowments to offer a source of competitive advantage (Al-Ali, 2003; Curado and Bontis, 2006). IC has been widely adopted in public organisations including higher education institutions for organisation development (Dumay *et al.*, 2015). The core mission of school education as a public good is to create intangible assets to the public society (Secundo *et al.*, 2016). Schools have to prioritise scarce resources and systematically monitor intangible assets with a view

to contributing to the economic improvement and better accomplishment of education goals (Bornemann and Wiedenhofer, 2014).

In education, IC is considered as individual or collective knowledge assets in schools that can be used to gain competitive advantage, and to enhance the value of other types of capital (Casey, 2010). It consists of a whole host of aspects that extend beyond know-how, procedures, lessons learned and all the other recognisable repositories of knowledge. It also includes reputation, brand recognition and trust. Hargreaves (2001) asserts that school leaders should improve and mobilise school IC to cope with the changing nature of school effectiveness. IC links with organisation outputs for school effectiveness and improvement. IC reporting of an educational institution has to be considered as an approach of synergetic educational research (Liening and Mittelstaedt, 2009). Kelly (2004a) divides school IC into thinking capital and non-thinking capital. Thinking capital is defined as the combined knowledge, skills, innovativeness and abilities of school teachers and staff. It is the same concept as human capital (Roslender and Fincham, 2001), and relates to the competence of teachers and denotes the tacit knowledge embedded in their minds, including their knowledge, skills, experiences and abilities. In this study, the words "human capital" are used instead of "thinking capital". Human capital is invariably a school IC component and is recognised as the central component of IC. The indicators to measure the human capital of schools are the professional competence of teachers. For example, teachers master the knowledge of their subjects and apply teaching strategies to enable student learning.

Non-thinking capital refers to the "non-human" storehouses of knowledge in an organisation that involves organisational structures and routines (Kelly, 2004a). The non-thinking capital of a school consists of the intangible assets of the organisation that remain when staff and students go home. These can include values, culture, processes, digital data systems, policies and procedures. Non-thinking capital also embraces organisational culture and management philosophy, which provide a framework to guide and interpret actions in the organisation. Similar to the concept of the structural capital of an organisation (Edvinsson and Sullivan, 1996), such as supportive infrastructure and databases, non-thinking capital is the knowledge that remains within the organisation at the end of the working day (Edvinsson and Malone, 1997). It can be defined as everything that gets left behind at the office when employees go home (Bontis, 2001). In this study, structural capital is used instead of non-thinking capital. The indicators for measuring the structural capital include the school's organisational structure, policy and communication that support the productivity of teachers. For examples, an organisational structure that enables teachers to perform effective teaching and learning; a collegial working culture for achieving the school goals; and the policies and succession plans that enable knowledge retention were adopted as the indicators. Human capital and structural capital are interlinked and mutually supportive of each other. They support and reinforce each other when an organisation has a shared sense of purpose. The human capital could improve the policies, practices and culture of the organisation and thus strengthen the structural capital. The structural capital enables the human capital to create and leverage its knowledge. School IC may be described as knowledge stocks in the two components and is generated through managing knowledge.

The knowledge-based view of organisations considers knowledge as the most important strategic resource for creating potential (Curado and Bontis, 2006). Knowledge resource is particularly important to ensure that competitive advantages are sustainable. Because KM is concerned with simplifying and improving the processes of sharing, distributing, creating, capturing and understanding knowledge (Gottschalk, 2006), it may serve as the process of creating value from an organisation's intangible assets (Liebowitz and Megbolugbe, 2003). KM is the process with the potential for transforming knowledge resources into IC. KM is

defined as a systematic and integrative process of co-ordinating organisation-wide activities. Individuals and groups can use these activities to acquire, create, store, share, develop and deploy knowledge, value information and expertise in pursuit of organisational goals (Rastogi, 2000). KM enhances the ability to redefine the knowledge and skills within an organisation, to ensure that they can be maintained at a certain level and to retain the organisation's innovative ability and its capacity to achieve organisational goals (Garud and Nayyar, 1994).

