Learning to create Technological Pedagogical Content Knowledge through distributed leadership: A Case Study of a Singapore Future School

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Abstract: This case study analyzed the forms of distributed leaderships practice in a future school in Singapore. From the technological Pedagogical Content Knowledge (TPACK) framework, the study attests that the various levels of leadership in the school are focused on different aspect of the TPACK and the collective effort in engaging in school reform for future learning can be viewed from the TPACK perspective.

1. Introduction

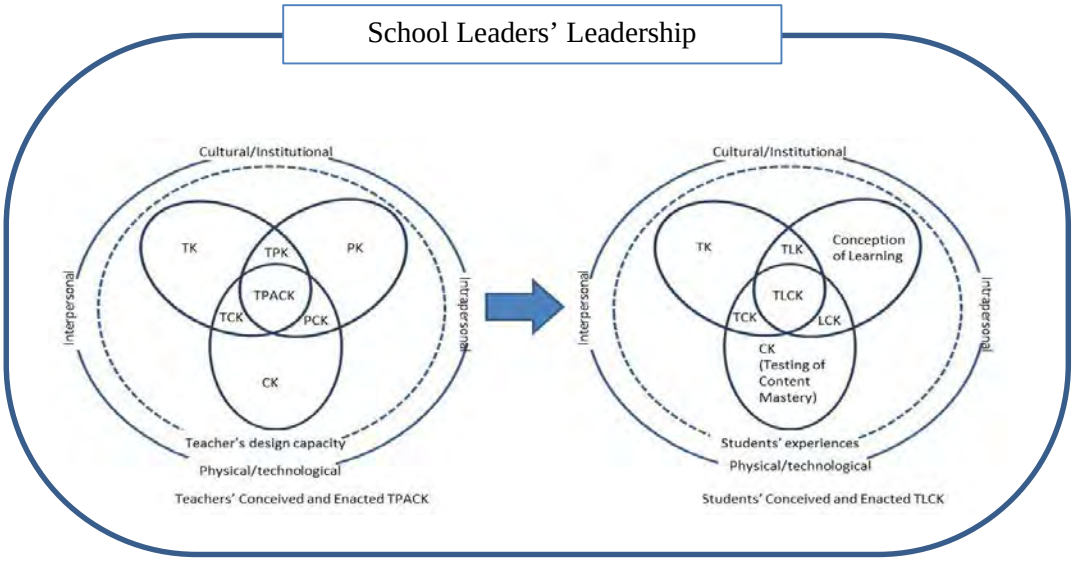
Current development of Technological Pedagogical Content Knowledge (TPACK) research has documented a variety of methods of developing preservice and inservice teachers' TPACK (Kramarski & Michalsky, 2010). Most intervention studies that engage teachers and educators in collaborative designing of TPACK report positive outcomes (see Chai, Koh & Tsai, 2013). While substantial research has been carried out under the framework of TPACK among teachers, Chai, Koh, Lim and Tsai (2014) have pointed out the possibility of extending the TPACK research to school leaders. They argue that teachers' creation of TPACK is enabled through or constrained by higher level instructional decisions made by school leaders. These decisions include the technological environment the school leaders envisage, the pedagogical directions they set and the content areas for lesson design. These decisions shape subsequent TPACK creation among teachers and consequently students learning experiences. How school leaders enact their leadership and thus form the technological pedagogical content environment has however not been research empirically. In addition, Figure 1 below (adapted from Chai et al., 2013) depicts the possible design space where school leaders have to exercise their leadership to create the conditions and directions for TPACK to emerge.

2. Method

The study adopts a case study design in its approach to answer the research question. The research questions addressed in this study is how do school leaders enact their leadership as viewed from a TPACK perspective? The case school is a future school that has devoted itself in several pedagogical initiatives including the building of MyCLOUD (Wong, Chai, Zhang & King, in press) for Chinese language learning; the Idea Garden (Tsai, Chai & Hoe, 2014) to facilitate knowledge creation among student communities for social studies and MyDesk (Tan, 2013) for seamless science learning. The principal, vice-principal, head of department (HOD) for Information and Communication Technologies (ICT), and the social studies subject coordinator from a future school (primary) were interviewed for this study in the context of innovating the social studies through Idea Garden. In addition, records of meeting from 2013-2014 was collected. The data was analyzed using figure 1 as a guide. The data coded situate

the loci of instructional decisions and actions that the school leaders have been devoting their energy for the past two years. The themes formulated below were sent to the participants for members checking to ensure that the researchers have represented their views fairly.

