Transcending Teacher Professional Development: From Determinism to Complexity

Abdul Rahman, University of Wollongong, Australia
Garry Hoban, University of Wollongong, Australia
Wendy Nielsen, University of Wollongong, Australia

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Abstract
There is a multiplicity of factors and actors that come into play to make teacher professional development (TPD) a strategic and powerful scheme for improving teacher practices. This multiplicity is evident in educational practices and theories. Consequently, traditional perspectives that take a simple view of TPD as a single, independent entity in teacher learning in isolation from other factors and actors are problematic. To better understand how TPD can bring about change in teacher practices–transforming teacher learning, there is a need to transcend the linear, causal, deterministic assumption about TPD. Here, in this discussion paper, I argue that powerful TPD is neither determined nor directed, but rather emerges. Powerful TPD emerges from many interconnected agents and these agents interact and combine in different ways depending on the situation, are reciprocal and are always nested, thus TPD is a complex enterprise. In order to showcase the complexity of the enterprise, TPD in the Indonesian context will be scrutinised using the lens of complexity theory.

Keywords: teacher professional development, teacher learning, teacher change, complexity theory, Indonesia

Introduction

Teacher professional development (TPD) has become a major focus of a worldwide educational reform agenda because of the belief that students' learning and achievement is largely dependent on the quality of teachers' instructional practices (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Doecke et al., 2008; OECD, 2009; World Bank, 2011). In this sense, TPD can be seen as a powerful mechanism for enhancing teachers' instructional practices (Desimone, Porter, Garet, Yoon, & Birman, 2002). If the educational reform agenda is to improve students' performance, then a powerful TPD is fundamental.

Yet, providing TPD that is powerful to enhance teachers' instructional practice is neither simple nor straightforward as a proposition or undertaking. Literature on TPD suggests that a number of factors need to be taken into account to provide powerful TPD. The factors range from contents, types and processes of TPD (Burney & Elmore, 1999; Darling-Hammond & McLaughlin, 1995; Desimone et al., 2002; Ingvarson, Meiers, & Beavis, 2005), to teacher characteristics (Cohen, Manion, & Morrison, 2007; Guskey, 2002; Little, 1993; Pajares, 1992; Putnam & Borko, 2000; Smylie, 1988) and the conditions in schools (Bredeson & Johansson, 2000; Jurasaite-Harbison & Rex, 2010; Wermke, 2011). These research studies not only illuminate the importance of these influential factors in TPD, but they also illustrate that powerful TPD is influenced by a multiplicity of factors.

This discussion paper presents a perspective on the complexity nature of TPD. It examines the multidimensionality and non-linear dynamics of TPD to shape teacher change and argues for a need to transcend the linear, causal, deterministic assumption underlying TPD practices –how TPD is conceived and conducted. The examination begins with an outline of perspectives on TPD and the corresponding implications of the perspectives. The paper then develops a proposition of TPD based on complexity theory and to illuminate the proposition, following the discussion is a showcase of TPD in the Indonesian context that is explored from the perspective of complexity theory.

Contemporary Perspectives on TPD

In the literature, there is a variety of terms and definitions related to the notion of teacher learning and change. Among those commonly used terms are teacher training, in-service education and training (INSET), in-service learning, staff development, continuing professional development (CPD), staff development, professional development, continuing education, professional learning and life-long learning along with their respective definitions. Yet, the ideas or meanings of these terms are mostly often overlapped. Burke (2000) illustrated that "when educators think of professional development, they usually think of in-service days" (p. 29). Therefore, these terms are sometimes used loosely and interchangeably (see for examples; Bolam & McMahon, 2004; Burke, 2000; Craft, 2000; Day, 1999). In this paper, the term teacher professional development (TPD) is adopted to mean "a learning system in which influential factors and actors interrelate and interact to shape teacher learning and change".