Knowledge is defined as a form of capital (Stewart, 1997) and can be classified into explicit and tacit knowledge (Nonaka and Takeuchi, 1994). Tacit knowledge is developed from direct experience and action, and is usually communicated through informal conversation and shared experience. Teachers meet to share their tacit knowledge and formulate a lesson plan together. Explicit knowledge refers to knowledge that is transmittable via formal, systematic language and removed from the original context of its creation or use (Cheng, 2015). The lesson plan, the teaching materials and the teaching guide created by the teacher who participated in the Lesson Study are in the form of explicit knowledge. Lesson study enables schools to develop knowledge that align within their school context and meet the need of their students for managing knowledge. Knowledge strategies refer to the overall approach an organisation takes to align its knowledge resources and capabilities for enhancing organisational performance (Zack, 1999). Knowledge strategies can be divided into two categories: codification for knowledge storing and "personalisation interpersonal interactive knowledge sharing" (Hansen *et al.*, 1999; Zack, 1999).

Personalisation interpersonal interactive knowledge sharing emphasises the use of dialogue through social networks, including occupational groups and teams, and knowledge that can be obtained from experienced and skilled people (Swan *et al.*, 2000). This strategy is based on the interaction between people in a social learning process. This usually involves face-to-face methods where people convey their "know how" or tacit knowledge to others (Smith, 2001). Sharing knowledge through person-to-person contact is helpful to human development (Hansen *et al.*, 1999). Individuals can reflect on their insights and share tacit knowledge with others who need that knowledge, and in this way, they can strengthen the competencies of the groups (Nonaka and Takeuchi, 1994). The indicators for measuring the managing of tacit knowledge in a school organisation include how learning communities are promoted to encourage knowledge sharing, how professional dialogue among teachers is encouraged to improve organisational competency and the level of knowledge sharing among teachers.

The codification strategy is a system-orientated approach for managing knowledge by codifying, storing and formally sharing knowledge through applying information technology (Choi and Lee, 2003). The codification for knowledge storing emphasises the capability for storing, sharing and using an organisation's explicitly documented knowledge. What happens in these cases is that individuals strive to explicitly encode their knowledge into a shared knowledge repository, such as a database. They also can then retrieve knowledge that other people have provided to the repository which may develop human capital. The codification strategy involves investment in information technology used for searching for specialised knowledge and for communicating among members (Liao, 2007). Structural capital is, of course, enhanced by using information technology to manage explicit knowledge. The indicators for measuring how explicit knowledge is managed include applying information technology to support knowledge sharing, providing support to teachers so that they can also use the information technology for implementing KM and establishing collaborative technology as a norm to support knowledge sharing through online communication within the organisation of the school.

Personalisation and codification strategies are not mutually exclusive, but rather support each other in implementing the knowledge transfer of organisations (Gammelgaard and Ritter, 2005; Venkitachalam and Busch, 2012). Lesson Study applies personalisation and codification strategies to create and retain pedagogical knowledge through constructing a knowledge-sharing platform. Best teaching practices can be leveraged through professional dialogue among teachers and then codifying these practices into lesson plans, teaching artefacts, video and reports for dissemination. Lesson study not only helps teachers to improve their instructional design skills (Cheng, 2011) but also supports them to acquire both internal and opportunistic knowledge, which they can then share informally (Jordan and Jones, 1997). These professional practices and organisation routines can develop teacher competencies and the structural capital of schools.

## Research methodology

This study assumes an association between KM strategies and school IC. Research tends to adapt a theoretical framework using KM to predict IC (Mehralian *et al.*, 2013). For example, Lee and Yip's (2015) study considered IC as the outcome of KM implementation. They studied a KM approach to IC reporting in Hong Kong. Kianto *et al.* (2014) argued that the value creation takes place when various types of existing knowledge are combined to generate new applications and these KM processes produce IC in the organisation. In the school context, KM processes may promote a mutual understanding, among teachers, of the school policy and practices, as well as the power and accountability within the school hierarchy. These KM processes can, therefore, create values for human capital and structural capital. KM processes empower teachers to act and communicate effectively by equipping them with required knowledge (Addleson, 2006). It would appear that structural capital can be enhanced if the school knows how to exercise knowledge strategies. Few studies have attempted to identify the effect of knowledge strategies in helping schools to build their IC. This study attempts to confirm whether personalisation and codification knowledge strategies can enhance school IC. The theoretical framework of this study assumes an association between personalisation and codification knowledge strategies and human and structural capital (Figure 1). This study assumes that there are predictive relationships of the personalisation and codification knowledge strategies on human capital and structural capital.

