Understanding teacher learning in professional learning networks (PLNs): The emergence of lived learning experiences

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Abstract

This paper reveals the nature of teachers' professional learning in online professional learning networks (PLNs) by narrating both my learning experiences and my understanding of the acquired theories (e.g., Gnosis, Episteme, Enactivism and Complexity Theory) from a seminar. The seminar made my learning experience the moments of wondering, discovering, struggling, and transforming, thereby resulting in my knowing about the acquired theories. These moments and the theories enabled me to reflect upon the conventional teacher professional learning and to explore the nature of teacher professional learning in PLNs such as knowledge, doing and being as a whole, learnable participatory position, emergence and understanding, true professional learning, and affordances of PLNs for teacher professional learning.

Keywords

Knowledge, knowing, professional learning, PLNs, emergence

Research purpose

This paper intends to understand the nature of teacher professional learning in online professional learning networks (PLNs) through the lens of my personal interpretations based on both my learning experiences and my understanding of a number of theories (e.g., Gnosis (spiritual knowledge), Episteme (practical know–how), Enactivism and Complexity Theory) acquired from a seminar.

Why did I choose to narrate my interpretations and understanding rather than a theoretical or empirical approach toward the nature of teacher

professional learning in PLNs? Personally, I have worked with mathematics teachers in China, Singapore, Botswana, and Canada in two major ways: holding workshops for transmitting the significant theories of professional knowledge and collecting data for empirical research on the teachers' classroom teaching or their students. Working together with those teachers allowed me to notice that, once they had a chance to communicate with me, they always talked about their stories of professional growth and/or their student learning stories rather than about the theories, the related data, or the research. In addition, they were also very interested in my personal experiences of professional learning. Sharing mutual interests deeply influenced both parties. To be honest, at that time, I never regarded those personal experiences or stories as a part of my workshop or research focus, even though they shaped me in a dramatic way. However, when I encountered a seminar during my research on teacher professionals in PLNs, it was through participatory learning that I realized the powerful significance of the personal experiences in teacher professional learning, particularly my own learning experiences from the seminar. At the beginning of the seminar, my held viewpoint about teacher professional learning contradicted participatory learning, but I preferred adhering to the one I held. And meanwhile, "something awaken[ed] [my] interest" (Gadamer, 2001, p. 50), "something address[ed] [me]" (Gadamer, 1989, p. 299), and something drove me to wonder and discover. Eventually, I shifted my way of learning from passively receiving the so–called knowledge to actively participating in constructing it. I enjoyed this shift very much because it allowed me to realize the power of "me" in the process of producing a deep understanding of, for example, the nature of teacher professional learning in PLNs.

The moments of wondering, discovering, struggling, and transforming that emerged from my learning experiences might seem familiar to you, but be unvoiced (Wittgenstein, 1968). My interpretation might call your "family resemblance" (Wittgenstein, 1968, p. 32) to account. Therefore, sharing my understanding is not "assessing verified knowledge" (Gadamer, 1989, p. xxii) but allowing my words to be heard to "re–tell ancient and power–laden narratives of initiation and transformation, 'insiders' and 'outsiders', thresholds and boundaries, liminal spaces and monsters" (Jardine, 2015, p. 245). That means that my interpretive "experience always implies an orientation to [your] experience" and it has "its proper fulfilment not in definitive knowledge, but in the openness to [your] experience" (Gadamer, 1989, p. 355). For me, being a teacher is to "enter into the process, not of amassing verified knowledge and

attaining 'expertise', but the process of becoming experienced" (Jardine, 2015, p. 253).
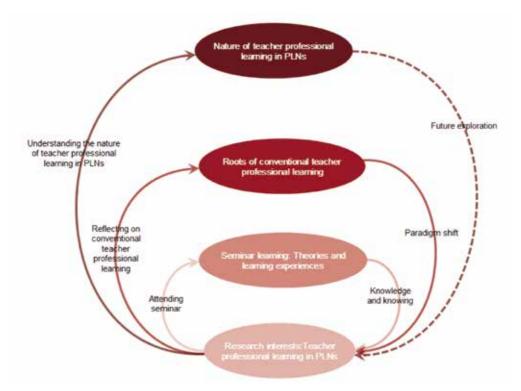
To put it more clearly, my interpretation is to open up the possibility for you to experience "the fecundity of the individual case" (Gadamer, 1989, p. 38) of teacher professional learning in PLNs that "comes to meet [you and me] in the world" (Jardine, 2015, p. 253). In this case, both my interpretation and understanding expect to "listen, to affect and to invite, not merely inform" (Jardine, 2015, pp. 235–236). Narrating my interpretation is "a conversation between [you and me]" and this conversation would unearth "new understanding and meaning within being" (Wood, 2006). Narrating is powerful to reflect upon the understanding with which the wondering, suffering, discovering, and transforming "[are] never mine alone but always ours" (Aoki, 1996, p. 410), unable to be achieved by any other approaches in education research.

Interpretive process

The whole interpretation went through a process of interpretive cycles (see Figure 1 derived from Ellis's (1998) hermeneutics circle.