A number of different perspectives have informed the practice of TPD over time. The first perspective views TPD as *activities, events,* or *opportunities*. Fenstermacher and Berliner (1983), for instance, viewed TPD as "the provision of *activities* designed to advance the knowledge, skills, and understanding of teachers in ways that lead to change in their thinking and classroom behaviour" (p. 4, emphasis added). In a similar vein, Bolam (2000) argued:

> [T]PD embraces those education, training and job-embedded support *activities* engaged in by teachers, following their initial certification, and head-teachers. Such activities are aimed primarily at adding to their professional knowledge, improving their professional skills and helping them to clarify their professional values so that they can educate their students more effectively. (p. 267, emphasis added)

The focus of this perspective of TPD is then on formulating the types of learning activities that can effectively and efficiently deliver the expected knowledge and skills for teachers. This perspective is concerned with the quest of "what" types, forms and models of TPD that work best to improve teachers' instructional practices. Thus, in the current discussion of TPD, the supporters of this perspective compel to replace the so-called "traditional" learning activities to "reform" ones such as changing workshops, seminars, and in-service training with action research, collaborative learning, or peer network.

The second perspective regards TPD as a *process* by which teacher quality can be enhanced (Evans, 2002; Sparks & Loucks-Horsley, 1989). Evans, for example, interpreted TPD, or 'teacher development' to use her term, as "*the process whereby teachers' professionality and/or professionalism may be considered to be enhanced"* (p. 131, emphasis in original). In this perspective, the concern is about uncovering the processes that work best for developing teachers' knowledge and skills. Therefore, the proponents of this perspective are likely to concentrate their attention on the "how" of TPD can be best delivered so that teacher quality is enhanced. Common issues in this perspective include whether to let teachers plan and pursue their own learning, to send them on courses, to present teachers with problems and challenges or to impose changes on them.

The third perspective combines the previous two perspectives and conceives of TPD as both activities and processes. Guskey (2000) defined TPD "as those *processes* and *activities* designed to enhance the professional knowledge, skills, and attitudes of educators so that they might, in return, improve learning of students" (p. 16, emphasis added). In an overarching and commonly cited definition, Day (1999) explained:

> Professional development consists of all natural learning experiences and those conscious and planned *activities* which are intended to be of direct or indirect benefit to the individual, group or school and which contribute, through these, to the quality of education in the classroom. It is the *process* by which, alone and with others, teachers review, renew and extend their commitment as change agents to the moral purposes of teaching; and by which they acquire and develop critically the knowledge, skills and emotional intelligence essential to good professional thinking, planning and practice with children, young people

> and colleagues through each phase of their teaching lives. (p. 4, emphasis added)

This perspective is the combination of both the "what" and "how" of TPD. Theoretically the activity and process of TPD are dependent on one another and, in most cases, a particular TPD activity informs the process that it entails and vice versa. For example, action research as a TPD activity, involves an investigative process whereby teachers examine their practices in order to improve them. This third perspective is evident among the scholars who propose a set of those "effective" features of TPD (e.g. Ball & Cohen, 1999; Burney & Elmore, 1999; Darling-Hammond & McLaughlin, 1995; Desimone et al., 2002; Hawley & Valli, 1999; Knapp, 2003).

The last *perspective* views TPD as a *complex system* rather than just an activity or a process, or both (Davis & Sumara, 2007; Hoban, 2002; Knight, 2002; Morrison, 2008; Opfer & Pedder, 2011). Opfer and Pedder (2011), for example, construed "teacher learning as a *complex system* representing recursive interactions between systems and elements that coalesce in ways that are unpredictable but also highly patterned" (p. 379, emphasis added). With the same orientation, Hoban (2002) coined the term "professional learning system" to advocate a theoretical framework in teacher learning "based on a combination of … conditions for teacher learning that need to complement each other to support educational change as a *complex system*" (p. 68, emphasis added). The next section discusses why it is more appropriate to conceptualise TPD as a complex system rather than just an activity, a process or both an activity and a process.

