

## **Teacher Development Through the Metaphorical Construct of Knowledge Creation**

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### **Abstract**

Metaphors are powerful influencers on how we conceive the world. In cognitive linguistics a conceptual metaphor crosses domains. This occurs when our understanding of an idea rooted in one domain can be applied to another domain to enrich our understanding of the latter. Recently, curricula are setting goals aimed at critical thinking skills and new courses that will lead not to a traditional knowledge transmission approach, but toward a knowledge creation one. The purpose of this study was to determine whether an organizational framework by Nonaka and Takeuchi (1995), considered to be an impressive knowledge creation model developed for the business world, could shed useful insights into the domain of education for the purposes of conceptualizing the role of knowledge creation in education. In the study, first an examination of Nonaka and Takeuchi's business model rooted in Japanese philosophy was carried out. The thrust of their model is to recognize the significance of tacit knowledge as a valuable resource existing within the individual company-worker and how to convert it to collective explicit knowledge leading to innovation and knowledge creation. In their framework, they impart four modes that represent the processes to make the conversion possible: socialization, externalization, combination and internalization (SECI). These modes are all relative to concepts of learning in the domain of education. A well-regarded approach in education known as knowledge building theory was brought into the study, to show how the processes of knowledge creation through the SECI model could be applicable to the domain of education. However, asking teachers to adopt a knowledge building pedagogy with the goal of idea innovation and knowledge creation is a contradiction to traditional teaching knowledge transmission approaches. Therefore, teacher development is required. The study offers two models that are applicable to teacher development in helping teachers meet curricula that are focused on knowledge creation.

**Key words:** curriculum, knowledge building, knowledge creation, explicit knowledge, metaphor, tacit knowledge, teacher development

### **The metaphor of knowledge creation**

Lakoff and Johnson's (1980) seminal study in *Metaphors We Live By* pointed out that our use of metaphors are windows into our minds that offer rich insights into how we conceptualize the world around us. A is not B, but A and B share similarities. This formula of connecting two different domains shows how metaphors are formed. For example, the famous Japanese baseball player Hideki Matsui was called Godzilla when he played in the USA. Of course, Matsui is not Godzilla, but they both share similar traits: strong, big, powerful and Japanese. Using characteristics of a fictional film character and imposing them on a real human provided richer conceptualizations, which allowed the public to better be informed of the qualities of the latter. In the same way, the metaphor of knowledge creation formed in the business world can offer richer insights into the world of education.

Paavola and Hakkarainen (2005) divided the learning process into three metaphorical descriptions. First, *acquisition*, which is formed by the theory that individuals are seen as containers of knowledge, in which learning is an implantation of information either enhanced by innate learning abilities or environmental factors that are cognitively constructed by the individual learner. The *participation* metaphor is built on the view that learning occurs through interactions with the outside world, one's culture, community and so on. Paavola and Hakkarainen argue that although these two metaphors are different in that one focuses on the individual and the other the social nature of learning, they both share a similarity. Their overall aim is to have the learner achieve mastery of knowledge whether it is learning the input transmitted to the learner or the artefacts produced by culture and community. On the other hand, the *knowledge* creation metaphor offers a third way. It goes from mastery (i.e., the learner's achievement of knowledge transfer) to advancing or constructing new knowledge:

The basic division is as follows: the acquisition view represents a “monological” view on human cognition and activity, where important things are seen to happen within the human mind, whereas the participation view represents a “dialogical” view where the interaction with the culture and other people, [sic] but also with the surrounding (material) environment is emphasized.

The knowledge-creation view represents a “triological” approach because the emphasis is not only on individuals or on community, but on the way people collaboratively develop mediating artifacts (Paavola & Hakkarainen p.539).

The third way conceptualized in the metaphor of knowledge creation allows for a reconceptualization of the learning process and its outcomes. People cooperate and interact not only to acquire or process knowledge, but to advance it. In this paper, the third way aimed at knowledge creation is studied. The paper attempts to show a direct relationship between the processes of an organizational knowledge creation framework depicting how workers and managers in the industrial world of corporations work together to become innovative and how it can be applied to school curricula as an organizational framework in the of domain of education.

The research questions are as follows:

- What are the processes of knowledge creation depicted in an organizational model used in industry for purposes of innovation?
- In what ways, can the processes of a knowledge creation framework designed for innovation in industry, be applied to school curricula and teacher development?

The first question explores the processes of a knowledge creation organizational framework, a model based on the work culture found in Japanese industry, designed by Nonaka and Takeuchi (1995). The model was selected in this study because of its prominence in work on knowledge creation (Hargreaves, 1999). The second question looks at how attributes of the organizational framework designed for innovation in industry have direct relevance to the field of education.

