Determinants of School Level Success in Design-Based Innovation Networks

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Abstract: Design-based implementation research (DBIR) is a methodological approach that has emerged in recent years to address the challenge of sustainability and scalability of such learning innovations in diverse settings in the educational ecosystem. These efforts are generally organized in the form of innovation/implementation networks (DBIN). While the network as a whole can be successful, implementations in individual schools differ, resulting in large variations in the depth and reach of the changes that take place at the school level. This study investigates two schools in a DBIN that demonstrated similar trajectories of change in the first two years, but very different outcomes at the end of the third year. The findings show that the fine grain details of the architecture for and leadership engagement in within- and cross-school learning, and the quality of the school-based learning interactions matter in determining the implementation outcomes of schools in the same DBIN.

Introduction

Design-based implementation research (DBIR) (Fishman et al., 2013; Penuel & Fishman, 2012) has increasingly become a methodology of choice when the goal is to develop sustainable and scalable solutions to significant problems of practice through the disciplined application of research based theory and knowledge. DBIR needs to engage two layers of theory (Penuel, 2015). The first level theory is about how students learn and focuses on learning taking place at the classroom level, and design-based research (DBR) has been contributing to our understanding at this level. However, scalable implementation of pedagogical innovation needs to scaffold learning beyond the classroom to higher levels of the complex, hierarchically nested layers of the education ecosystem. An important underpinning principle of DBIR is the partnership relationship among the multiple stakeholders involved, usually constituted as an innovation network (DBIN). In this study, we explore the second level of theory from the perspective of school level scalability of innovation and change in a DBIN.

It has been shown that organizational and administrative support at the school level such as timetabling and space for co-planning (Gumus, 2013), opportunities for peer observation (DeLuca et al., 2015) are important. (Wenger, 1998) refers to the organizational environment that provide opportunities and supports for collaborative learning in a community of practice as the "architecture for learning". Studies in educational change also found the architecture for learning, such as organizational routines, team structures and roles to be of critical importance to the effectiveness of educational change efforts in the classroom (Spillane, Parise, & Sherer, 2011; Stein & Coburn, 2008). The team structure, content, interaction foci, decision-making process and roles of participants are core elements of an architecture for learning (Law, Yuen, & Lee, 2015) in the context of teacher co-design.

This paper is an investigation into what differentiates implementation conditions and strategies between schools in the same DBIN that have successfully scaled from those that failed to do so. The study is underpinned by a model of scalable change as aligned learning at multiple levels, using the framework of architecture for learning. The context of this study is a DBIN that was funded as a university-school partnership program for three years. Two schools with apparently similar initial conditions and trajectories of implementation but widely different outcomes at the end of three years are selected as cases for in-depth analysis for this study.

The context of this study is a government funded 3-year university-school partnership program, titled "Self-directed learning in science with e-learning support for learner diversity and smooth primary-secondary transition" (SDLS), funded by the Education Bureau in Hong Kong. The overarching goal is to nurture and develop student's self-directed learning ability to become confident and capable life-long learners in the 21st century. In this paper, we first introduce the nature and design principles of SDLS at the network (DBIN) level. This is followed by a description of the implementation trajectories in both schools over the three years. Finally, we present our analysis of the schools' architectures for learning and school-level conditions of implementation.

Design principles for SDLS as a DBIN

As mentioned earlier, DBIR involves two layers of theories: theories about how students learn (classroom and individual level learning), and theories about organizations in the context of such changes. In the SDLS Project, self-directed learning (SDL) is the underpinning pedagogical theory guiding the design of learning at the student and teacher levels. For SDL to be implemented in classrooms, it requires deep changes in teachers' pedagogical practice, expertise in learning and assessment design, changes in routines, resource allocation, and other aspects in the architecture for learning (Wenger, 1998) for the pedagogical innovation to be sustained and scaled.