Teacher Professional Development as a Complex System

Complexity theory underlies the argument in this paper. While the theory originates in other fields, such as physics, biology, mathematics and economics, complexity theory has been increasingly employed in the social sciences, including education (Davis & Sumara, 2006; Hoban, 2002; Lemke & Sabelli, 2008; Nielsen, Clarke, Triggs, & Collins, 2010; Opfer & Pedder, 2011; Reigeluth, 2004). Complexity theory is a way of thinking and acting that perceives and conceives living systems to consist of multiple elements or agents that interact in many different ways, and further, the organisation of these systems cannot be understood in simple mechanistic or linear ways (Alhadeff-Jones, 2008; Mason, 2008; Waldrop, 1992). According to Mainzer (2007), "[t]he principles of complex systems suggest that the physical, social, and mental world is *nonlinear*, [and] *complex*" (p. 417, emphasis added). The systems are nonlinear because a direct causal connection cannot be specified. Semetsky (2008) explicated that "[a] single cause may in fact lead to a multiplicity of effects; conversely, a single effect may be produced by a multiplicity of causes" (p. 80). The physical, social, and mental worlds are complex because "a great many independent agents are interacting with each other in a great many ways" (Waldrop, 1992, p. 11). From this complex systems perspective, the paper builds on and extends the work of those who conceptualise TPD as a complex system in an attempt to develop a more dynamic understanding of TPD.

There are at least two primary reasons for conceptualising (TPD) as a complex system. First, casting TPD as a complex system implies that numerous factors come

into play in TPD. As described in the earlier perspectives, TPD is multidimensional in nature. Therefore, when teachers participate in a TPD program, their learning and change cannot be attributed to a single factor. Teacher learning and change are made possible by other elements or agents being already in place. Teacher learning and change occur, for example, when among others, a learning activity is available; the teachers have a need and/or motivation for the learning; their beliefs, knowledge and experience are compatible with the knowledge or skills to be learned; and supports are provided by principals or administrators (Ball, 1996; Bransford & Schwartz, 1999; Caffarella & Barnett, 1994; Cochran-Smith & Lytle, 1999; Richter, Kunter, Klusmann, Lüdtke, & Baumert, 2011). The presence of these agents and elements means that a perspective that views TPD as an *activity* is too narrow and restrictive.

The second reason for conceptualising TPD as a complex system relates to the process of TPD. A number of scholars argue that TPD researchers and practitioners have committed an epistemological flaw by approaching TPD in a linear, causal and deterministic way (Gravani, 2007; Hoban, 2002; Opfer & Pedder, 2011; Webster-Wright, 2009). Guskey (1986, 2002) and Desimone (2009), for example, proposed the following models of TPD:

Figure 1. Guskey's (1986, 2002) model

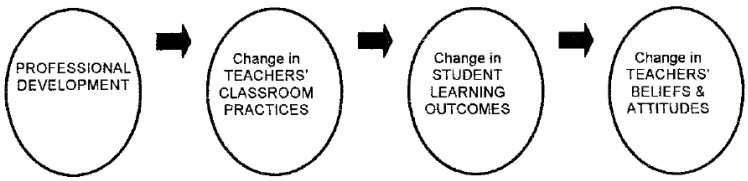
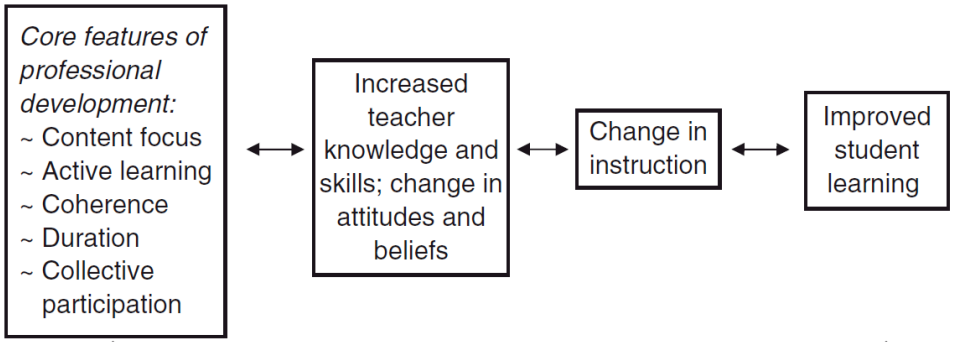