Figure 1: TPACK Design Space for School Leaders



3. Findings

With regards to the leadership practice, distributed leadership emerged naturally as the school leaders were engaged in actualizing the future school effort. The different roles undertaken by the leaders are shaped by institutional norms. The principal assumed leadership in contextualizing school directions towards cultivating 21st century competencies and ensuring learning of good foundational disciplinary-based knowledge. Based on that, he also enabled staff by structuring professional developments activities and sourcing for additional funding. His role is therefore more on interfacing with the external environment and people. The principal articulated his work as follow:

> At the beginning of the future school projects, my role is to lead my key personals, including the vice principals and the HODs (head of department) to contextualize the MOE (ministry of education) 21st century competencies framework for our school. This involves looking at what we have in terms of technology capacity, manpower capital and the students' general learning and family profiles. We went through rounds of intensive discussion and we agree to focus on values and key 21 competencies students need to have without compromising the foundational knowledge. Then we operationalize the framework and put up a proposal to obtain research and development fund for the school. I am also the person to source for potential collaborators from the IHL (institute of higher learning) to provide TPACK training for the KPs (key personals) and later the whole school. I set up collaborations with international researchers, industry partners and researchers from local university to bring in the necessary expertise to work with our teachers.

With the strategic directions set, the vice principal supported the school transformation by working with technology service providers, looking into the infrastructure of the school and ensuring that financial procedures are adhered to. For example, he drafted the documents to call for interested vendors to bid for the services and he reviewed the specification for learning analytics needed for Idea Garden. The vice principal's is therefore more focused on laying the necessary technological conditions within the school context. He acquired his technological expertise at the infrastructure level through his experience of working as education technology officer in the ministry of education. As for the HOD for ICT, he described his roles as ensuring alignment of school goals with the efforts devoted to ICT integration. He understands his work as guiding curriculum redesign and integrating the efforts for the various subject matters and providing support for the professional development activities. In his words,

> I see the need to take a step back and view KB and other projects from the system's perspective and see how, these projects collectively can enhance the learning experience of the student. The experience with KB reaffirms again the potential ICT has being integrated with the curriculum. Working closely with the co-PI and his team of researchers, project drivers, teachers, curriculum developers and even allied educators provide multiple insights to redesigning the existing curriculum and executing it in lessons. Research serves as an affirmation to delivering the planned redesigned curriculum. Anchored by a sound pedagogy with meaningful integration of the Idea Garden platform, we are experiencing first hand a new way of learning in our students, one that is important for the 21st century.
>
> The PD plan looks into the teacher's capacity building in three areas i.e. curriculum, pedagogy and technical aspects. In delivering the PD to the teachers, we work closely with Prof C and the curriculum developer and the ICT support staff team.

For the subject coordinator, Mr E, his main role is to ensure that the ministry curriculum goals are not compromised. He views his inputs and leadership for the project as follow:

> In creating new practices and procedures in my teaching, there is a rather drastic shift towards student-centered learning as part of 21CC skills. It takes a lot of getting used to especially relinquishing control of the students' everyday learning. A KB teacher is no longer a 'vessel' of knowledge to the students and requires a unique skills set of classroom management in order to have a successful KB classroom. In every lesson, the students are required to use various KB principles in their research and discussions.

In summary, he is responsible in ensuring adherence to the syllabus and at the same time creating the new practices needed for the new technologically supported pedagogy. He is also consolidating his experiences to pass on to his colleagues for future professional development "to equip teachers before they embark in KB".

4. Discussion

From the perspective of TPACK, the school leaders each occupy mainly a sub-domain of the TPACK factors. The principal established the general pedagogical push towards 21st century learning while the vice principals work mainly on the technological dimension in providing the necessary infrastructure. Building on the pedagogical direction sets the directions for reform. The ICT HOD works are situated in

the sphere of technological pedagogical dimension while the expertise of the subject coordinator lies in content knowledge and pedagogical content knowledge. The distributed expertise was brought to bear on collectively on the creation of the platform and pedagogical practices encapsulated in the form of lesson plans and materials, and also professional development materials for scaling up purposes. The creation of platform, practices and materials can be viewed as knowledge creation efforts in the school context. This becomes the main form of professional development for the teachers to draw upon their existing knowledge and ideas and refine them in collaborative discussion. In other words, the learning processes is in essence a knowledge creation processes (Chai et al., 2014).

School improvement and transformation is complex in nature, especially given the rapid advancement of technology. Multiple levels of leadership have to work synergistically in a coordinated manner. Heck and Hallinger (2014) termed this as "leadership for learning", which encompasses both instructional leadership and transformational leadership. While the principals in this case study are providing transformative leadership and developing knowledge for the technology and pedagogical dimensions, the HOD and subject head are working on instructional leadership in the technological pedagogical dimensions and the pedagogical content knowledge dimension.

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