### **Nonaka and Takeuchi knowledge creation framework**

The theme of Nonaka and Takeuchi’s book (1995) is encapsulated in its title: *The Knowledge creating company: How Japanese companies create the dynamics of innovation*. Their work looked at how knowledge is created and advanced within a company’s organizational framework. In their book, they offered several case study examples of Japanese companies, such as Honda, Matsushita, and Shiseido. Addressing their work represents a deliberate attempt in this study to draw on parallels between the concept of knowledge creation adhered to in the business world and its application in the field of education. First, I begin with a look at how they set up their framework as a Japanese concept by summarizing their discussions about organizational man-

agement theories, rooted in western tradition and philosophy. This will be followed by a discussion on how the Japanese philosophical approach to knowledge creation informed their framework.

In their formulation of the knowledge creation framework, Nonaka and Takeuchi first drew on philosophical distinctions by focusing on epistemological issues concerned with the Cartesian split and the debate that surrounds it. On the one side is the dualistic view of Descartes that mind and body, subject and object are separated. Following this view, contributions to knowledge or what we know can only develop with rational thinking (the non-material mind) by being objective. Objectivity or detachment from the object being studied occurs by applying deductive reasoning and reductive measures that would isolate oneself as the subject from tarnishing the outcomes. Taste is reflective of an embodied subjectivity. The non-material logical and objective mind is metaphorically detached from the subjective body or physical matter, which is sensory and subjective. On the other side is the empiricist view that knowledge grows out of physical sensory experiences (the body as matter). In this view, experience and perception shape how we perceive the world; knowledge therefore, emerges from inductive thinking. Ontologically, the objective view takes the position that there are universal truths and the subjective view is that truths are relative depending on the context. Although the two views are poles apart, Nonaka and Takeuchi argue for a third and more holistic approach.

Their model is built on traditional Japanese intellectual thought, which they believe bridges the gap between the mind and body debate. They offer a “Japanese approach to knowledge that integrates the teachings of Buddhism, Confucianism and major Western philosophical thoughts” (p.27). They take a holistic rather dualist view by positing the Japanese concepts of “oneness of humanity and nature...of body and mind ...and ...of self and other” (p.27). Of importance to their knowledge creation framework is “oneness of self and other”, which incorporates the other two sense making concepts of subjectivity and objectivity. In particular, they do not ignore the significant role of subjectivity and view it as existing with objectivity. They emphasize that in relation to others, Japanese sense making and conceptualizations develop out of collective interactions that are subjective and highly intuitive. For example, Japanese communicate and interact within a high context society using non-verbal cues, and are therefore not completely bounded by grammatical code. Because less emphasis on direct language means more openness to interpretation, one has to rely on tacit knowledge informed by intuition and context to decode ambiguity in interactions. Consequently, Nonaka and Takeuchi point out that the ambiguous nature of

the Japanese language brings oneness with others. The verb is not conjugated with the subject. Therefore, the audience can have sympathetic understanding with the perspective of the speaker because the 'I' can be avoided. "For the Japanese, you and I are two parts of a whole, two sides of the same coin" (p.31). By drawing on the collective nature of Japanese intellectual thought, a significant distinction is made in regard to their framework:

While Western societies promote the realization of the individual self as the goal of life, the Japanese ideal of life is to exist among others harmoniously as a collective self. For the Japanese, to work for others means to work for oneself. The natural tendency for the Japanese is to realize themselves in their relationships with others.

Nonaka and Takeuchi purposely looked at the Western philosophical traditions to point out that Cartesian dualism has historically shaped the way knowledge is treated in corporate management. They claim that organizational theorists erroneously tended to emphasize objectivity and individuality while underestimating the social role of knowledge building that recognizes the value of subjectivity and collectivity to create knowledge. In offering their third way, Nonaka and Takeuchi turned to Japanese philosophical thought rooted in tradition as an underpinning for the epistemological foundations of their knowledge building framework. This is done to show how Japanese companies have successfully approached knowledge creation in management practices. Next, their knowledge creation framework is addressed.

### **Processes of the knowledge creation framework**

In order to understand their model, Nonaka and Takeuchi made several distinctions of terms between information and knowledge, and information processing and innovation. The biggest difference is that information and information processing are passive concepts, whereas knowledge and innovation are about action. Although information and knowledge are about meaning and are relational to context, knowledge is conjoined with beliefs, which in turn are motivators for action. Knowledge is what we do with information. Information processing is also passive because it is externally driven and internally processed. On the other hand, new ideas are advanced from within companies to solve problems and adapt to new business climates. "They [companies] actually create new knowledge and information from the inside out" (Nonaka & Takeuchi, p.56).

