# Advancing understanding using Nonaka's model of knowledge creation and problem-based learning

Meng Yew Tee, Shuh Shing Lee
Faculty of Education, University of Malaya,Malaysia
{mytee22, lshuhshing}@yahoo.com

**Abstract:** Nonaka's model of knowledge creation can provide guidance in designing learning environments and experiences. However, Bereiter is critical of the model because it does not address whether understanding is deepened in the process of socialization, externalization, combination and internalization. To address this issue of understanding, this study proposed a framework that synthesizes the basic phases of problem-based learning with Nonaka's model. This design-based study investigated if a course designed based of this synthesized framework can help stimulate knowledge creation that is based on deepening understanding. Based on analysis of multiple data sources, the findings suggest that the participants demonstrated advancing understanding amidst knowledge creating conditions and processes consistent with Nonaka's model and the problem-based learning approach.

## Framing of this study

Studies (Tee & Karney, 2010; Tee & Lee, 2011) suggest that Nonaka's model of knowledge creation (Nonaka, Toyama & Byosiere, 2001) can provide some guidance in designing learning activities that can facilitate knowledge creation. However, Bereiter (2002, p.158-168) was critical of Nonaka's model of knowledge creation. He argued that one of the key weaknesses of Nonaka's model is that it offers "nothing about understanding and depth of understanding" (p.161). This is crucial, Bereiter argued, because fundamental understanding is what differentiates from blind luck or serendipitous imitation. He argued that understanding is the crux of expert knowing, and a model that does not explicitly address the issue of understanding is fundamentally flawed.

In an attempt to address this issue of understanding, the basic phases of PBL, or problem-based learning, (Bransford & Stein, 2002; Hmelo-Silver, 2004) are built onto the two layers of *ba* and SECI. According to Hmelo-Silver (2004), the basic premise of PBL is to situate learning in inquiry-based, collaborative, iterative, reflective and self-directed problem-solving contexts. This creates opportunities for learners to focus on an authentic and complex problem and then seek ways to critically evaluate, choose and use emerging knowledge to address the problem. This, in essence, should lay the foundation for deeper understanding. In this regard, this paper reports on a study attempting to understand better how Nonaka's model can be used to stimulate knowledge creation, and, if and how deeper understanding is cultivated. With Nonaka's model as a backdrop to stimulate knowledge-creating conditions and processes, problem-based learning is used as the basic approach to drive at understanding (Hmelo-Silver, 2004). The knowledge-base in the context of this study is technology, pedagogy and content knowledge, or TPACK (Mishra & Koehler, 2006), a framework built based on Shulman's (1986) seminal work on pedagogical content knowledge. In essence, a teacher who has cultivated advanced TPACK will exhibit a nuanced capability to critically choose or even design and configure, learn, and apply the technologies that will best meet the teaching and learning needs within their context.

This research was conducted using the design-based research process. Three types of data were collected, namely: reflections, student-created artifacts, and online discussions. In this study, credibility was addressed with four techniques—triangulation, prolonged engagement, persistent observation, and referential adequacy. The data were coded based on the Nonaka framework and indicators of understandings that emerged from the PBL process. Coding was done by two coders, independently in the first round and collaboratively in the second until consensus was reached.

## Advancing understanding by design

The students of this course comprised of 18 in-service teachers, with their ages ranging from mid-20s to early 40s. They taught different subjects at elementary, secondary and tertiary levels. For reporting and discussion purposes, the focus will be on Group A which consisted of three in-service teachers: A1, A2, and A3 who teach language arts (Chinese) in high school. A1 has been teaching for 16 years, with minimal use of technology. A2 has been teaching for 14 years, and has been exploring different technologies with limited success. A3 has been teaching for 20 years, and has never really used technology to enhance learning. The problem they chose to focus on: their students' struggle in writing essays in Chinese, a second language for most of their students. The environment (which is known as *ba* in Nonaka's model) was created to enable conditions of autonomy, fluctuation and creative chaos, redundancy, requisite variety, and trust and commitment (due to limited space, this data is discussed in a separate paper). The following table presents the main data and findings:

Table 1: Salient data in relation to problem-based learning, SECI and *ba*

| PBL | SECI | Highlight of salient data | Analysis |
|---|---|---|---|
| **I**: Identifying problem<br>**D**: Defining problem | S | (**#1**) A2: I do not know where to start because too many challenges and problems in Chinese language teaching. Same problems (are) always discuss(ed) among us (Chinese Language teachers) and no solution(s)…we really feel helpless and powerless. | In identifying and defining a problem, the *socialization* process allowed for sharing of feelings and *externalization* of issues (**#1**). This is followed by *internalization* characterized by action (**#2**) and reflection (**#2, #3**). A systematic evaluation of 33 student essays led to more advanced understanding of the problem (combination, **#4**). |
| | E | (**#2**) A1: These three weeks, I try power point to teach students…I thought I am using technology. But I realize that the teacher like me are still repeating the same way of teach(ing)….just (that) the teaching material change from picture to computer... | |
| | C | (**#3**) A3: I always think I know the problem of my students … but now I start thinking, am I (part of the problem too)? … I always believed that I (have) enough experience in teaching… (but) the more I learn, the more I am afraid my personal ego has mislead me… | |
| | I | (**#4**) A2: Findings show that 90.61% of the error comes from vocabulary error (46% from typo [the Chinese character is written wrongly or is incomplete], 31% from misuse of words [e.g. wrong character but the right sound] and 13% from missing words [e.g. just didn't know how to write the character]). | |
| **E**: Exploring solutions<br>**A**: Act on solutions | E | About the first solution:<br>(**#5**) A2: … I seldom refer to other information as a guide…I just do it with instinct. I always refer to my own experience while using technology in T& L | Articulating awareness of unmethodical bases for decision-making (**#5**). In designing the second activity, the teachers engaged in a more deliberate or methodical combination and internalization process (**#6**). The group utilized evidence (**#4**) and research-based practice to re-synthesize and design their solutions (**#6**). |
| | C | About the second solution:<br>(**#6**) A2 :Before I know about TPCK-GPM, I just "design" my lesson by instinct. …. GPM (giving-prompting-making - terms derived from Hammond and Manfra, 2009) open my mind by given some suggestion about activities so that I can make my lesson more diverse (in nature). For example, the second activity our group propose ~ Idioms online games, at first we thought that GPM model only can be use in one way (in one sequential order)… but (there)after I know it can be used in other way(s)…I'll surely suggest that we follow the sequence M-P-G-M…. Let students play the idioms online games first without teaching. After playing the games a few times at home, if they still can't get the correct answer for some questions, then only teacher prompt them by giving them some tips or direct them to get the correct answer through Facebook. Lastly, teacher teaches the meaning of each idiom in class and the students make sentences with the idioms in groups. … M-P-G-M model more on training students self-(directed) learning, they will participate and become active in learning process, not just accept passively. | |
| | I | | |

## Conclusion

The findings of this study suggest that a problem-based learning approach designed together with a conducive *ba* to stimulate socialization, externalization, combination and internalization can help teachers deepen their understanding in context of TPACK. They started with simplistic views of how technology itself can transform learning, but over time, began to demonstrate progressing knowledge and understanding of using pedagogical methods and technologies in ways that give the students the best opportunities to achieve the intended learning outcomes. Further studies need to be done to further explicate this synthesized framework.

## References


Bransford, J.D., & Stein, B.S. (2002). *Ideal problem solver* (2nd ed.). New York: W.H Freeman and Company.

Bereiter, C. (2002). *Education and mind in the knowledge age*. Mahwah, NJ: Lawrence Erlbaum Associates

Hmelo-Silver, C. (2004). Problem-based learning: What and how do students learn. *Educational Psychology Review, 16*(3), 235-266.

Mishra, P., & Koehler, M.J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.

Nonaka, I., Toyama, R., & Byosiere, P. (2001). A theory of organizational knowledge creation: Understanding the dynamic process of creating knowledge. In Dierkes, Antal, Child & Nonaka (Eds.), *Handbook of Organizational Learning and Knowledge* (pp. 491-517). Oxford: Oxford University Press.

Shulman, L.S. (1986). Those who understand: Knowledge growth in teaching. *Educ. Researcher, 15*(2), 4–14.

Tee, M.Y., & Karney, D. (2010). Sharing and cultivating tacit knowledge in an online learning environment. *International Journal of Computer-Supported Collaborative Learning (ijCSCL), 5*(4), 385-413

Tee, M. Y. & Lee, S.S. (2011). From socialisation to internalisation: Cultivating technological pedagogical content knowledge through problem-based learning. *Australasian Journal of Educ. Tech, 27*(1), 89-104