The research adopts a two-phase experimental design. This consists of a questionnaire survey in the first phase and a qualitative case study with documentary analysis and narrative inquiry in the second phase. A cross-sectional predictive quantitative survey was designed to collect data from teachers at 13 primary schools in Hong Kong who took part in a project called Applying Knowledge Management for School Development. The data were collected directly from teachers who were asked to fill out a questionnaire. For the study, the researcher was interested in a theoretical solution uncontaminated by unique and error

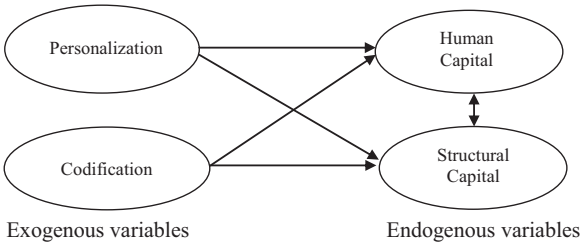


**Figure 1.**
Research framework

variability. The study was designed using a framework based on underlying constructs that are expected to produce sources on the observed variables. A SEM was applied to examine the factor structures and the paths among the variables, using LISREL 8.3 (Joreskog and Sorbom, 1999). The SEM is a collection of statistical techniques that allow the examination of a set of relationships between exogenous variables and endogenous variables.

The questionnaire consisted of 12 items, three items for measuring each variable (Table I). The items for measuring personalisation and codification knowledge strategies were adopted from Cheng (2012). The researcher conducted a content analysis of the research and theory in IC literature (Kelly, 2004b; Basile, 2009) to develop the items for measuring human capital and structural capital. The research questions required some notion of distance in the theorising and often assumed an equal spacing of the interval scale. The data were treated as an interval scale. All items were measured using a six-point Likert-type scale ranging from one (strongly disagree) to six (strongly agree). Teachers were asked to indicate how they perceived their learning behaviour in regard to the 12 items. The sample of 13 schools was drawn from 20 primary schools in Hong Kong, which took part in a school improvement project on KM organised by the researcher. All the teachers of the 13 schools were invited to participate in the questionnaire survey. Some 445 teachers responded to the questionnaire. A SEM was applied to confirm the constructed validity of the instruments. The reliability of teacher responses to individual items on the four scales of the instrument was examined on the basis of item-total corrections and coefficient alphas by using the SPSS program.

The second phase design used a series of interviews in a case school to explore how school leaders capitalise knowledge within their schools. A case study can effectively clinch a causal

| Item no. | Items of the questionnaire |
|---|---|
| | *Personalisation strategies (reliability $\alpha = 0.878$)* |
| 1 | My school encourages professional dialogue among teachers to improve its organisational competency |
| 2 | Knowledge sharing among teachers is one of the major priorities of our school plan |
| 3 | My school promotes learning communities to encourage knowledge sharing |
| | *Codification Strategies (reliability $\alpha = 0.891$)* |
| 4 | My school has applied information technology to support knowledge sharing |
| 5 | My school provides support to teachers for them to apply information technology to implement KM |
| 6 | My school has institutionalised collaborative technology to support knowledge sharing through online communication |
| | *Human capital (reliability $\alpha = 0.921$)* |
| 7 | Teachers in my subject department can apply various teaching strategies to enable student learning |
| 8 | Teachers in my subject department have mastered the subject knowledge for teaching |
| 9 | Teachers in our school have mastered the teaching strategies that would enhance student learning |
| | *Structural capital (reliability $\alpha = 0.801$)* |
| 10 | The organisational structure of my school enables teachers to carry out effective teaching and learning in relation to the school goals |
| 11 | Communication among teachers is effective and maintains a collegial working culture for achieving the school goals |
| 12 | The existing school policies and succession plans for human resource management can enable knowledge retention in my school |