Self-directed learning as the pedagogy of choice for the DBIN

As a pedagogical approach, SDL has two key features that are characteristic of learning as collaborative inquiry: (a) it requires students to take personal ownership of their learning (setting learning goals, accepting responsibility for their thoughts and actions, and maintaining control for the many learning decisions), and (b) the learning process often involve interactions with the teacher as well as with other learners (Brockett & Hiemstra, 1991). Synthesizing the literature on SDL (Candy, 1991); Gibbons, 2003; Tan et al., 2011) and aligning SDL with the process of inquiry and problem solving, we have articulated a five-component model of SDL: goal setting, self-planning, self-monitoring, self-evaluation and revision, as the operational definition SDL for the DBIN. A brief description of these five components are presented in Table 1.

Table 1: A description of the five SDL components

SDL component	Description
Goal setting	Students identify own learning goals, targets
Self-planning	Students regulate and plan for the detailed decisions and arrangements associated with their own learning
Self-monitoring	Students self-manage their own time, monitor their own repertoire of learning strategies, and adjust their own learning pathways as they progress
Self-evaluation	Students are aware of the assessment criteria, and apply these for self-evaluation
Revision	Students draw on peer and/or teacher feedback to reflect on their own learning, and make appropriate revisions, and apply learning to new contexts

Critical to successful pedagogical change is deep teacher learning, learning that leads to deepening changes in teacher practice. In this DBIR project, SDL also underpins the learning design for teachers. Teachers need to *experience* learning as a self-directed learner in collaboration with other teachers: they need to be given the space to determine what they consider as appropriate and reasonable for their SDL experimentation in their own classrooms, plan, implement, monitor and reflect on the experience for further improvement and experimentation. We take a growth perspective on both student and teacher learning, and do not impose targets on teachers' practice.

Teacher collaboration in teacher design teams provides opportunities for teachers to engage in "professional talk": reflecting on the curriculum, their practices and goals for students' learning (Parke & Coble, 1997); exploring new pedagogies, including the effective use of technology in teaching and learning (Agyei & Voogt, 2012). Opportunities for co-planning are not adequate to ensure productive teacher learning. The team membership composition in terms of background and expertise, team size (Handelzalts, 2009), the nature and focus of team interactions (Ehrlenspiel, Giapoulis & Günther, 1997), and the role of school-based facilitators in the design and associated decision making process (Huizinga et al., 2014) have been shown to have important implications for the learning outcomes of teacher design teams. In our project, we adopt teachers' collaborative inquiry centering on the co-design of students' learning, peer observations and reflective debriefing as the format for implementing SDL for teacher learning. The details of this design will be described in a later section.

Social technical co-evolution and the multilevel multiscale model of aligned learning for scalable innovations

Pedagogical change and innovation in a classroom does not happen in a vacuum. Classrooms are embedded in schools, communities and education systems and are influenced by intricate interdependencies with local, national, international communities and organizations as well as business enterprises (Davis, Eickelmann & Zaka, 2013). There is increasing recognition that the scalability of educational innovations can only be addressed if we can take account of the complexity of education ecosystems (Sabelli & Dede, 2013). As Law et al. (2016) illustrate (see Figure 1), different parts of the education ecosystem are highly connected and interdependent. For students to achieve the desired 21st century learning outcomes such as the 4Cs and digital literacy through collaborative inquiry and associated pedagogical and assessment innovations, aligned changes at teacher, school and system levels are needed. Such changes can be conceptualized as learning at these multiple levels. Hence, scalable innovation in DBIR is not a one step process, but an iterative process of aligned change through interactions and feedback across the different sectors and levels of the ecosystem. The second level of theory in DBIR is to address the challenge of achieving the necessary aligned learning.

Current literature on DBIR has generally taken on a sociocultural perspective in understanding the challenge associated with achieving alignment in the process of change, in particular, Lave & Wenger's (1991) community of practice (CoP) theory. Members of the same professional practice share the same understanding of their enterprise, norms of mutual interaction and repertoire of capabilities. Scaling pedagogical innovations require communication across different communities of practice: teachers, principals, district level subject matter experts, policy makers, etc. To facilitate boundary crossing (Stein & Coburn, 2008) between different CoPs, there needs to be boundary practices (i.e. interactions constituted to bring members of different CoPs together on issues of common concern) and boundary objects (i.e. artefacts that scaffold boundary crossing). Stein & Coburn (2008) further put forward the concept of architecture for learning, which refers to the conditions conducive to learning across boundaries, and identified the following as key elements of the architecture: networks/organizations (formal and informal) that connect people within and across CoPs, mechanisms through which people interact, and the artefacts that serve as reifications that embodies a set of ideas or processes for sharing and communication within or across community boundaries.