Figure 2. Desimone's (2009) model

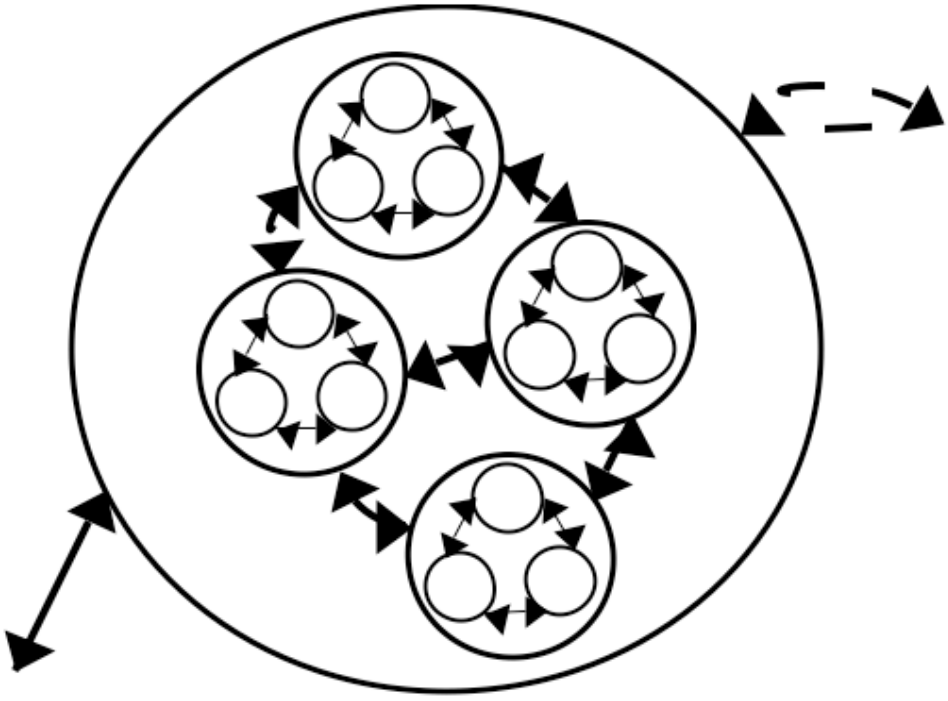


Although the two models are different in some aspects such as the order of changes and the nature of relationship among factors and actors, both of the models are presented visually in a linear, cause-effect, deterministic way. The models assume that: 1) an activity or reality occurs in a sequential process; 2) one part of an entity causes or affects another part in a linear way; and 3) because of this linear, cause-effect relationship, the outcome of an activity is pre-determined and known. This view holds that a known input will repeatedly produce a similar effect (Jayasinghe, 2011). Thus, it is a common belief in the field of TPD that once teachers attend "effective" TPD, the desired learning and change will follow. Unfortunately, the relationship of

agents (factors and actors) that interrelate in TPD is highly complex, which means that the outcomes of TPD are mostly unpredictable (Gravani, 2007; Knight, 2002). TPD is more than just a process or a compilation of an activity (by an agent) and a process, but is a nonlinear system in which "the effect is disproportionate to the cause" (Larsen-Freeman, 1997, p. 143).

It is from this multidimensionality and non-linearity of TPD that the paper argues for TPD as a *complex system*. Figure 3 depicts a representation of TPD as a complex system. However, Figure 3 presents only a simplified image of a much more complex set of processes and structures. First, there are multiple factors and actors (small circles) operating in one system (the larger circle). Second, as the two-way arrows suggest, the processes at play in a system are not linear but rather one element or agent can feed back or influence (or be influenced by) other elements. Third, the arrows outside the larger circle indicate that there are other systems, elements or agents operating outside this particular system that are influential to this one. In sum, through the lens of complexity theory, TPD is a learning system with multiple elements and agents that interact in non-linear ways to occasion the emergence of teacher learning and change.

Figure 3. Conceptual framework of TPD as a complex system (Adapted from Davis & Sumara, 2006)



TPD in Indonesia from a Complexity Perspective

This section presents a description of typical TPD in Indonesia. Some basic concepts of complexity theory are useful in attempting to understand the complex nature of TPD. Among these concepts include: *nested structure, feedback and sensitivity to initial conditions,* and *emergent and self-organisation.*