**Table I.**
Item content and scale reliability

inference by uncovering fortuitous and decisive piece events or situation that allow a comparison for discoveries (Seawright, 2016). The case school – which had conducted Lesson Study for a long time – was selected for the case study. The researcher used Snowden's (2002) pre-hypothesis research to collect narratives from school leaders. This covered issues such as how and why their plans are formulated as regards knowledge transfer activities, as well as enhancing teacher competencies and school capacities. The narrative inquiry produces a collaboration between the researcher and the participants. It places them in the school context that they can understand and allows them to tell stories without any bias resulting from leading questions. The researcher then writes a narrative of their experiences. The narrative patterns linking strategy praxis, the customary practice and knowledge transfer processes in school management, teaching and learning were transcribed and labelled with codes. Each code was assigned with a codification that identifies the individual topic concerned. So, these codification distinctions include personalisation; teacher competencies and school capacities (e.g. strategies for managing knowledge, tacit and explicit knowledge); events (e.g. meetings, training workshops and document retrieval and storing); and actors (e.g. principal, heads of department and teachers). Each pattern in the transcripts will be compared with another transcript, one incident with another incident and one category with another category to identify emerging patterns. The incidents are those texts or descriptions recounted by the participants that may include interaction of experience to others, situation or place, where it makes sense to know the strategies for managing knowledge and to create school IC.

## Findings

The reliability coefficients of the scales ranged from 0.801 to 0.921 (as shown in Table I), which was judged adequate for this study. The structural and measurement coefficients from the completely standardised solution under maximum likelihood are presented in Figure 2. The goodness-of-fit statistics are shown in Table II. The SEM confirms the theoretical framework of this study. The SEM shows that personalisation is a predictive variable for human capital ($\gamma = 0.37$) and structural capital ($\gamma = 0.44$). Similarly, codification strategies are a predictive variable for human capital ($\gamma = 0.34$) and structural capital ($\gamma = 0.43$). All the paths in the model were significant at the 0.05 level according to the $Z$

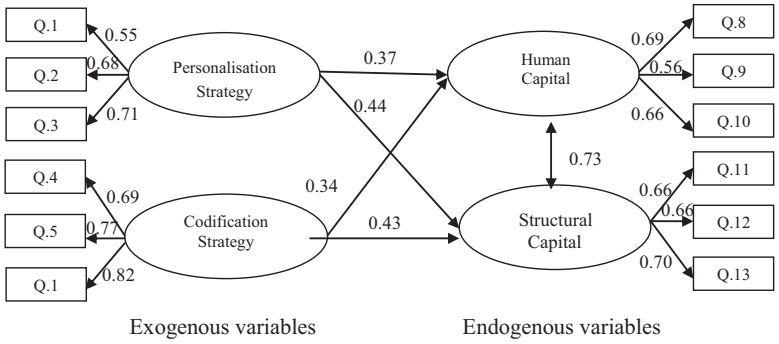


**Figure 2.**
Result for the structural model

**Table II.**
Goodness of fit statistics of the structural equation model

| $\chi^2$ | df | $p$-value | PGFI | RMSEA | SRMR | CFI | NNFI | IFI |
|---|---|---|---|---|---|---|---|---|
| 59.28 | 45 | 0.075 | 0.56 | 0.026 | 0.023 | 1.00 | 0.99 | 1.00 |

statistics. There are significant relationships among the endogenous variables of the models. The covariance coefficient between human capital and structural capital is 0.73, indicating the existence of close relationships among the activities. This finding suggests that human capital and structural capital are interlinked, and they support and reinforce each other in terms of creating value for the sustainable development of schools.