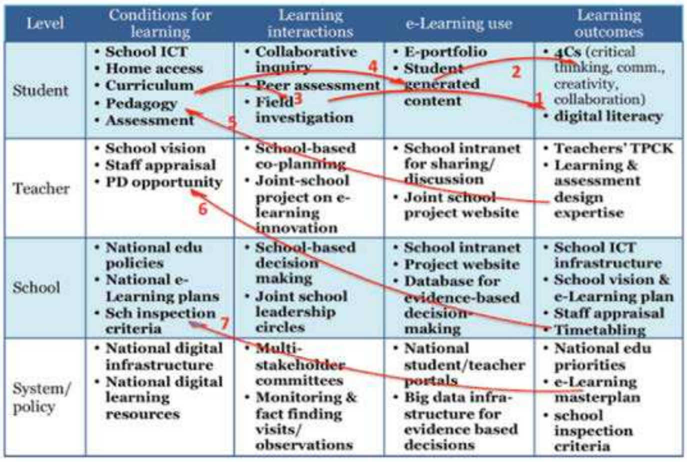

Figure 1. A diagrammatic representation of the interrelationship across factors and parameters at different levels. (Source: Law et al., 2016, p. 73)

While the architecture of learning provides the environmental conditions for learning, any design for learning needs to be underpinned by a theory of how learning happens. Based on the idea that deep learning within each CoP would most likely occur through inquiry learning with peers, Law, Yuen and Lee (2015) propose a multilevel multiscale (MLMS) model of learning, which argues that an architecture for learning for CoPs at higher levels of the education eco-system needs to span larger units of scale. The scale of a design-based innovation network that can support learning of a CoP of school leaders would have to engage multiple schools, and the learning of a CoP of district leaders would have to engage multiple districts. An implication of the MLMS model as a DBIR design principle is that the architecture for learning needs to scaffold learning within and across units at different levels of scale as well as across the different levels. In the SDLS Network, the MLMS model of learning serves as a design principle for the second layer of theory to guide the design-based implementation research.

Design of the architecture for learning for the SDLS DBIN

SDLS conceptualizes four levels of structure in its design: student, teacher, school and network, and the DBIR designs architectures for learning at the network level and encourages schools to design its own school-based learning architecture. At the network level, we provide a finer grain organizational structure to connect schools and teachers in multiple ways for different types of interaction foci and mechanisms to support scaling across the three years. The network started with 10 primary and 10 secondary schools, organized in two clusters of five primary schools and two clusters of secondary schools as illustrated in Figure 2. Assignment of schools to these clusters is based on their geographic proximity and are hence referred to as regional clusters. An additional five primary and five secondary schools were added to the network in each subsequent year, and the clusters were restructured so that there is a mix of old and new schools in each cluster.

There are four types of cross-school teacher-level learning activities organized for schools in the network:

1. Regional cluster meetings—these cluster meetings are held in one of the five schools within each regional cluster, and these generally focus on sharing around the day-to-day work of teachers in the design of curriculum units, learning and/or assessment tasks, choice and deployment of learning resources/tools (both conventional and digital). These meetings are generally informal and teachers find these to be very useful and enjoyable. Teachers in the same cluster often connect outside of the scheduled cluster meetings, usually through electronic means.