Two other terms that are of utmost importance to their framework are tacit and explicit knowledge, the two dimensions of knowledge creation. These two terms are different in important ways. Polanyi (1958, 1966) coined the phrase tacit knowledge or tacit knowing as procedural knowledge that cannot be easily written down or verbalized. This is the subjective knowledge of experience (body). Because it cannot be codified, tacit knowledge is difficult to transfer to others. For example, knowledge of how to ride a bike, make bread and speak a language is often hard to explicitly transfer. In other words, the ‘how’ of procedural knowledge does not readily transfer to the ‘what’ of declarative knowledge. For example, possessing explicit grammatical knowledge (objective and rational) and knowing what the formal rules are (mind), does equate implicit knowing of how to use it, as evidenced with children in their native language (or learning a second or foreign language). The dichotomy is summed up astutely by Polanyi (1966), “We can know more than we can tell” (p.4). Nonaka and Takeuchi visualized explicit knowledge as the tip of an iceberg and tacit knowledge as the deep and hidden foundation of the iceberg. In their model, tacit knowledge is seen as a rich and untapped resource within company employees: The embodiment of knowledge enriched by experiences of doing their jobs that somehow must be recognized and converted to explicit knowledge and shared for the creation of new ideas.

#### Four modes of knowledge creation

The processes of converting tacit or implicit knowledge to explicit knowledge are found in Nonaka and Takeuchi’s organizational framework consisting of four modes, socialization, externalization, internalization and combination (SECI) as below:

Table1.

*Nonaka and Takeuchi’s Four modes of knowledge creation* (1995, p.62)

	Tacit Knowledge	To Explicit Knowledge
Tacit Knowledge	Socialization	Externalization
From		
Explicit Knowledge	Internalization	Combination

- *Socialization* is the core mode. Through sharing tacit knowledge with each

other in a collective environment within a community of practice (i.e., a workplace or classroom) implicit knowledge is revealed. Nonaka and Takeuchi provide an example. Matsushita Electrical Industrial Company set out to make an automatic high-quality bread making machine. The challenge was how to automatize the dough kneading process, which is reflective in the creative and tacit knowledge found in master bakers. Socialization was carried out in a community of practice environment as staff members of Matsushita voluntarily worked under a highly reputed master baker in Osaka.

- *Externalization* occurs when tacit knowledge is articulated. After spending time with the baker, his tacit knowledge was revealed one day when one of the Matsushita staff noticed he was not only stretching the dough but was also adding a twisting motion. Once the master baker could make known this knowledge, engineers were soon able to convert the tacit knowledge into explicit knowledge by retooling the machine to create a twisting movement.
- *Combination* represents the sharing of explicit knowledge as codified knowledge known by different members. For example, a management team comprised of managers from diverse backgrounds or fields who bring their professional explicit knowledge expertise into identifying problems and coming up with innovative solutions.
- *Internalization* reflects the iterative learning process in knowledge creation, and it develops out of the other three modes. One learns by doing. As new information is internalized, tacit knowledge is enriched and then nurtured by the other three modes to become explicit. In this way, knowledge creation becomes sustainable

Knowledge creation and the four modes in the above were designed to create innovation in the organizational systems of companies. The purpose was not to focus on worker productivity with the aim to master what they do, but to focus on how they can use their knowledge to innovate, to advance ideas within a shared community of practice. That is, to convert their tacit knowledge to explicit knowledge.

Concepts that underpin the knowledge creation framework are directly applicable to the field of education. The SECI model above should be of interest to educators because it is very much aligned with social cultural theory put forth by child developmental psychologist, Lev Vygotsky (1978). Learning is a social process (socialization). Children first learn concepts from interacting with the culture they are embedded (externalization). The tool to mediate this interaction is language. Knowledge then is internalized as language advances thought (internalization), which then is articulated

during social interaction. This ongoing reiterative external-internal-external learning process driven by social interaction leads to cognitive development and to the advancement of learning (combination). Therefore, like the organizational systems in companies that are designed for knowledge creation, schooling at all levels should be actively involved in the ‘business’ of knowledge creation. Similarly, tapping into the vital resources of the tacit knowledge of workers in a shared community of practice has equal value to recognizing the significance of engaging students’ tacit knowledge to enhance knowledge creation in the classroom. Next, the ways that the knowledge creation framework can inform education and teacher development are addressed.