The hypothesised model is a good fit to the data. The results of the LISREL based on 455 participants showed that the chi-square value was not significant for the overall model, $\chi^2$ ($N$: 455) = 59.28, $p$ = 0.075. As an absolute fit index, the chi-square assesses the discrepancy between the sample covariance matrix and the implied covariance matrix based on the hypothesised model. A non-significant chi-square value suggests that the model may be a reasonable representation of the data. However, the assessment of fit using the chi-square test is confounded by sample size. When the sample size is large, the small difference between the sample covariance matrix and the reproduction covariance can be found to be significant. In this study, SRMR = 0.023, whereas RMSEA = 0.026 (90 per cent CI: 0.00; 0.043). Given that this is a very stringent model, these fit indexes show that the model fits the data fairly well.

*Case study*

School A is an aided primary school. A number of students with a variety of learning difficulties, who require extra support, have enrolled there. School A has been using Lesson Study for more than 10 years to improve both teaching and learning. When School A is externally reviewed, the report shows that the staff members have a good working relationship with one another. It also shows how much effort the teachers have put in to use Lesson Study to improve their lesson planning. However, the report also recommends that School A helps their students develop higher order thinking (HOT) skills to address the problem of their learning diversity. School A then took this recommendation on board. It made the problem-based learning (PBL) approach a priority in the school plan to develop students with HOT skills. The principal revealed that most of the teachers had no prior experience of first designing and then incorporating effective PBL activities in their classes to stimulate and help develop students' HOT skills. Based on the strength of the working relationship among the teachers, School A had continued to apply Lesson Study to leverage tacit knowledge between staff members to design PBL activities. It had developed a classification system in a digital archive (DA) for each of their departments to store their lesson plans, teaching artefacts, teaching handbooks and other documents. Through Lesson Study, teachers were able to raise any issues they had about creating PBL activities, and they were encouraged to codify their findings into lesson plans, teaching material and artefacts in a handbook, so that knowledge could be retained.

Teachers who all taught the same subject would meet regularly together to design PBL activities to address students' learning difficulties and misconceptions. They implemented, observed and evaluated PBL activities in their classes. Looking at what the teachers had to say in their interviews, it appears that they felt that taking part in the Lesson Study was a valuable tool for sharing and generating knowledge through collaboration with partners. All of the teachers who attended the interviews agreed that they valued the opportunity to share their knowledge and experiences and to learn from other teachers. Testimony from the interviews with the teachers shows that Lesson Study is a useful tool for leveraging best practices in designing PBL activities and implementing a system of curriculum management. This develops pedagogical content knowledge to stimulate students' thinking:

> Identifying the students' understanding of the teaching content is the most valuable aspect that I have learned about PBL through the Lesson Study. I will concentrate more on how students

think, how they learn, and check if there are any misconceptions before designing the PBL activities (Mr Y).

Through observing the lessons, I know how to design effective PBL activities. I can recognise the kind of student difficulties which may be encountered in the teaching content (Mr L).

The Lesson Study activities helped us to address student learning problems. We were able to practise PBL more effectively. Most of us are now more knowledgeable about PBL than before [head of department (HOD) and coordinator of professional development (CPD)].

These findings show that Lesson Study has helped to develop the teaching competencies of these participants and has contributed to the human capital. Evidence from the interviews indicates that Lesson Study could be institutionalised as a knowledge-sharing platform so as to nurture a knowledge-sharing culture. This culture can further strengthen communication, trust and emotional support among teachers:

Lesson Study provides a platform for us to share our knowledge as teachers and design problem-based learning (PBL) so that I can improve my teaching. It has helped us significantly as it has created a culture of communication vice principal (VP).

Lesson Study promotes collaboration between us, irrespective of the differences in our experience and seniority. I treasure the opportunity to conduct a Lesson Study which will enable me to share the experience of teaching the same topic with other teachers (Mr W).

I am a new teacher at this school and I need teaching advice and support from other experienced teachers. Lesson Study provides an opportunity for me to learn from them. I want to connect with other teachers in order to learn how to design PBL activities. It is good to have experienced teachers, who can observe my lesson and give me advice on how to improve my PBL design (Mr Y).