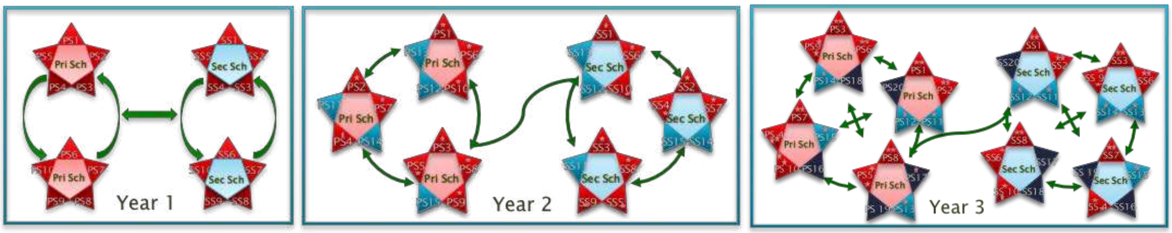

Figure 2. Organization of schools in a network of interacting clusters through the three years of the project.

2. Primary school level and secondary school level cluster workshops involving all project schools at the same school level—these school level meetings are generally used to introduce curriculum and pedagogical ideas related to specific curriculum themes/topics of interest to the teachers in the form of inquiry tasks such that teachers will experience together with their peers in a playful manner the learning tasks as students. Teachers often find that they can pick up useful ideas and snippets for adoption in their teaching, and at the same time experience firsthand self-directed learning in science as a learner.
3. Whole network meetings (four in a year)—these meetings serve three key functions: (1) introducing self-directed learning as a pedagogical approach and its core features; (2) sharing of SDL learning designs and their implementation in classrooms by project school teachers, often including classroom videos, samples of students' work, and teachers' own reflections; and (3) introducing some "advanced topics" such as designing assessment as learning, using virtual reality tools for scientific exploration, etc.
4. Open classroom and peer observation of teaching—each school commits to designing and implementing one SDL curriculum unit per semester. University-based project staff are assigned to each of the schools and conduct school-based co-planning sessions for each implementation. Each school will select one lesson from one of the two implementations each year for open classroom observations by interested teachers and principals in the network. A debriefing session involving teachers in the observed school and the visitors will take place immediately following the observed lesson.

Cross-school teacher-level learning activities are scheduled throughout the school year so that each month one of the activities listed under 1 to 3 will be organized. The different meetings are interlaced so that teachers will have opportunities to engage in different collaborative learning activities that inform and/or support their own school-based collaborative inquiry of SDL implementation, culminating in the implementation of their own designed SDL units and the open classroom for peers' observation. Principals of participating schools need to commit to releasing their teachers to participate in the monthly cross-school meetings and workshops.

Two of the four whole network meetings include the participation of principals. For these, half of the meeting is designed as opportunities for cross-school, cross-level interactions involving both teachers and school leadership (principal and/or vice principal) as it is important in the MLMS model that leadership gets opportunities to learn about how other schools implement SDL at classroom and school levels. During this half of the meetings, in addition to teacher sharing of their practices, principals and school project team members are also invited to share the management and resource allocation provisions and other strategic organizational decisions made at the school level to address challenges encountered and/or further ways to enhance the innovation implementation in their schools. This provides an opportunity for teachers and school leadership to understand the innovation implementation as a multilevel effort within a school. During the other half of these meetings, school principals will take part in "leadership circle" meetings separate from the teachers so that they can discuss and share challenges and solutions at the school level. Principals are also strongly encouraged to participate in at least one open classroom observation in another school in each year.

Methodology

In this study, we wish to understand how schools design their own architectures for learning (AfL) to support their implementation of SDLS, as well as whether and how features of the AfL relate to different implementation outcomes. The methodology adopted is comparative case studies of the network schools. We collect quantitative and qualitative data on (1) the schools' participation in the various activities organized by the network; (2) the planning, implementation and post-lesson reflection for each SDL curriculum units designed and implemented in each semester by each school, through document collection and observations conducted during co-planning meetings, lesson observations, debriefing meetings, and online curriculum-related activities of the teachers and students on iLAP, a customized Moodle platform serving as the project Learning Management System; and (3) each school's architecture for learning (both formal and informal) through surveys and interviews with the principal and project core team members in each school at the beginning of their first year of participation and at the end of each project school year.