For the research in question, the seminar-based learning experiences and the understanding of the acquired theories (e.g., Episteme, Gnosis, Enactivism, and Complexity Theory) constituted the foundation for the knowledge and knowing of the essence of teacher professional learning in PLNs, thereby rendering my interpretation more solid and cogent. Resorting to those ever-learnt theories, I reflected on the conventional teacher professional learning particularly from the perspective of Episteme and I expected to dig out its roots of being determined, authority, knowledge as object, measurement, and learning as building, these roots demonstrating the imperative of paradigm shifting of teacher professional learning. After re-examining my research topic in terms of my learning experience and the learnt theories, particularly Gnosis, Enactivism, and Complexity Theory, I endeavoured to find out the nature of teacher professional learning in PLNs: knowing-doing-being, learnable participatory disposition, emergence and understanding, true professional learning, and affordances of PLNs for teacher professional learning. The nature is likely to be regarded as a future exploration on paradigm shift of teacher professional learning.

Figure 1: The interpretive processes

The above interpretive processes allowed me to understand both the nature of teacher professional learning in PLNs and the reason why such learning was essential to their professional development; however, my inquiry so far has not come to an end but is still left open to the future (see the dotted line in Figure 1).

The narrative threads were unravelled as wondering, revealing, struggling, and transforming to visualize my lived experiences of becoming an active knower from a passive receiver in a professional learning seminar.

The lived experiences

Wondering: A passive recipient

My research interest is to understand the nature of teacher professional learning in PLNs. In recent years, in order to seek quality professional development (Marrero et al., 2010), a great many teachers and teacher educators have resorted to online resources and approaches which have become significantly influential in teacher professional development these days (Beach & Willows, 2014; Borba & Llinares, 2012; Dash et al., 2012; Trust, 2012). However, even if more and more teachers have engaged in PLNs, few related studies have touched upon what, how and why teachers learn in online PLNs. This aroused my research interest, so I decided to equip myself with more adequate and appropriate knowledge to pursue the targeted research by attending a seminar titled "Advanced Research Seminar in Secondary Education" in my department.

Each class in the seminar was driven by the scheduled weekly readings and follow-up responses from participants. The whole seminar adopted winter counts[1] as a pedagogy and, in that tradition, invited participants to create their own twelve symbols to represent emergent ideas, feelings, or stories that inspired them.

I still have a fresh memory about what I had presented in the first class of that seminar. At that time, I made an analogy that, if my research topic were compared to a container which could be filled up with the knowledge acquired from the seminar, I would be thought of as a passive recipient of the knowledge in that container. The research topic appeared to be separated from that expected knowledge. But actually there was not any pre-determined knowledge as I had expected available to stuff the container of my topic. Then, I wondered why I had such dominant thoughts about viewing myself as a passive recipient of knowledge. In fact, I was not alone. Teachers have been traditionally treated as naive learners who would accept "planned enculturation or training" (Osberg & Biesta, 2008, p. 315). Although teachers, even student teachers, have numerous learning experiences, these experiences do not play a substantial role in their conventional professional development. Thus, I began to inquire as to why teachers have been rooted in such learning concept and practice.

Discovering: The roots of conventional learning

The above–mentioned inquiry drove me to discover the roots of conventional teacher professional learning. Fortunately, it was Davis's (2004) work highlighted in the seminar that helped me to find out the very answer, grounded in Episteme with "its original concern for everyday know–how, tend[ing] toward more mechanical metaphors" (p. 21).

Being determined

Conventionally, the type, content and context of teachers' professional learning is often assumed as "pre–determined" (Osberg & Biesta, 2008, p. 314), resulting in teachers having few choices or sometimes no choices in their professional development (Francis–Poscente & Jacobsen, 2013). Such assumption is rooted in the episteme based in "a logical–rational mode of thought" (Davis, 2004, p. 26). The episteme claims that everything that has happened is "absolutely determined by what has already happened" (Davis, 2004, p. 32) when breaking with the gnosis "referring to mystic–religious belief" (Davis, 2004, p. 26) promoted by Descartes and his contemporaries. That would possibly justify the pre–determined type, content and context of teachers' professional learning.

Authority

The predetermined content of professional development is also taken as authorized knowledge which teachers (and learners) are required to accept and adopt in their teaching practice. The learners' surrender to authority is grounded in the dogmatic assumption that knowledge (gnosis) independent from knowers is "a godhead or other supernatural source" (Davis, 2004, p. 58). Their submission is also assumed as "not just deemed possible, but necessary" (Davis, 2004, p. 58). Learning in religious tradition, in fact, is treated as all about the educator's intentions, and authority is invested in the educator rather than the learner (Davis, 2004).

Knowledge as object

Knowledge is considered "synonymous with information and data rather than doing" (Davis, 2004, p. 37), while the learner is recognized as "a repository of knowledge—a vessel to be filled" (Davis, 2004, p. 61). It is understood that the

"knowledge–as–object metaphor is deeply inscribed in Enlightenment–based traditions" (Davis, 2004, p. 61) and in contemporary teacher education as well. For teachers, the so–called authorized knowledge is deemed as tangible and transferable or transmittable to them. Teaching which is regarded as imparting objective knowledge might have burgeoned in the soils of religion (Davis, 2004), but it is still blossoming in our school practice and teacher education and becoming specific in our thinking and behaviour.