It seems that the knowledge for designing PBL activities has been co-constructed through discussions and collaboration in the Lesson Study. Through using the method of Lesson Study, teachers can collaboratively plan and work out the teaching approach to help students develop HOT skills. They can also develop a mentoring system for supporting new teachers. The school has also installed a DA for storing documents so as to preserve their knowledge capital. Evidence from the interviews shows that teachers stored their materials in the DA for future retrieval:

I observed that the teacher stored the plans of the PBL activities captured from the Lesson Study in handbooks, procedural manuals, agendas and minutes. These were then stored in the digital archive, ready for dissemination and future application to other subjects (principal).

I save the lesson plans in the digital archive so that other teachers can retrieve the material for future reference. The existing DA enables us to understand some guidelines and administrative procedures. But I may not fully understand the ideas captured in some of the lesson plans which were developed by others, so I may need those colleagues to brief me about their core ideas (CPD).

We scan all the documents generated from the Lesson Study and store them in a common area, a folder labelled "Department", so that colleagues can retrieve and use the materials. But our current classification system is complicated and unwieldy, so it takes us a long time to classify the knowledge into different categories and file together with the relevant teaching material. So what happens in reality is that most teachers tend to ask other people for information rather than retrieving a lesson plan from the digital archive (Mr TL).

> In my experience, teachers tend to store their own information rather than acquiring information from the digital archive. It isn't very straightforward to understand and apply the teaching ideas of other colleagues' by just reading the explicit data and information saved in the lesson plans without taking part in the meetings. Different students may need different approaches for effective teaching and learning (VP).

These findings show that teachers did store their documents in the DA. But it seems that the teachers preferred to gain any new knowledge by consulting their colleagues in their Lesson Study groups rather than reading the lesson plans and documents stored in the DA. This could be because the documents are classified in a complicated way, where it is time-consuming to find them. It could also be that the teachers struggle to understand the context of the ideas in the lesson plans in isolation. Without the context, it can take more time to master the concepts behind the lesson plans. So, sometimes it is just easier for the teachers to directly ask their colleagues. The teachers tended to adopt a people-based communicative approach rather than using an IT approach for retrieving and sharing knowledge.

## Discussion

The SEM looks at how the participants perceive the knowledge strategies of the IC of their school. The model clearly shows that the concepts of the personalisation and codification knowledge strategies, human capital and structural capital are empirically constructed into four latent variables. They co-exist in the empirical model and are experienced by the teachers. Both codification and personalisation knowledge strategies have an impact in terms of enhancing human capital and structural capital through transforming knowledge into school capital. This finding confirms the study of Hansen *et al.*, which claims that knowledge strategies predict human capital and structure capital of schools. Furthermore, it verifies Kelly's model of human capital and structural capital supporting and reinforcing each other.

The SEM confirms the theoretical framework that knowledge can be capitalised through personalisation and codification strategies. This finding supports the argument of Mehralian *et al.* (2013) that the KM process can leverage knowledge assets to produce IC. In a similar way to the evidence shown in the study by Lee and Yip (2015), the knowledge assets can be reported in the form of human and structural capital. The Lesson Study adopted as a KM approach in School A affirms the assertion of Kianto *et al.* (2014) that various types of existing knowledge related to instructional design can be leveraged and combined to generate new knowledge for problem-based learning.

The personalisation strategy is a predictor of human capital. This finding supports the argument of Jordan and Jones (1997) that person-to-person contact can help individuals to acquire and share internal and opportunistic tacit knowledge. This is similar to the socialisation process of Nonaka and Takeuchi's (1994) knowledge creation model in which the individuals' tacit knowledge is exchanged and the human capital of the organisation is enhanced. This finding also supports the claim from Helmi (2002) that teachers can share their insights with people in need of them. For example, the process of sharing and transmitting knowledge in the Lesson Study conducted in School A helps to design problem-based learning for anyone else among the teaching teams who needs it. Teachers are able to share insights with their colleagues that they have gained through the experience of Lesson Study. Similar to the argument of Cheng (2015), Lesson Study, as a KM approach, empowers teachers to act and communicate effectively by equipping them with the required knowledge. Therefore, it is not surprising that a personalisation knowledge strategy is a predictor for human capital.