### **Knowledge creation in schooling**

To meet the needs of a rapidly changing global market accelerated by digital technological advances, a workforce with high information processing skills has become the new model for competitive companies to replace traditional manufacturing enterprises (Castel, 2010). Tan and Tan (2014), who promote knowledge creation in Singaporean education, write, “In the twenty-first century, new ideas and innovative products are the new sources of economic growth, more significant than physical and tangible resources like minerals and land” (p.11). This has brought a change in economic-related workplaces from knowledge transition to knowledge creation. The shift presents a challenge to educational practices, which are still rooted in the industrial age. In too many classes, one finds a lecture style, teacher-centered, knowledge transfer approach in which information is transferred to the student, who is expected to recite back or provide the answers expected by teachers, showing he or she has efficiently and accurately understood the transmitted information. However, to develop knowledge creation skills among learners, educational goals in school curricula from primary, secondary and tertiary levels must go beyond mastering content. In an economic organizational knowledge creation model such as in Nonaka and Takeuchi, workers actively collaborate within a community of practice to focus on innovation for new products or solving problems. In schooling under a knowledge creation goal, the focus should be on involving students in an active learning processes that sharpen knowledge building skills, which include working in collaborative, problem solving tasks, finding solutions that lead to the improvement of ideas (Scardamalia & Bereiter, 2006).

### **Knowledge building pedagogy in knowledge creation**

The educational practice of knowledge creation can be realized in Scardamalia and

Bereiter's work on knowledge building, a concept they pioneered (2006), which has been highly recognized in the field of education (Tan & Tan, 2014). Through a knowledge building approach, the aim is to recreate educational practices within a coherent pedagogical model that initiates students into the knowledge creation process. They write, "One important advantage of knowledge building as an educational approach is that it provides a straightforward way to address the contemporary emphasis on knowledge creation and innovation" (p.99). In short, knowledge building occurs when school curricula emphasize knowledge creation as an overarching learning goal. In business, innovation leads to creating new products. In education the innovative key to knowledge building is idea improvement. Ideas are advanced through connectivity. Our brains function as self-organizing networks of interconnected ideas that accommodate new ideas, which contribute to the formation of larger more robust concepts. Scardamalia and Bereiter premise their knowledge building model on connectivity, "Explaining conceptual development, however, entails self-organization at the level of ideas—explaining how more complex ideas can emerge from interactions of simpler ideas and percepts" (p.110).

Principles that support knowledge building are similar with the SECI model of Nonaka and Takeuchi. For example, ideas are further advanced through socialization within in a community of practice (workers within a company; students in a classroom). The conversion of tacit knowledge to explicit knowledge is sought after and is motivated by providing a public space for which the iterative process of exchanging ideas and knowledge can flourish. In addition to the classroom, a knowledge forum network is highly suggested in Scardamalia and Bereiter's knowledge building approach. Through a shared network platform, students conceptualize a solution to a problem or improve on ideas by outlining their thoughts on a mind map framework. They also formulate their solutions, write their thoughts about them as they are designing them, and go back and revise what they have written. The revision aspect of the forum is strongly supported as it allows students to reconceptualize their ideas, which further inform their solutions.

An important aspect of the knowledge building pedagogy is to conceive of learners not by traditional metaphors as containers or passive receptors of knowledge in which teachers deposit information (Freire, 1972), but as active members of a knowledge building community. Scardamalia and Bereiter provide six themes of their knowledge building pedagogy that curriculum planners should consider for how to get students to actively take part in the knowledge creation process (p.99~111). The themes are summarized as follows:

• *Knowledge advancement as a community rather than individual achievement*

All too often according to Scardamalia and Bereiter, schooling intensely focuses on the education of the individual through knowledge transmission emulating the work of scholars that is measured in the achievement of test scores. In a transmission model of education, to think of the advancement of knowledge for the community is a mental state that does not exist. In contrast, a knowledge building approach holds the principle that students should not be rewarded for the information they hold in their minds, but what they can produce for society, which inevitably and individually enriches them.

• *Knowledge advancement as idea improvement*

The view that all interesting ideas are improvable. The process of improving ideas is a spiraling process that is reiterative and can be revisited in the school curricula at a later date. What children can know about electricity in elementary school can be reconceptualized and improved on in knowledge building activities in secondary and university schooling. Moreover, in the real world, contribution to knowledge is acknowledged by new ideas or improving on them, not by emulating or reproducing them, which is what schools often require and assess.

• *Knowledge 'of' in contrast to knowledge 'about'*

This theme of knowledge building depicts the dichotomy between procedural knowledge of something and declarative knowledge about something. Knowledge of something is a richer concept than knowledge about something. In the former case, one can put knowledge into action; in the latter, one can show they know about a topic as in taking a test without knowing how to use it. The heavy reliance on pedagogy aimed at test taking skills to prepare students to have knowledge about topics at the expense of developing knowledge of topics is the antithesis of knowledge building. Scardamalia and Bereiter (2006, p.107) draw a pedagogical distinction between the two areas of knowledge in the classroom. They write, "To be useful outside the limited areas in which knowledge about is sufficient, knowledge needs to be organized around problems rather than topics (Bereiter, 1992). Through problem solving, students build on knowledge through 'learning by doing' principle.