Measurement

Following the idea that the learner is taken as the recipient of knowledge, researchers or educators have measured teachers' knowledge or capability for teaching in such traditional ways as using their students' performance, observing their classroom teaching, or inviting teachers to attend students' tests. For instance, Ball et al. (2005) provide the prominent work on the measurement of mathematics teachers' content knowledge. They give credibility through a large–scale survey to the linkage of mathematical teachers' knowledge to the performance of their students in mathematical learning. Their survey proves that the more mathematical knowledge teachers possess, the higher the scores of their students.

Applying statistical methods to measurability has become a means of quantifying "ideality" (Davis, 2004, p. 39). Influenced by the positivist movement—the most radical expression of empiricism (Davis, 2004)—measurability has been seen as a useful tool to differentiate the scientific from the quasi–scientific (Davis, 2004), the formal from the non–formal, and the qualified from the disqualified within teacher education. This has exerted tremendous impact on our current teaching practice and teacher education.

Learning as building

According to Descartes' suggestion about learning (Davis, 2004, p. 77), we fully believe that knowledge should be logically constructed on firm foundations. Descartes' view holds that preparing for teaching is tantamount to preparing a linear lesson plan which attends to a topic rather than a group of learners (Davis, 2004). Preparing a lesson plan is regarded as an important pathway to ground teachers' capabilities in teaching. Accumulating the knowledge and

skill of planning a lesson is deemed a major object of teachers' professional learning.

A full understanding of the roots of conventional teacher professional learning enabled me to realize that it was imperative to shift the traditional paradigm of teacher professional learning; therefore, I was eager to explore the nature of teacher professional learning in PLNs.

Struggling: Being

As mentioned above, I had expected at the beginning of the seminar to acquire predetermined knowledge that would be useful for my research in the "teacher–centred" teaching model I had experienced before such as passively learning and accepting what the teachers taught in the classroom. However, it was not long before I found that no predetermined knowledge was available for my research. In the seminar, learning came in the way of sharing and discussion among participants, and the instructor only played the role of facilitating our discussions and offered his key responses at critical moments.

More importantly, during the sharing and discussion in the seminar, the instructor encouraged all participants to express their responses to the weekly readings in multiple ways such as poems, stories, or painting. At the beginning, I still held my original intention to obtain anticipative knowledge beneficial for my research topic. When I did my first two weekly responses, I made great efforts to apply to my research topic the so–called "knowledge" obtained from the weekly assigned readings. However, I found such application so stiff and vapid that I managed to stop it. Meanwhile, I also enjoyed many inspiring responses such as stories, feelings, and experiences shared by other participants. Their responses motivated me to give up my pedantic way of obtaining knowledge from someone and somewhere and to try new ways of presenting my responses to the weekly readings. However, I was still bewildered because I had never tried such kind of learning.

At last, I came to realize that the most important thing that I should cherish was to open my own mind to freely express my ideas and feelings in response to the diverse resources presented.

As I responded to my understanding of local knowledge tradition from Turnbull's (2000) book, I tried connecting my response to some Chinese traditional knowledge such as Geomantic omen, or Fengshui, with which I was familiar. The response ended up with my own interpretation of the local knowledge tradition with the unique knowledge involving my identity, beliefs, culture, and knowing. Thus, the interpretation was produced by connecting the understanding of myself with the assigned reading—local knowledge tradition. Clearly, this was different from my original intention to apply to my research topic certain ideas called "knowledge" from those assigned readings. Later on, my unique response aroused the interest of my colleagues and the instructor in the seminar, and this encouraged me to pave a new way for a fresh burst of ideas by connecting my responses with my identity, beliefs, cultural knowledge, and previous learning and working experiences. In this sense, my understanding became unique knowing.

Transforming: Becoming an active knower

With the subsequent sessions of the seminar proceeding, I gradually realized my role was shifting from a passive recipient to a very positive knower in sharing my responses. I very much appreciated such an interactive way of learning that enabled me to become an active participant, allowing me to use my own way of understanding the nature of teacher professional learning in PLNs, including knowledge, doing and being as a whole, learnable participatory position, emergence and understanding, true professional learning, and affordances of PLNs for teacher professional learning.

Knowing–Doing–Being

As a major theory discussed in our seminar, enactivism expresses the views on knowledge. It highlights the dynamic interdependence of "thought and action, knowledge and knower, self and other, individual and collective" (Davis, 1996, pp. 113–114), pieces together action, knowledge and identity, and conflates doing, knowing, and being (Davis, Sumara, & Kieren, 1996). Accordingly, knowledge is inseparable from doing, because "all knowledge is situated in specific activity bound to a social, cultural and physical context" (Van de Gevel & Noussair, 2013, p. 21). There is "not knowledge–as–object but knowledge–as–actions" (Van de Gevel & Noussair, 2013, p. 21). Knowing the world is doing it rather than abstracting it to be exclusive of it (Davis, Sumara, & Kieren, 1996).

Just as an encapsulated saying goes, "knowing is being in doing" (Van de Gevel & Noussair, 2013, p. 21).