TPD in Indonesia: A glimpse

A typical TPD program in Indonesia starts with a letter of invitation but mostly in a sense of a request received by schools from educational authorities (districts, provinces, or central government) or TPD providers. This letter specifies the information about contents, duration, venues for the TPD program and most importantly the allocated number of teachers or subject teachers required to attend the program. The principals then choose teachers to represent the schools at the TPD programs. Although, there is sometimes a guideline or a set of criteria for choosing the teachers, in most cases, the decision on which teachers to choose is at the principals' discretion. Thus, a TPD program commonly involves teachers from various backgrounds (e.g. districts, school types, career status and qualifications). Generally, TPD learning activity takes the form of workshop training which is held at training centres or hotels in districts, provinces or a state capital. The duration of this workshop training ranges from a one-day workshop to a 15-day workshop training. In the workshop training, teacher participants receive intensive lectures on specified educational topics such as teaching methods, curriculum or assessment from 08:00 to 17:00 and then a second session in the evening from 19:30 to 21:30. Training instructors are not only required to follow specified teaching methodologies to assure consistent delivery, but also to ensure that the same outcomes are achieved by all participants. Upon their return to their schools, teachers have the responsibility to cascade the newly gained knowledge and skills to their fellow teachers through a series of learning activities in their districts and schools (Adey, Hewitt, Hewitt, & Landau, 2004; Supriatna, 2011; Thair & Treagust, 1997).

With this kind of TPD practices, many have argued that TPD has a little or limited impact on teachers' instructional practices for several reasons. First, schools do not provide adequate support for teachers to share their learning experiences with other teachers as well as to experiment the newly gained knowledge and skills. Second, what teachers learn from their TPD is often not applicable or practical to their school and classroom conditions. Third, teachers have restricted time and energy to have professional talks with their colleagues due to the fact that many teachers hold a second job to supplement their low incomes (Saito, Imansyah, Kubok, & Hendayana, 2007; Supriatna, 2011; Yuwono & Harbon, 2010). Put differently, "[t]he impact of training in transforming Indonesian educational institutions is not clearly established at all. The effects of training are arbitrary and, too often, dependent on the unplanned interactions of returning trainees, their supervisors and opportunities in their working environments. Much training leads nowhere except to unrealized potential, frustration and waste" (Cannon & Arlianti, 2008, p. 79).

Nested Structure

Complex systems are made up of elements or agents that are simultaneously agents of other systems (Davis & Sumara, 2007; Doll, 2008). Each whole system is a collection of interacting agents and at the same time is a part of a more inclusive whole. In this arrangement, "the part-whole relationship is a nested one" (Doll, 2008, p. 187). Therefore, in the nested structure of a complex system, everything is inextricably interrelated with everything else and the development and change of one agent/system influences and is influenced by that of other agents/systems. The concept of nested structure helps us to embrace the idea that TPD is composed of and comprises other agents/systems. TPD is itself a system along with its constituent parts including instructors, activities, learning materials and participants and at the same time it is a part a greater system such as a TPD system or an educational system for a country. Thus, TPD is not an isolated or independent system disconnected from other systems in which it operates and to which it is related.

It is commonly argued that TPD in Indonesia brings about little impact on teacher learning and instructional practices. One of the important reasons for this small impact is the types of TPD activity that are made available to the teachers. The answer is then to look for and introduce new types of TPD that are "empirically effective" to improve teacher quality such as lesson study and action research. However, something which is assumed to have a positive impact often does not yield the expected outcomes. The introduction of lesson study in TPD program in Indonesia, for example, does not in itself guarantee teachers' improved learning and instructional practices. Sometimes quite the opposite is true. Teachers who attempt a lesson study in their schools may become resentful to their fellow teachers or principal who are not "in the same page" which in turn badly influences school dynamic. Other teachers may feel the lesson study to be too demanding or time-consuming, which may lead them to withdraw their participation. Schools may become over-reliant on this new type of TPD and then fall into a traditional view of TPD where the procedure or activity is supposed to be a quick fix for quality improvement that has been mandated by authorities. Thus, impact of TPD cannot be solely attributed the type of TPD/learning activity. There are other actors and factors, such as teachers, principals, and members of schools that affect the TPD impact at teacher or school level.TPD cannot be fully understood without reference to other agents and systems within which it operates.