• *Discourse as collaborative problem solving rather than as argumentation*

The role of language as a tool for cognitive development and how we behave can

be seen in the concept of discourse. The sociolinguist Paul Gee wrote “Discourses are ways of being in the world; they are forms of life which integrate words, acts, values, beliefs, attitudes, and social identities as well as gestures, glances, body positions, and clothes” (p. 7). In schooling, forms of discourse are the main ways we conceptualize and communicate our ideas to others, in conversations, writing reports, making presentations and responding to questions. In debates for instance, Lakoff and Johnson’s (1980) conceptual metaphor of argument as war is relative. War represents a non-collaborative domain that is mapped on to the debate argument domain. For example, discourse would be more argumentative as the students are trying to win the argument: *I disagree with you, Your point is incorrect, You should agree with my point because...* . In the constructive nature of knowledge building, socialization skills are needed in collaborative learning problem solving activities. Students could be given cooperative discursal phrases while interacting with each other’s ideas, such as, *That’s right and. . . , Interesting, tell me more about that... OK, and how about..., my idea is a little different, I might be wrong, but..., It would help us, if we...*

- *Constructive use of authoritative information*

The content of school learning is heavily influenced by information that often comes from experts. Knowledge is transmitted to the learners in a top-down approach that expects learners to unquestionably accept and memorize content uncritically. However, in knowledge building, the authoritative texts should be introduced in ways that allow the learners to construct their own meanings of the text to enrich their understandings. Using collaborative problem-solving activities that have students try to apply the knowledge gained from authoritative texts would offer co-constructive opportunities for the learners to interact with the ideas presented to them, critically.

- *Understanding as an emergent*

The emergence of new ideas contributes to knowledge creation. Scardamalia and Bereiter’s concept of connectivity mentioned previously is that smaller ideas connect to larger ideas to form robust conceptualizations of knowledge. Vygotsky (1978) posited that learning itself is a social activity: language is a psychological tool that mediates an individual’s cognitive development through social interaction. Viewed in this manner, the individual’s conceptual growth occurs through the social exchange of ideas to create more complex ideas. An individual’s knowledge or tacit knowledge emerges through the socialization process and then internalized for richer implicit understandings. In regard to pedagogy, educators need to think in terms of connectivity,

to provide opportunities for students to exchange their ideas with others and through this dynamic process of interaction emerges the formation and understanding of more complex concepts.

The six themes of knowledge building pedagogy provide a bridge between the concept of knowledge creation from the business world and ways to implement it in the domain of education. The themes are all relative to contemporary social constructivist approaches in education and to the national curriculum goals of the Ministry of Education. Students are asked to develop critical thinking skills and create their own solutions from problem solving tasks. Classes in schools, including courses at universities, should be more socially interactive, requiring collaborative activities. In doing so, students are no longer given content to memorize or master, but to find ways to formulate the emergence of ideas by constructing their own meanings of the texts or materials they are engaged with. However, these approaches to teaching underpinned by social constructivism are in contrast to the heavily relied on traditional, transmission model of pedagogy supported by behaviorist principles of learning. Preparing teachers to make changes from one approach to another can be problematic, and the solution is in teacher development.

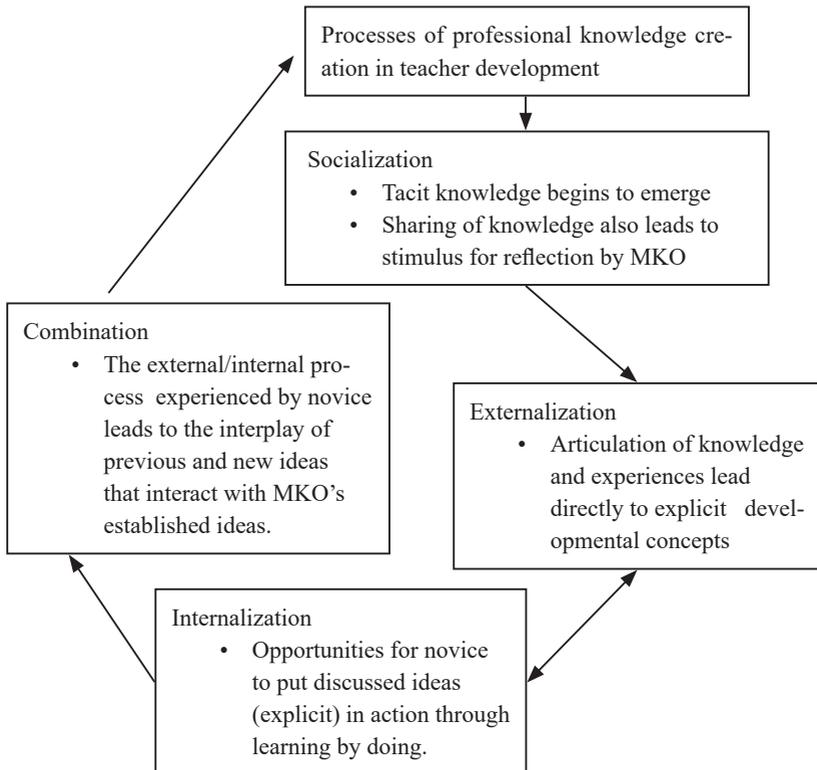
### **Knowledge creation and teacher development**