My knowing, doing, and being in the seminar could be interpreted as an embodied (enacted), co-emergent interactive process shifting from three separated parts to a combined whole. This inspired me to better understand teachers' knowing, doing and being as a whole in PLNs.
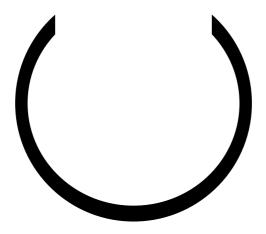
PLNs afford "instant access to information and connections to thousands of individuals with an array of expertise" (Trust, 2012, p. 133). These individuals or participants in PLNs could not only freely access the resources they need but also provide or seek suggestions for dealing with daily challenges or problems in teaching practice. PLNs are generally considered to "transform professional development and learning opportunities for teachers" (Trust, 2012, p. 133), rather than transmit a static product derived from Euclidean architectures to teachers (Davis & Sumara, 2010). For example, if a teacher in a PLN desires to know more about the concept of equivalent fractions, they might post a question to the PLN where other teachers or participants would offer interpretations of the concept from their own perspectives and experiences. Their interpretations probably go beyond those from the textbooks or authorities in the conventional professional development. The "all-at-once and interpretive" (Davis & Sumara, 2010, p. 840) knowing provides a different way of understanding and recognizes "the context and the immediate" (Davis & Sumara, 2010, p. 843) and the individuals; and knowledge is constructed. Therefore, learning in PLNs shifts teachers' professional learning from delivery-based towards participatory and inquiry-based modes (Brooks & Gibson, 2012; Laferrière, Lamon, & Chan, 2006) and from teachers as recipients towards teachers as (co-)producers of professional and scientific knowledge (Kieran, Krainer, & Shaughnessy, 2013). Thus, just as I had experienced in the seminar, participants' or teachers' knowing, doing, and being in PLNs are considered an integration.

Learnable participatory disposition

Adopting winter counts as a pedagogy in this seminar also offered me a special opportunity of experiencing participatory learning. Based on the aboriginal idea of winter counts—pictorial calendars or histories of events, we were required each week to produce a symbol representing the emergent ideas, feelings, or stories that inspired us. At first, I thought of the creation of each symbol as a

process of producing individual knowledge and knowing. Shortly afterwards, however, I came to realize that the knowledge and knowing were not generated by myself alone but rather emerged from collective contributions. For example, in my winter counts emerged the idea of leaving space for students' exploration. The idea was originally inspired by a participant's weekly response whereby she left more negative space for imagination in her painting. The negative space was then used as thinking space for students' exploration in our further classroom discussion. This idea prompted me to reflect on students' mathematics learning – there was not enough space available for students to explore mathematics, because they spent too much time on memorizing and practicing the facts and the procedures and formulas ever considered as the true mathematical knowledge in traditional mathematics contexts. After I experienced all the participants' sharing, classroom discussions, and my own individual reflections, I produced the following symbol (see Figure 2) to represent the idea of leaving space for students' exploration in their mathematics learning. At the end of the seminar, I created a total of 12 ideas represented by 12 symbols for my winter counts, presenting my unique learning process: from knowing myself in new ways to reflecting on learning environments and curriculum. The experiences of creating my winter counts and the notion of learnable participatory dispositions aided me to have a deeper understanding of the participatory learning in PLNs.

Figure 2: The symbol of leaving space for students

Typically, the teachers do not intend to obtain the prescribed knowledge but rather to contribute to the flow of ideas, suggestions, or problems in the networks, and their contributions could eventually benefit the emerged knowledge and knowing for teaching. For example, in a PLN, to understand the essence of, participants present multiple interpretations of the concept of equivalent fractions in different models such as areas, length, multiplication chart, degrees, and set. The related interpretations and representations are not prescribed but rather emerged from the active participants in the PLN, with their emergence possibly seen as "a coherence" (Davis & Sumara, 2010, p. 835), and meanwhile, they are helpful to motivate and maintain active interactions among the participants. Therefore, the interpretations and representations demonstrate that knowledge is the emergence of the possible (Davis & Sumara, 2010, p. 835).

Emergence and understanding

Complexity theory arouses participants' considerable interest in the seminar. As an emerging field, complexity theory comes with the realization of fractalness and self-organization in nature (Doll, 2012; Smitherman, 2004). According to the theory, "learning occurs in nonlinear patterns, emergent, divergent, and convergent" (Smitherman, 2004, p. 15), and knowledge emerges from our participation in the world rather than being transferred from one person/place to another one (Osberg & Biesta, 2008), particularly highlighting the "dynamic and collective aspect of teacher knowledge" (Charalambous & Pitta-Pantazi, 2015, p. 32) in a "space of emergence" (Osberg & Biesta, 2008, p. 326). It is evident that the paradigm of teacher knowledge is shifting from the static domains of the content knowledge (Ball, Thames, & Phelps, 2008) to the emergent nature of knowledge for teaching. And more importantly, the emergent nature of teacher knowledge is aligned with the concept of "currere" (Davis & Sumara, 2008; Pinar & Grumet, 1976) – regarding curriculum as method or process (Petrina, 2010) because what teachers would learn is based on their participation in the professional learning rather than the objective documents. In addition, learning is described by Davis and Sumara (2010) as acts of interpreting and reinterpreting original experiences and constantly reorganizing what has been known. Each act continues to be assimilated or accommodated in a cycle without end during the "recursive, irreducible, and creative" (p. 931) process. This process could be better understood from the perspective of hermeneutical understanding. For instance, understanding is viewed as a "continuous cycle of re-vision and re-interpretation" (Davis, Sumara, & Kieren, 1996, p. 157) while

learning is a circle of understanding experiences without beginning and ending (Davis, Sumara, & Kieren, 1996). In Davis and Sumara's (2010) argument, such kind of learning is better illustrated by a fractal image rather than a logical process of Euclidean geometry.