In this study, we have selected two primary schools (Schools A and B) that joined the project in Year 1 for our investigation. Both are government-funded schools located in public housing estates (government housing for low-income families). These two schools showed similar trajectories in SDLS implementation during the first two years in the project but differed greatly in scale and depth of implementation by the end of the third year.

The trajectory of SDLS development in the schools

In Year 1 of the SDLS project, participating primary schools were advised to start their innovation implementation in Grade 5 so that the teacher workshops and cross school teacher collaboration can be focused around topics in the Grade 5 science curriculum. We required all schools to involve at least two teachers at the same grade level in the implementation of SDLS so that there can be peer collaboration within schools. Schools were encouraged to engage all GS teachers at the implementation grade levels for sustainable school-based adoption of SDLS.

Schools A and B decided in year 1 to involve all the grade 5 classes in their schools (A has three classes at each grade level and B has four). Both also extended the implementation to include all grades 5 and 6 classes in year 2. By the end of Year 2, there were discernible shifts in teachers' pedagogical and assessment practices in both schools from teacher-directed practices to more student-centered practices. The teachers were willing to let go of control and let students take the lead in designing experiments from the beginning to the end. There was also a shift from teacher-based assessment to include peer assessment. In School B, students were asked to design their own self-assessment rubric. The teachers also reported their own learning gains:

> *"I have lots of questions in making the electric fan. ... as I am not a [science] subject specific trained teacher, in the process of creating a powerful fan, I engaged as a self-directed learner in solving the problem and learnt some scientific concepts. My scientific knowledge was enhanced. I am more confident as I went through what my students will encountered in the learning processes." (School A teacher)*
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> *"Traditionally, we design the worksheet for students to fill in the blanks. Now students need to design their own experiments, they need to set their goals, steps and review their results. Sometimes, they encountered problems and failed. It is good that students have this kinds of experiences ...." (School B teacher)*

Apparently, these two schools had similar implementation scales and the teachers had similarly found the SDL learning experience to be beneficial both to their students and themselves. However, the two schools diverged in their implementation trajectory in the third year. School A kept the same project core team, maintained its momentum and expanded the implementation to include all classes in grades 4, 5, and 6. The school further created more e-learning courserooms on the iLAP beyond the ones set up by default for each participating class. Some of these additional courserooms were for students' SDL explorations on topics outside of the school curriculum, and some for teachers who wish to try implementing SDL with e-learning in non-science related subjects. Teachers in School A continued to deepen their understanding of SDL and gave progressively more agency to their students. The teachers observed that when students were interested and given choices to set their own goals, they were motivated to try different ways to accomplish those goals. At the end of Year 3 interview, one teacher reported becoming more self-directed, and that she had learned more from her students, particularly when they asked unexpected questions. Several of the School A teachers felt that the self-directed learning accomplished by students in all classes and ability groups exceeded their expectations, even though at the beginning of the year they faced the challenge of having students whose cognitive and creative abilities varied greatly.

School B on the other hand decided to change the personnel involved in the project, including the team leader and the scale of the implementation. The original project leader was moved to be in charge of another project, and only 2 classes at Grade 4 were involved in SDLS in this final year. The rationale given for the change in scale was the lack of adequate ICT infrastructure in the school. The SDL practices implemented in the two P.4 classes were also more teacher-centered compared to the previous two years. There were essentially no e-learning activities included in the SDL implementation. The two teachers involved did not have experience with iLAP and they did not join the training workshops offered for teachers new to the project. At the end of year 3, these teachers found students' SDL learning outcomes to be mediocre, and they attributed this to the weaker capacity of P.4 students to undertake SDL.

Architecture for learning at the school level

Why did the two schools' implementation trajectories diverge so drastically in the third year? There was no change in the leadership or staffing at the school level in either A or B. What may be the reasons for the sudden change? In this section, we describe the AfL associated with the implementation of SDLS at each school over the three years. We first describe the project implementation team structure, interaction mechanisms, and decisions made by the two teams. This is followed by a description of the school-based teacher learning organization and mechanisms, and how these connect to the learning opportunities provided by the architecture for learning at the SDLS network level. Finally, we report on the leadership (principal and senior management team) engagement in project-related learning at the school and network levels.