The knowledge creating concepts found in the work of Nonaka and Takeuchi were formed to meet the demands of rapidly changing workplaces. In this era of vast technological change, workers need skills that require them to be self-organizing, innovative and flexible (Castel, 2010). In schools, teachers as professional are faced with similar challenges and need the necessary skills themselves to adequately prepare their students when they enter the work world. Hargreaves argued (1999) that if school curricula aim at knowledge creation, then teachers must renew their approaches to teaching. In his call for the advancement of teacher development to enable “knowledge creating schools” (p.127), he directly linked organizational changes regarding innovation in the business world to education. He posited that both schools and industry, high technology firms, especially, have similar characteristics, which lead to the creation of professional knowledge because they are required to make rapid changes in a short amount of time. For example, the Ministry of Education makes policy changes to the national curriculum every ten years as well as ongoing incremental demands to meet the policy within that period.

Hargreaves cited Nonaka and Takeuchi’s work, which he believed “... is the most impressive model of knowledge creation” (p.127). He applied their SECI mod-

el aimed at converting tacit knowledge to explicit knowledge to teacher training at schools where a teacher with more experience, referred to by Vygotsky (1978) as a more knowledgeable other (MKO), uses her expertise and knowledge in the role of a mentor to guide the developmental process of the new teacher to eventually meet her potential. As a participant in the process, the MKO benefits as well. The following can be used to visualize how Hargreaves viewed the SECI model in teacher development: In the SECI model used in teacher development, the aim is knowledge creation and not knowledge transmission. In other words, the model avoids the traditional top-down, craft model of training, in which knowledge of the trainer as a master is transmitted to the trainee as an apprentice, who is expected to be a passive recipient and learn by

Figure 1.  
*Adaption of Hargreaves' view of the SECI model in teacher development*



watching. As cited in this paper, respective of declarative and procedural knowledge, what we can tell what we know is much less than what we actually know. Therefore, the knowledge creation model allows for the processes of knowledge creation within the experienced teachers in the role of supervision to tap into their tacit knowledge, creating a sort of percolation of robust ideas that are converted to find their way to surface and become explicit to novices. This process not only benefits the novice, but the MKO mentor as well as the conversion process also stimulates mentors to reflect on their teaching, which leads to teacher growth. Importantly, the knowledge creation process is initiated by socialization, which underpins the conversion of implicit knowledge to explicit knowledge. Through the iterative process of sharing ideas, knowledge is enhanced through a combination of ideas that are constructed from both novice and MKO (Takegami, 2020). It is especially significant that similar to the principles and aims of knowledge building pedagogy, novices are not seen as passive participants, but as active co-constructors of their own teacher development.

### Discussion

The overall aims of this study were two-fold. First, the study set out to reintroduce the ideas found in Nonaka and Takeuchi's SECI model for knowledge creation. In the business world "what is the bottom line?" is a popular metaphorical phrase. The phrase comes from accounting and the last figure on a ledger shows either the amount of profit or loss. The phrase has come to mean the ultimate result that can affect the survival of a company. In the 21<sup>st</sup> century, because of factors such as globalization and the increasing amount digital technology, the 'bottom line' for companies is to be innovative, to either keep up or stay ahead of competition. Thus, in this study the SECI model was used because it reflected a serious bottom line backed by experience and professional knowledge in industry to address the processes of knowledge creation. Further interest in the model came about because the four powerful and interrelated forces, socialization, externalization, combination and internalization are brought together for innovation. The major thrust of the model is to convert the rich, untapped resource of workers' tacit knowledge into explicit knowledge. The benefits of this conversion can be metaphorically visualized in Japan, where there is an abundance of mineral-rich water flowing and percolating beneath the land. When this resource is discovered and brought to the surface, hot springs emerge, resulting in many benefits for both business and pleasure.