My learning experience of doing winter counts is actually fractal–like. This could be interpreted by Davis and Sumara's (2008) four conditions for emergence: "internal diversity; redundancy; neighbour interaction; and decentralized control" (p. 38). During the seminar, several topics in each class were scheduled to be explored deliberately based on weekly assigned readings. Participants shared their diverse responses based on their teaching practice or professional learning experiences. This satisfies two necessary conditions for ideas emerging—internal diversity and redundancy.

In addition, the classroom discussion meets another two conditions for emergence: neighbour interaction and decentralized control. In each class, all the participants were scheduled to share and comment on weekly readings; while the instructor shared his related comments to further deepen or extend our discussion on the topics. The classroom discussion unexpectedly produced many emergent ideas which could be taken as "a range of new possibilities" (Davis & Sumara, 2010, p. 830). Eventually, those emergent ideas as part of winter counts were presented through the symbols, interpretations, stories, and feelings created by participants who had integrated the ideas into their own experiences, culture, knowledge, and emotions.

In my winter counts, for example, I integrated the dance metaphor, originally drawn from the dance story shared by a participant, into my experiences as a math teacher, into my knowledge of mathematics, and into my feelings about students' unhappiness in mathematics learning, and then I produced a dance metaphor to reinterpret and describe how students could "dance" happily in mathematics learning.

The experiences of doing winter counts and knowing the notions of complexity theory enabled me to better understand the idea of emergence and integration which could occur in teachers' participation in online PLNs.

Fractal–like knowing

Within PLNs, the notion of knowing is not considered as accepting ideas, facts or operations but understanding emergent ideas/thoughts/questions from participants' interaction. Taking the equivalent fractions as an example again, the emergent interpretations of the concept could be conceived as the demonstrations of individual "internal understanding" (Davis & Sumara, 2010, p. 831). However, it is possible for the learning group in a PLN to generate the connections between interpretations and their impacts on students' later mathematics learning. The connections and the impacts as group actions are regarded as "understanding" (Davis & Sumara, 2010, p. 831) when the group members remain interactive. Such kind of understanding could happen to any possible topic. Within the learning group, knowing is treated as "fractal–like: a continuous, re–iterative event" (Davis & Sumara, 2010, p. 831) in which the interactions among the group members are active and "open up a range of new possibilities" (Davis & Sumara, 2010, p. 830).

Individual and collective

The understanding emerging from the learning group is not regarded as the aggregation of individual understanding. Rather, "the individual is embedded in the collective" (Davis & Sumara, 2010, p. 832). In the case of , the connections and the impacts of equivalent fractions are thought of as the collective generation. Individual contributions are not simply added into the collective knowledge and knowing but could be conceived as triggers, elements, contexts, or disposition to the collective understanding. From a fractal perspective, these individual contributions could be taken as "different levels of the same fractal image" (Davis & Sumara, 2010, p. 832).

Space for emotions

Teachers' emotions occupy little room in conventional teacher professional learning; however, the emotions such as "passions, love, creativity, spirituality, and aesthetics" (O'Hara, 2007, p. 937) play significant roles in collective learning. For example, a teacher in a PLN shares their teaching suggestions or ideas about a mathematical concept which eventually benefits other teachers' teaching; they might feel pride and have a sense of achievement and in turn, these emotions could reinforce their active participation in the PLN.

The quality of learning

With the learning in PLNs taken as fractal–like, its quality could be affected by the scale of independence. If a lot of active participants in a PLN support collective actions, they could reach a larger scale of independence with the knowledge and knowing flowing actively. This means that the openness of PLNs could bring the possibility of larger–scale independence. Therefore, it is potential for teachers to attain higher quality of professional learning through their participation in PLNs.

True professional learning

One of the topics in my winter counts was the relationship between Gnosis and Episteme derived from Davis's (2004) work. The relationship was understood as a shift from complementary in the Enlightenment era to antagonistic in modern times and then to complementary again in the future. This prompted my reflection on the nature of teacher professional learning within PLNs, particularly from the perspective of Gnosis.

Effect on the learner

Gnosis assumes that teaching is understood in terms of unrealized possibilities rather than pre–determined curriculum objectives (Davis, 2004); learning is understood from the perspective of "effect on the learner" rather than "the intentions of the teacher" (Davis, 2004, p. 54). The assumption exerts a huge influence on teacher education, which is demonstrated by its paradigm shifting from transmitting to transforming. For example, in a PLN, teachers could decide their own professional learning topics according to their practical needs, and they could communicate with or react to each other, possibly resulting in the generation of the relevant knowledge and knowing which could further improve their professional knowledge.

Tacit knowledge and knowing

Teachers possess abundant explicit knowledge, but they do "know more than [is] available to conscious awareness" (Davis & Renert, 2014, p. 27). The Socratic teaching method focusing on the questioning technique can draw the tacit knowledge and knowing out of them (Davis, 2004). In PLNs, for example, it is possible that the emergent questions, inquiries, or comments draw forth the

tacit knowledge and knowing from participants (e.g., mathematics teachers) who in turn could take advantage of their knowledge and knowing to increase their online interactions in their professional learning.