School level project team structure, roles, interaction mechanisms and decisions

Project team structure. The School A project implementation team was led by the PSMCD (a formal, school-based curriculum leader role in primary schools) throughout the three years. The School B team was also led by its PSMCD for the first two years, but leadership shifted to the assistant principal in the third year. The PSMCD in both schools had curriculum and pedagogical expertise but did not have a science disciplinary background. The School B assistant principal had a science background. Other members of the School A project team included both the Principal and Vice principal, the General Studies (GS, the subject home for science in the primary curriculum in Hong Kong) panel head and all of the teachers involved in the project implementation during each of the years. Other School B project team members included the GS panel head and all of the project implementation teachers in each of the years. Hence, structurally, school A had top level leadership involvement, whereas School B only had involvement up to the middle management level.

Project team participation in activities organized by the network. School A makes provisions for as many teachers as possible to participate in the various cluster and whole network activities organized by the project throughout the three years. For School B, there was also active participation in the activities organized by the SDLS network during the first two years by project team members, except the principal. In year 3 only one or two teachers participated in the various project activities.

Project team leader roles in learning. The roles of the project team leaders differed right from the first year, even though the leader was the PSMCD in both schools. Both team leaders played the roles of liaison with the university-based network team and coordination of within-school project administration. In addition, the PSMCD in A served as the pedagogical mentor in the project and participated in all the school-based co-planning meetings as well as in all of the activities organized by the SDLS network, helped to resolve difficulties encountered in the implementation, including communicating issues and needs to the principal and the senior management team. In the third year, the PSMCD was so convinced of SDL as a pedagogy of choice for student learning in general that she started implementing SDL in her own Chinese language classes using iLAP. On the other hand, the role played by the PSMCD in B was only administrative, which included also the allocation of teachers to the implementation classes and arranging tablets for students' use during classes as needed. In the third year, the new project leader (assistant principal) rarely participated in any of the activities organized for the clusters or the entire network. Hence, the project leader in A engaged fully as a learner and a leader of learning for the team, while the role of the project leader in B was solely administrative.

Project team decisions. As the PSMCD in A was fully involved in all of the learning activities at both network and school levels, the whole project team was involved in discussing issues, and making or facilitating decisions that would support project implementation and teacher learning. These included getting the school's agreement to remove one curriculum topic to allow more time for student exploration, making arrangements for teachers to attend within-school and cross-school open classroom observations, creating additional courserooms in iLAP for more SDL focused e-learning activities for students, and creating a WhatsApp group to facilitate efficient communication among team members. In B, the project team did not make any specific decisions or recommendations to the senior management. The team discussed administrative arrangements to implement the participation requirements required by the university-led SDLS project.

School-based teacher learning organization and mechanisms

Both schools had grade-level teams involved in the co-design of SDL lessons in selected curriculum units. In A, all involved teachers contribute materials to the co-design work. At the co-planning meeting, which was held during the weekly timetabled co-planning period, the teachers discussed with the PSMCD and the GS panel head their lesson designs in detail, including the feasibility of the plan, anticipated problems and solutions. Experiments were tried out many times with different variables. Besides serving as the pedagogical mentor, the PSMCD also communicated to the principal for discussion at the senior management level if there are obstacles encountered in the implementation process. Teachers felt safe and supported during the implementation process, describing the PSMCD as a 'pillar' of support. Frequent informal interactions were facilitated by staff room seating arrangements and the use of WhatsApp groups. In addition to the formal open classroom observations, all project teachers took turns to observe each another, provide peer feedback and made iterative revisions to their co-designed lessons.