Nonaka and Takeuchi's organizational framework may be especially applicable to Japan because it was based on the Japanese work culture, which is collaborative,

community oriented and holds rewarding Confucian values, such as diligence, loyalty and public mindedness. However, their model is also appealing because it is a break from certain traditional Confucian values of social top-down hierarchy. The recognition and respect of the employees' tacit knowledge and the role it plays in innovation is an example of a horizontal approach to management. The import of creating a caring environment to nurture knowledge creation can be found in a follow-up book by von Krogh, Ichijo, and Nonaka (2000). They mention that in the first book of Nonaka and Takeuchi, the phrase 'knowledge management' is used. They argue that 'manage' implies something that needs to be controlled, i.e. managed. The control over workers by management stifles creativity. In their book, they continue to improve on knowledge creation model by replacing managing with enabling. They emphasize the concept of *ba*, meaning allowing the workers a creative space whether it is mental or physical to allow for the process of converting tacit knowledge to emerge, leading to innovation. The idea of allowing a space for creativity for students as opposed to traditional teacher-centered instruction was stated above as well in knowledge building pedagogy. In addition, *ba* is also applicable to creating space for new approaches in teacher development to meet new curriculum demands, such workshops for faculty development.

In this paper, it was stated that ideas are advanced through connectivity. The motive for this study was to respond to the research inquiry of drawing connections to the ways processes of a knowledge creation framework designed for innovation in industry can be applied to school curricula, pedagogy, and teacher development. Educators should immediately be able to see that the robust concepts found in the knowledge creation framework are directly related to the field of education. First of all, the organizational framework discussed in this paper is like a visual mapping of the knowledge creating process in industry grounded in philosophical theories, methods and techniques that are set in motion to be innovative to foresee the demands of a rapidly changing market and needs of customers. Likewise, a school curriculum is an organizational framework, a road map or guideline, grounded in theoretical, epistemological and technical concerns to adequately prepare students with the necessary skills to be active and creative in the work force. In school curricula, innovative policies are formed, expected goals are set, courses are selected, subjects are labelled and detailed in a manner that coheres with the overall aims of a curriculum. These curricula areas embody, explicitly, what should be taught, but are implicit in how they should be taught. In other words, a curriculum is written and unwritten. The former is a formal document and the latter hidden. The hidden aspect of the curriculum can be

noted in how teachers interpret the level of implementation of the expected criteria; in their tacit knowledge of what can be carried out in practice. Therefore, if curriculum planners expect successful implementation of innovative policies, teacher preparation is needed. In short, they must first recognize the importance of teachers' tacit knowledge as a valuable resource and this must be addressed with teacher development.

Adequate teacher development is needed to prepare teachers for the necessary skills to teach knowledge creation in schooling. In my own experience of having more than 30 years of teaching experience working on curricula in secondary schooling, and now at the tertiary level, I have found that the 'how' of teaching cannot be overlooked. New innovations created in curricula need appropriate teaching approaches to carry them out. Nonaka and Takeuchi's framework as shown in this study apply learning concepts that are applicable to contemporary theories and methods in education that reflect the trends of policies that emerge from the Ministry of Education. At the national level and in boards of education there are calls for active learning approaches and the development of critical thinking skills involving students in problem solving activities. These goals are found in knowledge building pedagogy aimed not at mastery of skills, but at idea innovation. However, the challenge will be to overcome a heavily reliance on approaches to teaching and learning that emphasize 'active' teacher centered, lecture type instruction and on the other end are students as 'passive' recipients of the knowledge being transmitted. This environment puts limitations on knowledge creation or building.

In the following, I designed an original model underpinned by Nonaka and Takeuchi's notion to convert tacit knowledge to explicit knowledge and the principles found in the knowledge building pedagogy. The aim of the model is to inform teacher development.

Table 2.

*Theory to practice model for knowledge creation and building for teacher development*

<b>Learning theory</b>	<b>In Principle</b>	<b>In practice</b>
Social Cultural Theory (Vygotsky)	Language has a dual function as a tool for communication and for cognitive development.	Learning occurs through social interaction that triggers the external-internal developmental processes .
<b>Teaching approach</b>	<b>In Principle</b>	<b>In practice</b>
Social Constructivism	Educational approach founded on Vygotsky's work that learning is social.	Classroom is a community of practice where students engage in student-centered activities promoting the external-internal developmental process through exchanging ideas.
<b>Teaching method</b>	<b>In Principle</b>	<b>In practice</b>
Collaborative Learning	Distinct from individual learning, collaborating students can profit from sharing information and knowledge.	Problem solving interactive group activities, which have a shared common goal to provide opportunities for learners to cooperate and not compete with each other.
<b>Teaching techniques</b>	<b>In Principle</b>	<b>In practice</b>
Co-operative learning	Development of team building skills in which learners are accountable to each other.	Students are given tasks that require different roles and responsibilities of students on a team to perform.
<b>Subject content examples: EFL course</b>	<b>In Principle</b>	<b>In practice</b>
Vertical Farming	Innovative future concept	Plan a vertical farm structure and think about production, design, cost, and limitations. Negotiate solutions and find common ground. Then present your ideas.
Waste and Recycling	Authentic problem that needs innovative ideas	Plan how to reduce waste, what do with the rest of waste, how to motivate the community to follow your plan and think about design, cost, limitations. Negotiate solutions and find common ground. Present your ideas.