Teacher

The mystical traditions of Gnosis assume that a teacher could be anyone or anything because "learning is understood in terms of the learner's response not the teacher's intention" (Davis, 2004, p. 59). This assumption provides significant implications for teachers' learning in PLNs. In PLNs, teachers could learn from anyone or anything based on their own needs because no predetermined knowledge is available for them.

Coherent we

In Gnosis, individuality is taken as a "participant in a universe" and "one of many actors in a cosmic drama" (Davis, 2004, p. 36) while the social collective is assumed as "a coherent We" rather than "a sum of Is" as in episteme (Davis, 2004, p. 36). The assumption about the collective could offer a substantial interpretation on professional learning in PLNs.

From the collective view, an individual participant (teacher) could work with other counterparts on a concept, an idea, a problem, or an issue which arouses their interest in the open space of PLNs. From the online interactions with other teachers or participants might emerge brand-new related concepts, ideas, problems, or issues which could either boost a deep understanding of the previously acquired concepts, ideas, problems, or issues, or elicit other possible topics to be discussed; therefore, the interactions could facilitate online discussion among the participants and refresh one another's understanding of any possibly deep-rooted concept, idea, problem, or issue.

Affordances of PLNs for teacher professional learning

PLNs afford much more than what we expect for teacher professional learning. The affordances can be generally interpreted with respect to three dimensions: the individual dimension of self-expression and self-reflection; the collective dimension of social, emotional, and/or cognitive interactions; and the provocative dimension of boosting the individual and collective affordances.

The individual dimension

Self-reflection is regarded as a trait of effective professional learning (Lapointe-McEwan, Deluca, & Klinger, 2017; Quatroche, Bauserman, & Nellis, 2014) and as a tool for professional learning (McAleer & Bangert, 2011). Researchers have found both that PLNs are a valuable platform for people to project their own expression (self-expression) and reflection (self-reflection) (Brescia & Miller, 2006; Deng & Yuen, 2011) and that PLNs can promote participants' reflections on teaching practice (Moser, 2012; Noble et al., 2016). Participating in PLNs provides opportunities for teachers to reflect on their teaching experiences and ideas (thoughts), express their feelings, and seek or offer support (Trust et al., 2016; Hur & Brush, 2009). On the other hand, self-expression, particularly regarding the expression of feelings, is considered integral to the learning process but is often underestimated in the conventional formal professional learning environment (Boud & Walker, 1998; Deng & Yuen, 2011). PLNs are places where teachers can voice their feelings regardless of their learning, teaching, or life situation. This has been extremely important for teachers during the COVID-19 pandemic because many of them are feeling exhausted (e.g., 70% Alberta teachers) and isolated (e.g., 63% Alberta teachers) (The Alberta Teachers' Association, 2020). For instance, the participants can express their frustrations about lack of confidence or technological support in online teaching during the pandemic.

The collective dimension

The social nature of PLNs would not let individual self-expression or self-reflection stand alone in the online space. Luehmann and Tinellli (2008) claim that self-expression and self-reflection in PLNs are "conversational in nature" (cited by Deng & Yuen, 2011, p. 449) and will be affected by the audiences. Participants in PLNs voiced self-expression and self-reflection not only for themselves but for others as well. They are aware of "how others might be engaged in productive collectivity" (Davis & Simmt, 2006, p. 309). Making conversations or communicating with other teachers has been regarded as a crucial characteristic of teachers' effective professional learning (Patahuddin, 2013), the "important avenues" toward their professional growth (McAleer & Bangert, 2011, p. 106), and the best service for their learning (Dewey as cited in McAleer & Bangert, 2011). The communications or conversations could bring about solutions for problem-solving, plans for practices, interpretations for

understanding, or strategies for tackling issues. This is also greatly important for teachers during the COVID–19 pandemic because many of them might find that their used teacher support systems burn out (Barron et al., 2021) but they can get help from peers through their communications or conversations in PLNs. For instance, the conversations can be initiated or driven on how to deal with the frustrations relevant to confidence or technological issues during the pandemic online teaching once there are participants who express their related frustrated feelings.

The provocative dimension

The provocative dimension speaks to the other noticeable advantage of PLNs in relation to resources and experience sharing. It does not directly touch upon the individual and the collective affordances but opens more spaces and brings more audiences or resources for self–reflection and collective interactions. This dimension plays the role of boosting the individual and the collective affordances, and even the development of PLNs.

Overall, the teachers participating in PLNs can reflect on their individual teaching or learning experiences as well as express their feelings or emotions. Their self–reflection and self–expression represent the individual dimension of teacher participation. The individual posts reach out both to arrest the attention of other participants and to initiate their interactions since PLNs are social in nature. The interactions shift the teachers' participation from the individual to the collective dimension. Besides, the provocative advantage from resource and experience sharing of PLNs could facilitate individual reflection and expression as well as collective interactions, boosting the individual and the collective affordances of the PLN. Thus, the affordances of PLNs are interrelated and function as a whole to provide support for individual needs, collective knowing, and the development of PLNs. Their three dimensions provide a systematic perspective (Wang, 2020) and a whole teacher perspective (Trust et al., 2016) to view teacher professional learning, which transforms the paradigm of conventional teacher professional learning—transmitting the predetermined professional knowledge and skills.