The personalisation strategy is a predictor of structural capital. This finding supports the claim that person-to-person contact can empower individuals to communicate effectively. This means that a culture of sharing knowledge can be enhanced in addition to the understanding of the school policy and practices. Structure capital is where the value added by the knowledge creation process is assumed to reside. Therefore, the person-to-person contact can strengthen the non-human storehouses of knowledge in a school with organisational routines such as policies and procedures (Edvinsson and Sullivan, 1996). The Lesson Study in School A has cultivated a knowledge-sharing culture, which includes an institutionalised routine for a knowledge-sharing community and mentoring and professional development activities. A mutual understanding among teachers of the school policy and practices involved in HOT has been promoted by Lesson Study. These types of culture, practices and routine are examples of the structural capital of a school. So, a personalisation strategy creates values for improving the structure capital of schools.

The codification strategy is a predictor for human capital. If a school adopts a codification strategy, it can be very useful in providing solutions for designing problem-based learning. The finding supports the claims of Boisot (2002) that codifying knowledge for a repertoire can make it easier to diffuse that knowledge within an organisation to enhance staff competencies. This is similar to the internalisation process of Nonaka and Takeuchi's (1994) knowledge creation model, where teachers can internalise the explicit knowledge through their teaching practices, and thus their competencies are enhanced. In School A, teachers are endeavouring to explicitly encode their knowledge into a shared knowledge repository. This can include handbooks for designing PBL activities, teaching guides as well as retrieving the knowledge of other teachers who have added to the repository. The teachers make the most of information and communication technology to codify and store knowledge in databases, so that they can reuse this knowledge in a "people-to-document" manner (Gupta *et al.*, 2009). Therefore, human capital can be enhanced by knowledge codification with information technology.

The codification strategy is a predictor for structural capital. This finding confirms the study of Lee and Yip (2015) that by adopting the latest information technology to preserve knowledge, the structural capital of an organisation is created. This finding also confirms the study of Voelpel *et al.* (2005) that structural capital can be enhanced by applying information technology to store, organise and share reusable assets. Investment in information technology means increasing the structure capital of an organisation, which can facilitate the process of knowledge retrieval, storage and utilisation. In School A, the knowledge was codified into documents and stored in the DA. The codified explicit knowledge is stored in knowledge repositories, including e-mail and a DA, all of which are useful for efficiently managing the knowledge of an organisation. These IT tools and the KM system help teachers to codify what they have learned from school activities and make the knowledge more accessible to every teacher at the school. The process of knowledge codification enables knowledge diffusion among the teachers (Boisot, 2002) and eventually enhances the human capital of the school.

The results of the SEM also show that human capital and structural capital are interlinked and mutually supportive of each other. These findings concur with Stewart' s (1997) assertion that the structural capital enables the human capital of an organisation to share and leverage knowledge, and the knowledge leveraged will in turn reinforce the sharing culture and practices of the organisation. It also confirms the claim of Edvinsson and Malone (1997) that structure capital is the embodiment and the supportive infrastructure of human capital. The Lesson Study conducted in School A can be regarded as a KM practice

which nurtures human capital in the form of teacher development. The Lesson Study also creates a knowledge-sharing platform and culture, and is the structure capital of School A.