Feedback and Sensitivity to Initial Conditions

A feedback loop is a mechanism that either keeps a system in an overall steady state by dampening perturbations or amplifying a specific quality in the system so as to ensure the change is noticed and a response enabled (Davis & Sumara, 1997; Haggis, 2008). On one hand, a feedback loop that functions to regulate and control the course and the outcome of the system is called a negative or regulatory feedback loop. On the other hand, a feedback loop that functions to notice or inform the system when something new happens and thus amplify it into messages that signal a need for change is called a negative or regulatory feedback loop (Wheatley, 2009). A feedback loop, both negative and positive one, occurs between the interacting agents of a system and the feedback continually adjusts and modifies both the agents of the system and the system itself (Haggis, 2008).

A complex system has also "initial characteristics [that] can have profound effects on later behaviour … [and] small variations at the beginning of a process can have large effects in the end" (Buell & Cassidy, 2001, p. 212). In the realm of complexity, this is understood as 'sensitivity to initial conditions'. The initial condition of a complex system involves many different combinations of interactions which are possible at that point in time (Haggis, 2008). Haggis further explained that "[t]his untrackable history of interactions (both within and beyond the system) is crucial in determining the form of future emergences, making time and history of central importance [in complex systems]" (p. 158). The ideas of feedback loop and sensitivity to initial conditions suggest the necessity to acknowledge and engage with the history of the particular TPD system and its interacting parts. The feedback loop mechanisms help us to recognise that the outcome of TPD is shaped by the kind of responses that are fed back into the interacting parts and the TPD system. The sensitivity to initial conditions suggests that a similar TPD program can produce different outcomes at the teacher and school level because of the diversity of teachers' or schools' initial characteristics.

TPD programs in Indonesia commonly emanate from agents (districts, provinces or central authorities) external to teachers and that operate at a different level of the system. To assure the smooth and successful implementation of TPD programs, the authorities have virtually developed every aspect of the TPD including content, duration, number of participants and so on. Based on these pre-specifications, policy makers, TPD providers, instructors, and principals evaluate the progress or outcome of the programs. Teachers, in turn, are expected to adjust their behaviour and attitude towards these criteria. This kind of evaluation is essentially a negative feedback loop that aims to regulate and control the courses and outcomes of TPD programs on teachers. A deviation from the specified processes and outcomes is not tolerated and, thus, should be abandoned, leaving teachers no room for improvisation. A powerful TPD program should allow and stimulate any single ideas and experiences to be amplified into innovations or novel practices, instead. It indicates that TPD also needs to incorporate positive feedback mechanisms so that a seemingly small event can be amplified to bring about a bigger impact.

The idea of sensitivity to initial conditions means that the starting point of any TPD program is different from one teacher or a group of teachers to another. These are initial conditions that are consequential in terms of the impacts of TPD on teachers. Where teachers start with a particular TPD program often has a big impact on where they end up. Some teachers may have already accessed materials or ideas presented in the TPD programs, and thus, could feel bored and/or influence the dynamic of group in the program. Others might have had prior negative TPD experiences that could influence their present response to a new program. In a more positive circumstance, a teacher may point out a particular practice that he has been doing in his class and this point could trigger other teachers to engage in an in-depth group discussion that could presage the development of a learning community.

Feedback mechanisms and sensitivity to initial conditions help us to recognise that while some aspects of TPD can be carefully managed and controlled, others cannot. Further, it is almost impossible to know in advance which interactions will be significant, what interactions have preceded the TPD, and what has resulted from these previous and unknown interactions (Haggis, 2008). Sometimes, those who

involve in TPD just need to observe until they recognise what emerges and provide necessary positive feedback.

Emergent and Self-Organising

From a complexity theory, change is natural, evolutionary, and emergent from a process that is neither imposed nor directed (Byrne, 2001; Morrison, 2008; Waldrop, 1992). What emerges at a system level is the result of interactions among the agents of the system. The popular example is termites that develop into a colony and as a collective can build an incredible structure (e.g. the termite mound) relative to the size of the builders. Yet, in the process of building the mound, there is no chief termite, architect termite or master plan. Each individual termite acts locally, following a few simple shared rules: the termite mound emerges from a process of self-organisation. This manner of organisation means that most of the interactions between agents within such systems are with their closest neighbours and are based on simple sets of local rules. Self-organising systems, like the termite colony, demonstrate the ability of all social or living systems to organise into a web of interactions that increases capacity: this capacity cannot be reduced to the sum of its parts.