Conclusions

My learning experiences in the seminar underwent the moments of wondering, discovering, struggling, and transforming. These moments and the obtained

theories (e.g., Gnosis, Episteme, Enactive Theory, and Complexity Theory) therefrom enabled me to reflect upon the conventional teacher professional learning and uncover the nature of teacher professional learning in PLNs. And meanwhile, the experiences of the seminar–based learning which was thought of as my professional learning (knowledge and knowing) provided me with an opportunity of interpreting the aforesaid theories in my own way. Thus, the integration of the acquired theories into my learning experiences served as the basis of my exploring the nature of teacher professional learning in PLNs, including knowing–doing–being, learnable participatory disposition, emergence and understanding, true professional learning, and affordances of PLNs for teacher professional learning.

In addition, my interpretations were "concerned not only with [my] individual [understanding], but also with rational understanding of both ourselves and the world around us" (Chambers, 1987, p. 18). Meanwhile, I viewed the interpretations as an epitome of teacher professional learning transformation from conventional to participatory way. The moments of wondering, discovering, struggling, and transforming were interweaved in "our own Being–in–the–world" (Wood, 2006, p. 11).

Notes

1. Winter counts (Lakota: waníyetu wówapi or waníyetu iyáwapi) are pictorial calendars or histories in which tribal records and events were recorded by Native Americans in North America (https://en.wikipedia.org/wiki/Winter_count).

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References

Aoki, T. (1996). Narrative and narration in curricular places. In Pinar, W. & Irwin, R. (Eds.). (2005). *Curriculum in a new key: The completed works of Ted T. Aoki*. Lawrence Erlbaum.

Ball, D., Hill, H. C., Bass, H. (2005). Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade and how do we decide? *American Educator, 29*(1), 14–17, 20–22, 43–46.

Ball, D., Thames, M., & Phelps, G. (2008). Content knowledge for Teaching: What makes it so special? *Journal of Teacher Education, 59*(5), 389–407.

Barron, M., Cobo, C., Munoz-Najar, & Ciarrusta, I. S. (2021, February 18). *The changing role of teachers and technologies amidst the COVID 19 pandemic: key findings from a cross-country study*. World Bank Blogs. https://blogs.worldbank.org/education/changing-role-teachers-and-technologies-amidst-covid-19-pandemic-key-findings-cross

Beach, P., & Willows, D. (2014). Investigating teachers' exploration of a professional development website: An innovative approach to understanding the factors that motivate teachers to use internet-based resources. *Canadian Journal of Learning and Technology, 40*(3), 1–16.

Borba, M. C., & Llinares, S. (2012). Online mathematics teacher education: overview of an emergent field of research. *ZDM Mathematics Education, 44*(6), 697–704.

Boud, D., & Walker, D. (1998). Promoting reflection in professional courses: The challenge of context. *Studies in higher education, 23*(2), 191–206.

Brescia, W. F., & Miller, M. T. (2006). What's it worth? The perceived benefits of instructional blogging. *Electronic Journal for the Integration of Technology in Education, 5*(1), 44–52.

Brooks, C., & Gibson, S. (2012). Professional learning in a digital age. *Canadian Journal of Learning and Technology, 38*(2), 1–17.

Chambers, C. (1987). *Phenomenology and Hermeneutics*. University of Victoria.

Charalambous, C. Y., & Pitta-Pantazi, D. (2015). Perspectives on priority mathematics education: Unpacking and understanding a complex relationship linking teacher knowledge, teaching, and learning. In L. D. English, D. Kirshner (Eds.), *Handbook of International Research in Mathematics Education* (3rd ed.; pp. 19–59). Routledge.

Dash, S., de Kramer, R. M., O'Dwyer, L. M., Masters, J., & Russell, M. (2012). Impact of online professional development on teacher quality and student achievement in fifth grade mathematics. *Journal of Research on Technology in Education*, 45(1), 1–26.

Davis, B. (1996). *Teaching mathematics: Toward a sound alternative (Vol. 7)*. Taylor & Francis.

Davis, B. (2004). *Inventions of Teaching: A Genealogy*. Lawrence Erlbaum.

Davis, B., & Simmt, E. (2006). Mathematics-for-teaching: An ongoing investigation of the mathematics that teachers (need to) know. *Educational Studies in Mathematics*, 61(3), 293–319.

Davis, B., & Sumara D. (2008). Complexity as a theory of education. *TCI: Transnational Curriculum Inquiry, 5*(2), 33–44.

Davis, B., & Sumara, D. (2010). Curriculum forms: On the assumed shapes of knowing and knowledge. *Journal of Curriculum Studies, 32*(6), 821–845.

Davis, B., Sumara, D., & Kieren, T. E. (1996). Cognition, co–emergence, curriculum. *Journal of Curriculum Studies, 28*(2), 151–169.

Deng, L., & Yuen, A. H. (2011). Towards a framework for educational affordances of blogs. *Computers & education, 56*(2), 441–451.

Doll, W. (2012). Complexity and the culture of curriculum. Complicity: *An International Journal of Complexity and Education, 9*(1), 10–29.

Ellis, J. (1998). Interpretive inquiry as a formal research process. In J. Ellis (Ed.), *Teaching from understanding: Teachers as interpretative inquirer* (pp. 15–32). Garland Publishing.