There is no timetabled co-planning period in School B, where co-planning took a more product-oriented approach. One teacher took the key responsibility of designing the SDL lessons, and sought the inputs of other GS teachers at the same grade level to refine the plan during co-planning. In Year 2, the co-planning took on a stronger learning focus, when GS panel head was also teaching Grade 6. There was a lot of informal discussions and collaboration between him and the teacher with the key responsibility for SDL lesson design. These intensive collaborative design interactions brought visible changes in the quality of the designed lessons and the scope for student agency in the planned learning activities. It is unfortunate that these quality learning opportunities initiated autonomously by these two teachers and the ensuing outcomes were unnoticed by the school leadership, and terminated when the school changed the implementation staffing and scale.

Leadership engagement in SDLS-related learning at the school and network levels

While a school is not led by a single person, the school principal plays a very important role in setting the direction, communicating and implementing the school's priorities, serving as a role model and a cheer leader. The principal in School A was almost a classic example of a fully supportive school head. He attended all the open class observations and debriefing sessions held in his own school, participated in some of the co-planning meetings in his own school, offered his school as the venue for regional cluster meetings and occasionally attended these, observed some open classrooms in other project schools every year, attended every year the two network level meetings to which principals were invited, and shared his school's project implementation experience with other schools during whole network meetings. The principal in School B attended all the three open classroom observations in his own school, and only participated in one whole network meeting in Year 1.

Innovation implementation often require changes in school routines (Spillane et al., 2011), resource allocation, as well as curriculum and assessment policy decisions. In A, there are examples of different categories of strategic arrangement in support of SDLS implementation in the school. In terms of resource allocation, each participating teacher was given a one lesson reduction in teaching load per week to recognize the extra time they need to spend on the project. Technical support staff was allocated to the project to provide e-learning design and on-site classroom support. The physical seating arrangement in the staff room was changed to allow the project teachers to sit in close proximity so that they can easily have frequent informal interactions. Weekly timetabled co-planning periods were instituted as a school routine to ensure that teachers not only can, but also have the accountability to engage in collaborative co-planning. School-based peer lesson observations was also instituted as a school routine to scale up teacher learning and to showcase good practices within the school. The school has also modified its school-based assessment policy so that 10% of subject scores are allocated for project work performance. It is clear that there is a conscious policy in A to support teacher learning within and across schools.

In school B, resource allocations similar to those in A were made: a one lesson per week reduction in teaching load for participating teachers, and assignment of technical support for e-learning implementation. However, no other provisions were made for the project implementation beyond making arrangements for teachers to attend the minimal number of cross-school open classroom observations stipulated by the project.

School-level support for e-learning in SDLS

The iLAP online portal was designed to facilitate student learning, collaboration, self and peer assessment, as well as making visible the students' learning process and outcomes to themselves, their peers, teachers and parents. Both schools made use of iLAP in the first two years, with School A making more sophisticated uses to facilitate student interactions. In year 3, e-learning use in A escalated, but stalled in B. The school-based provisions for e-learning also differed. School A invested in more class sets of tablets, ensured that teachers were trained to use iLAP and the tablets, as well as provided training to students on Chinese character input to ensure that they could use their home computers to work on the e-learning tasks on iLAP. In School B, the lack of ICT infrastructure was given a reason to scale down SDLS implementation in Year 3, and students' inability to do Chinese character input on computers was mentioned by teachers as a hurdle to implement e-learning in the school.

Discussions

In this paper, we have analyzed the differences in the architecture for learning between the two schools in their implementation of SDLS. The DBIN level support were the same for both schools. However, school A had a rich and multi-thronged organizational and leadership structure as well as interaction mechanisms and environment that allow them to take full advantage of the learning opportunities made available at the network level, which at the same time fostered a strong collaboration and peer learning culture within the school. School B also provided the same tangible resources to support the innovation, but did not demonstrate an awareness of the importance of supporting within and cross-school learning in the implementation process. In changing the project leader and staff in the third year, the school has in fact undermined the human and social capital (Hargreaves & Fullan, 2012) that had begun to build up through the project. It is taken for granted that the design principles underpinning the student level learning design need to be made explicit to teachers so that they can be intentional collaboration partners in DBR. We propose here that in DBIR, there is a need for us to also make explicit the second layer of design principles for our collaboration partners, which should also be a focus for the university-school partnership.

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