The emergent and self-organising principles help us to understand that providing TPD opportunities to all teachers in the same way will not yield the same outcomes for every teacher. Outcomes of TPD are shaped by the kind of local needs, interests, or conventions that shape teachers' behaviours and responses toward their TPD experiences. The principles also posit that local actors in TPD such as teachers, principals, and administrators have the capacity to behave adaptively and produce the expected outcomes without directions detailing their actions.

The emphasis of TPD in Indonesia is often on careful, top-down organization rather than encouraging local interactions. As mentioned previously, most TPD programs are imposed on teachers by superior authorities who envisage particular changes in the participating teachers. However, most teachers do not achieve or display the envisaged changes because teachers need to adapt what they take from the TPD to what already exists or applies in their schools. For example, delivering an ICT training program to teachers and asking them to integrate ICT into their instruction does not necessarily mean that all teachers will use ICT-based learning activities. Teacher capacity to develop and implement such learning activities may be enabled or hindered by local factors, such as IT resources at the school, teacher values and beliefs about ICT, school culture and the principal. Those involved in delivering such training have little or no control over such local factors.

The principles of emergence and self-organisation suggest that particular outcomes or effects cannot be imposed on teachers by external authorities. TPD providers cannot position themselves as authorities that can direct the courses and hence outcomes of particular TPD activities. Instead, the system in which teachers is a part of, say a school, "decides" what is and is not desirable, acceptable or applicable.

Implications and Conclusion

What specifically, then, are the implications of complexity theory for the practices of TPD? Complexity theory presents a number of challenges to conventional ways of thinking about TPD.

First, people who are involved in TPD need to redefine TPD. It is a common practice that when one thinks of TPD, the focus of attention is on the activity of TPD to the exclusion or little attention of other factors and actors. However, if TPD is regarded as a complex system then the attention needs to be extended from a focus on individual consideration of activity to the TPD as a whole. A complexity perspective enables people to view TPD as a system of relationships and participations (Davis, 2003). Second, whoever has a stake in TPD needs to surrender certainty and predictability. A complexity perspective informs the inevitability of changes in the courses and outcomes of TPD on teachers. Attempts to hold or fix the courses and outcomes of TPD as constant are impossible and indicate a perspective on learning that "assumes learning can be isolated, separated, and controlled from the milieu in which it is embedded" (Clarke & Collins, 2007). From a complexity perspective TPD providers, administrators, and principals cannot determine completely the courses and outcomes of TPD in advance. However, this indeterminacy does not mean that anything goes randomly or that plans, expectations or standards for TPD are abandoned. Rather, it is an acknowledgment that expecting teachers to perform neatly to a predetermined set of outcomes (practices) of TPD and at the same time to allow for "rich" learning for teachers is highly improbable. Last, people who are involved in TPD need to allow for improvisation. Too often teachers are positioned and treated to be passive recipients of knowledge and skills. They cheerfully forgo inquiry and mindlessly submit to what they are being told to do. However, in many literature about TPD this is not the sort of learning that can help teachers improve themselves. Teachers have to be reflective practitioners in their learning (Shulman & Shulman, 2004) and the generative space created by improvisation is essential for the emergence of such properties. Improvisation is "a willingness to hold in abeyance patterned responses and allow for the possibility of something new to emerge" (Clarke & Collins, 2007, p. 170). Clarke and Collins further explicated that improvisation is a not a solitary act but relies on interaction, communication and a willingness to explore from others.

To sum up, if people who are involved in the provision of TPD are to understand the potential of TPD to enhance teachers' instructional practices, there is a need to transcend the linear, causal, deterministic assumption underlying current TPD practices. Complexity theory helps us to understand and acknowledge the complex interplay of factors that influence teacher learning and change. It also helps us to accept and capitalise on the fact that TPD opportunities may not influence teachers, schools, and ultimately students, in the same ways as expected or predicted. TPD is a complex enterprise of practices, and thus approaches underpinned by a "one size fits all" approach will likely flounder because they fail to take into account the inherently complex nature of TPD.

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