Francis–Poscente, K. & Jacobsen, M. (2013). Synchronous Online Collaborative Professional Development for Elementary Mathematics Teachers. *The International Review of Research in Open and Distance Learning, 14*(3), 319–343.

Gadamer, H. G. (2001). *Gadamer in conversation: Reflections and commentary*. Edited and translated by R. Palmer. Yale University Press.

Gadamer, H. G. (1989). *Truth and method*. Continuum Press.

Luehmann, A. L., & Tinelli, L. (2008). Teacher professional identity development with social networking technologies: learning reform through blogging. *Educational Media International, 45*(4), 323–333.

Hur, J. W., & Brush, T. (2009). Teacher participation in online communities: Why do teachers want to participate in self–generated online communities of K–12 teachers? *Journal of Research on Technology in Education, 41*(3), 279–303.

Jardine, D. W. (2015). On Hermeneutics. In K. Tobin & S. R. Steinberg (Eds.), *Doing Educational Research* (2nd ed.; pp. 235–254). Sense Publishers.

Kieran, C., Krainer K., & Shaughnessy, J. M. (2013). Linking research to practice: Teachers as key stakeholders in mathematics education research. In K. Clements, A. Bishop, C. Keitel, J. Kilpatrick, and F. Leung (Eds.), *Third International Handbook of Research in Mathematics Education* (pp. 361–392). Springer.

Laferrière, T., Lamon, M., & Chan, C. K. K. (2006). Emerging E–trends and models in teacher education and professional development. *Teaching Education, 17*(1).

LaPointe–McEwan, D., DeLuca, C., & Klinger, D. A. (2017). Supporting evidence use in networked professional learning: the role of the middle leader. *Educational Research, 59*(2), 136–153.

Marrero, M. E., Woodruff, K. A., Schuster, G. S., Riccio, J. F. (2010). Live, Online Short–courses: A case study of innovative professional development. *International Review of Research on Open and Distance Learning, 11*(1), 81–95.

McAleer, D., & Bangert, A. (2011). Professional growth through online mentoring: A study of mathematics mentor teachers. *Journal of Educational Computing Research, 44*(1), 83–115.

Moser, M. E. (2012). *Understanding how novice teachers utilize online collaboration* (Doctoral dissertation). Available from ProQuest Dissertations & Theses Global. (Publication No. 3543893)

Noble, A., McQuillan, P., & Littenberg-Tobias, J. (2016). "A lifelong classroom": Social studies educators' engagement with professional learning networks on twitter. *Journal of Technology and Teacher Education, 24*(2), 187–213.

O'Hara, M. (2007). Strangers in a strange land: Knowing, learning and education for the global knowledge society. *Futures, 39*(8), 930–941.

Osberg, D. & Biesta, G. (2008). The emergent curriculum: navigating a complex course between unguided learning and planned enculturation. *Journal of Curriculum Studies, 40*(3), 313–328.

Patahuddin, S. M. (2013). Mathematics teacher professional development in and through internet use: reflections on an ethnographic study. *Mathematics Education Research Journal, 25*(4), 503–521.

Petrina, S. (2010). Currere: Curriculum as Method or Process. http://www.dlc–ubc.ca/ wordpress_dlc_mu/edcp562/files/2011/09/Currere.pdf

Pinar, W. F., & Grumet, M. R. (1976). *Toward a poor curriculum*. Kendall Hunt Publishers.

Quatroche, D. J., Bauserman, K. L., & Nellis, L. (2014). Supporting professional growth through external resources. In L. E. Martin, S. Kragler, D. J. Quatroche, & K. L. Bauserman (Eds.), *Handbook of professional development in education* (pp. 431–442). New York, NY: Guilford Press.

Smitherman, S. (2004). *Chaos and complexity theories: A conversation*. San Diego, CA: American Educational Research Association.

The Alberta Teachers' Association. (2020). Alberta Teachers Responding to Coronavirus (COVID–19)—Pandemic Research Study. https://www.teachers.ab.ca/COVID–19/2020–School–Re–entry/Pages/COVID–19–Survey.aspx

Trust, T. (2012). Professional learning networks designed for teacher learning. *Journal of Digital Learning in Teacher Education, 28*(4), 133–138.

Trust, T., Krutka, D. G., & Carpenter, J. P. (2016). "Together we are better": Professional learning networks for teachers. *Computers & Education, 102*, 15–34.

Turnbull, D. (2000). *Masons, Tricksters and Cartographers: Comparative Studies in the Sociology of Scientific and Indigenous Knowledge*. Amsterdam: Harwood Academic.

Van de Gevel, A. J., & Noussair, C. N. (2013). *The nexus between artificial intelligence and economics*. Springer, Berlin, Heidelberg.

Wang, X. (2020). *Understanding Collective Conversations in a Mathematics Professional Learning Network* (Doctoral dissertation). Available from UNIV OF ALBERTA LIBRARIES's Institutional Repository. (Accession No. uac.99d970fc. c2fa.4791.bd89.0fdeb166a916)

Wittgenstein, L. (1968). *Philosophical investigations*. Cambridge: University of Cambridge Press.

Wood, K. (2006). *Conversations: Hermeneutic inquiry unearthing pedagogic relations*. Unpublished Master thesis. Faculty of Education University of Lethbridge, Alberta, Canada.