The above illustrates a cohering model from theory to practice, firstly, supported by social cultural theory as mentioned, originated by the work of Lev Vygotsky, a Russian child developmental psychologist (whose ideas were repressed during Stalinist Russia and since emerged in 1978). A major contribution to the classroom is that learning emerges through interaction with the community or one's culture and is socially mediated through language, which operates as a psychological tool for purposes of a dual role of expressing and cognitively developing one's thoughts. Social constructivism is the realization of social cultural theory in the field of education. Both collaborative learning and cooperative learning cohere with principles of social cultural theory and social constructivism, bringing them closer to the classroom. Finally, two activities are presented from an EFL class as coherent examples of knowledge creation and building activities. The model offers possibilities for ways to incorporate the SECI model for the conversion of tacit knowledge that students bring with them in a learning environment to become explicit for idea improvement. In this way, Nonaka and Takeuchi's organizational framework has informed teacher development as way to visualize knowledge building and meet the future demands and courses of school curricula.

### **Conclusion**

This study acknowledged the power of metaphor to form conceptualizations that help to better inform our knowledge. Metaphors cross one domain with another, which lead to more robust insights or ways of thinking. In a sense, conceptual metaphors lead to reconceptualizations that help us to see things differently. Mapping the knowledge creation framework used in the business world on to the domain of education to reconceptualize areas of education was the motivation for this study. The purpose was to make the case for educational planners to reconceptualize curricula aims that go beyond knowledge transmission or mastery of subject content to the goals of knowledge creation and idea innovation.

First, the knowledge creation framework of Nonaka and Takeuchi was used to draw parallels to education. Principles of their framework are rooted in Japanese philosophy of oneness with others. They bring this collective value into their model. Company employees are not minimized as individual skilled workers who keep their heads down and do their job. Instead, they are metaphorically looked at as a collective resource with rich, percolating tacit knowledge hidden within, and if brought to the surface for conversion will lead to valuable explicit knowledge leading to innovation and company gain. The SECI modes they use bring together principles found in

learning. Socialization creates a collective climate conducive to sharing knowledge that leads to the bubbling up of ideas to the surface and made public. The social component creates an atmosphere for implicit knowledge to be converted to explicit knowledge. The process is furthered by the company staff at all levels combining their explicit professional knowledge. The outcomes of the model result in the formation of a work culture that leads to idea innovation and knowledge creation.

The premise of this study was to show that idea innovation and knowledge creation should also be the role of education. Knowledge building pedagogy was shown as a means to map a conceptual framework used in the business community onto the domain of education. In Scardamalia and Bereiter's knowledge building approach, the aim was knowledge creation and idea innovation and not knowledge transmission. They argued that at best a knowledge transmission approach gets students to master or achieve the knowledge they were taught, but does not go beyond to knowledge creation. Like Nonaka and Takeuchi, their approach was to recognize students' tacit knowledge as a valuable resource that needs to be explicitly converted through providing opportunities to engage them in content with a pedagogy aimed at going beyond understanding to idea improvement. In the latter case, knowledge building is in harmony with the educational aims of the Ministry of Education. They both aim at the development of critical thinking skills and potential for idea innovation through a collective environment of team cooperation and deeper reflection on topics through problem solving activities. Learners work together in student centered classes, sharing ideas with each other, generating new ideas and then presenting them. Knowledge building pedagogy enables a 'learning by doing' community of learning atmosphere. Moreover, the teacher is metaphorically seen as an enabler and not a classroom manager to control the environment, which can suppress the atmosphere for knowledge building.

However, as pointed out in this paper, knowledge building pedagogy is in contrast to traditional teacher-centered teaching approaches that are deeply engaged in knowledge transmission. An outcome of this study was that if curricula planners want to incorporate further courses aimed at knowledge creation, then they must consider that teachers have to change their teaching approaches to be more reflective of knowledge building. Two teacher developmental models were presented in this study. First, a teacher development model in practice at school sites (see Figure 1.) directly applied the SECI framework. Next, a broader theory to practice model for general teacher development to introduce important explicit and contemporary professional knowledge for teacher training at university or board of education seminars was given (Table 2.).

Finally, in this 21<sup>st</sup> century, the future is quickly advancing toward us. It will come at a rapid and dynamic pace, and it will mean everchanging challenges for schooling. In this information age, companies are already reconceptualizing organizational systems that enable their workers to be idea innovators. Accordingly, and in metaphorical terms, formal education, which begins with schooling, is the fertile domain where the seeds of knowledge creation should be planted and nurtured. Therefore, the systems of the two domains in business and in education, respectively are linked, and rich conceptualizations can be formed by learning from each other.

“The locus of metaphor is not in language at all, but in the way we conceptualize one mental domain in terms of another”—George Lakoff (1993)

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