The findings also back up those of a study by Hansen *et al.* (1999, p. 112) that organisations should have a balanced mix of the two strategies. The personalisation strategy stresses the need for a knowledge-sharing platform with a focus on connecting individual teachers. Meanwhile, the codification strategy focuses on building comprehensive databases that deal with the various teaching subjects and also the identifiable learning needs of the students. Another reason for applying both strategies is that there is a mixture of tacit and explicit knowledge used in teaching in school organisations. For example, any subject matter which is taught in the class is explicitly codified in lesson plan books and teaching materials. Some school activities are more mass-produced. They are more standardised and lack any distinguishing characteristics. In these scenarios, the codification knowledge strategy would be a better fit as these teaching processes and knowledge can be used over and over. Such codified knowledge exists in the form of guidelines, handbooks, procedural manuals, agendas and minutes, all used as part of the school's overall strategic plan to provide students with quality education. But teaching requires a unique and tailored approach, and this is where personalisation knowledge strategy is better suited because it allows those "knowledge carriers" to use their intellect and sense of intuition and also adapt the materials required (Hansen *et al.*, 1999, p. 113). This teaching knowledge is tacit and embodied in teachers' minds where personalisation knowledge strategy is required for leveraging and sharing. So, it is important that teachers not only share knowledge in a DA but that they also communicate with one another. By adopting mixed knowledge strategies, KM can be an effective approach to enhancing school IC.

## Implications

To strengthen the IC for school development, school leaders could promote the application of both personalisation and codification knowledge strategies. It would be best for schools to have a healthy mix of the two strategies with the balance leaning to one side or the other depending on the school context. However, the choice of knowledge strategy depends on the specific organisation (Blackler, 1995). Will the knowledge be codified and stored in databases in which the DA is used to help teachers communicate? Or will the knowledge be shared with other teachers who are within or connected to the school? If school leaders plan to implement the codification strategy, they should be prepared to invest in information technology as the whole strategy is dependent on the information technology infrastructure. The information technology infrastructure required would include mobile devices, data warehouses, applications to access the data, networks and servers. If school leaders select personalisation as the KM strategy, they would perhaps have to invest less in IT but more in people within their organisation, that is the "knowledge carriers".

A personalisation knowledge strategy can be implemented by cultivating a Lesson Study community. A knowledge-sharing culture can be developed and enhanced in schools when teachers share their tacit knowledge within the communities of practice. These communities can be applied as a KM strategy for managing school IC (Lesser and Everest, 2001). The organisational structure of schools should strive to incorporate reward systems as a way to encourage staff to share their knowledge. A codification for knowledge storing and retrieval is usually implemented by building a school-based taxonomy in the KM system (Andreeva and Kianto, 2012). A DA is an information technology-based system designed to support and enhance the process of knowledge creation, retrieval, storage, transfer and application within organisations (Alavi and Leidner, 2001). Although IT is needed to capture the information on who knows what and to provide information systems to connect people, it is the people in the

organisation who are more important. School leaders should incentivise the knowledge carriers to talk to and assist teachers rather than to enter the knowledge into some IT systems (Hansen *et al.*, 1999, pp. 113-114).

Some models for exploring IC tend to break it down into human capital, structural capital and relational capital (Sveiby, 2001; Guthrie and Petty, 2000). The missing of relational capital in Kelly's theoretical framework could be the limitation of this study. Relational capital represents the knowledge embedded in the relationships with the outside environment, which may be a powerful weapon in a school's ability to achieve its strategic objectives. For example, the support of parents and their social socio-economic status provide significant relational capital for helping with homework and acting as unpaid assistants. A tripartite IC model which disaggregates the intangible resources into human capital, structural capital and relational capital is therefore recommended for future research.

## Conclusion

KM can be an effective approach for schools to capitalise school knowledge. An empirical model was used to articulate the predictive effects of personalisation and codification knowledge strategies on human capital and school capital. This paper makes a theoretical contribution to existing literature by providing an empirical model for the implementation of knowledge strategies for enhancing school IC. School leaders may consider cultivating Lesson Study communities and developing a set of taxonomy in a DA in their schools to support the development of professional competencies of teachers and to improve the implementation of policies and practices at their schools. In this way, schools can increase their tangible value, thus continuously attracting quality students and maintaining the school's brand name in the eyes of their stakeholders. By implementing KM, they can provide quality education and accountability to the public. This study provides a framework for school leaders to leverage knowledge for capitalising on school IC. This then can be used as a means of tackling some of the challenges within the modern education system, such as curriculum reform and marketisation, so that schools can be sustainably developed in our knowledge-based society.

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