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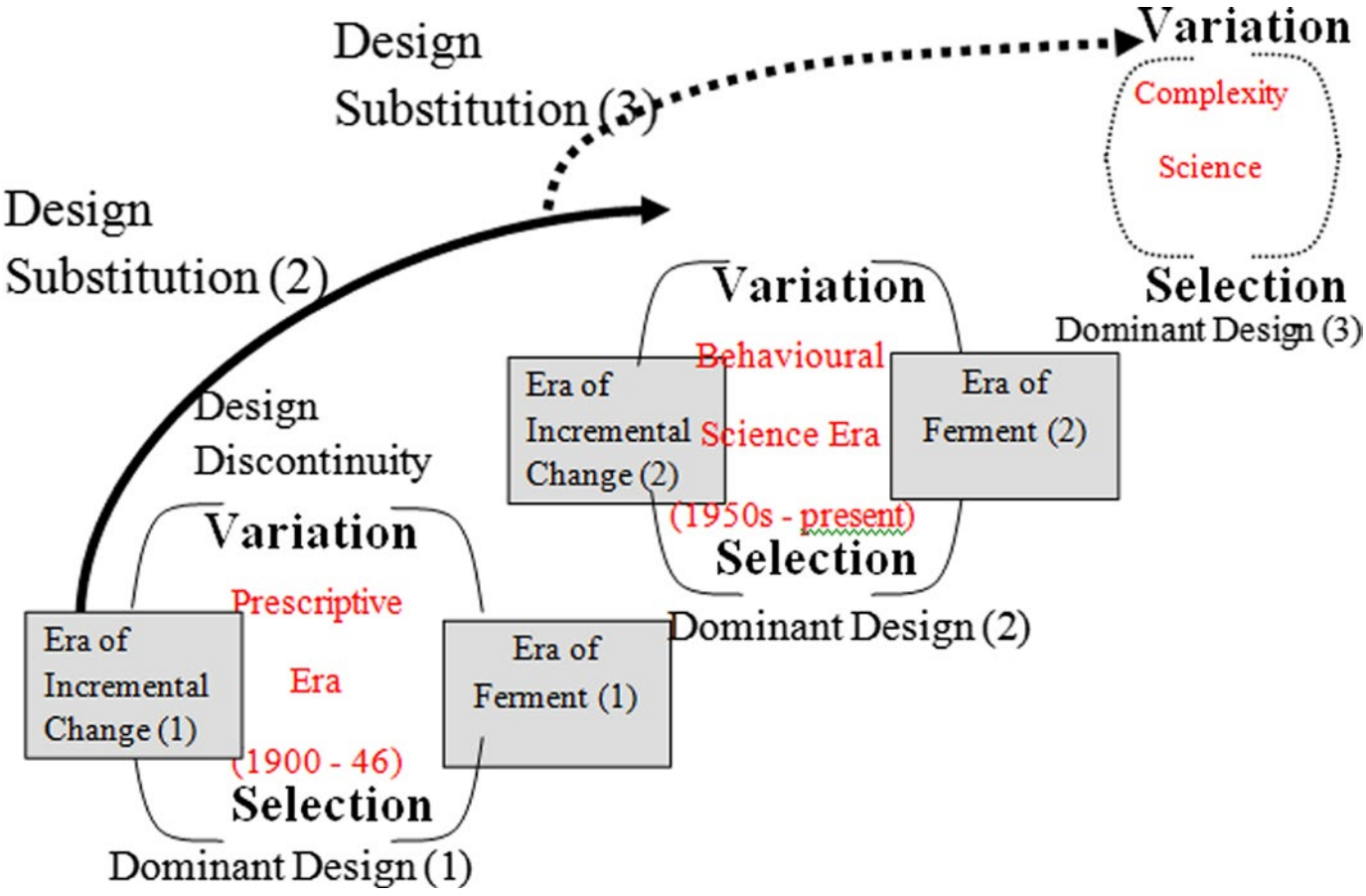

PROFESSIONAL EDUCATION & TRAINING | RESEARCH ARTICLE

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Complexity-based learning—An alternative learning design for the twenty-first century

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Abstract: In programme delivery, while the international trend in education has seen a shift from teacher-centred to student-centred learning and from transmission to reflective approaches, most leadership programmes have remained heavily teacher-centred. A key feature of teacher-centred learning relies on practices of course-driven programmes. This feature has been remarkably resilient over the years in the face of efforts to effect change in programme delivery and a new understanding of complexity in the world of education. The complexity theoretical framework provides us the advantage of an alternative design for leadership development programmes that is able to meet current and future challenges. Yearly, billions of dollars are spent on training and development. It is important to ensure that the outcome of training, learning and development must yield practical outcomes that are relevant, innovative and implementable solutions.

Subjects: Continuing Professional Development, Leadership Strategy, Teaching & Learning - Education

Keywords: leadership, leadership development, complexity theory, programme design

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PUBLIC INTEREST STATEMENT

Leadership development tends to rely on course-driven programmes. Learning through courses has been remarkably resilient over the years in the face of efforts to effect change in programme delivery and a new understanding of how learning takes place in real life. This article proposed the complexity-design learning approach as a viable alternative to the traditional course-driven learning. The complexity-design learning provides us the advantage where participants create new leadership and management knowledge that are relevant to their increasingly complex organizations. This new knowledge emerged rather than taught, as participants actively participate in the learning challenges incorporated in the complexity-design programme. A tag line that aptly describes the complexity-learning approach is "The process is the content" vis-a-vis the traditional approach where "The content drives the learning". In other words, professors/trainers do not know what the participants will learn at the beginning of the programme. Learning emerged at the end of the programme.

1. Introduction

At the turn of the new millennium, the impact of rapid globalization and the focus on innovation in international competition has ushered in a new demand for a different set of employee skills needed for the innovative economy. Where strength and manual dexterity used to be enough to ensure employment and a comfortable standard of living, more jobs now and in the future will require skills, such as interpersonal communication, adaptability, innovative, creative and organizational skills, that are seen as crucial in complementing technical and mathematical skills. Workers welcome the increasing number of new job opportunities available in a broad spectrum of industries. The want ads, clamouring for workers in the information technology, communications and service industries, reflect both the increased opportunities for workers and the increased need for up-to-date skills. Countries such as Singapore, Hong Kong and Vietnam are responding to the changing skills demand by investing in more education and seeking different ways of training and development (Powell & Lindsay, 2010).

The pace of change has seen a growing consensus that our views of organizations must also change. Powell and Lindsay (2010) stated that organizations today no longer can be described based on the static classic models of hierarchy and bureaucracy. Organizations today are considered as dynamic and open social systems (Cunningham, 2000). The complexity of a social system involves interrelated elements. Internal interdependence is one of the key elements where changes in one component of an organization frequently have an impact on other parts of the organizations. As an example, changes in the job requirement will affect the type of skills needed and the in turn will have an impact on the speed, quality of production activities and final product.

Another element is capacity for feedback and learning. Organizations today survive and compete on new knowledge and innovative thinking (Cunningham, 2000). Organizational capacity to manage knowledge, feedback and generate new learning is obviously more complex today than it was a decade ago.

The increasingly complex organization is central in our examination of the relevance of leadership development, delivery and learning. In programme delivery, while the international trend across academe has seen a rhetorical shift from teacher-centred learning to student-centred learning and from transmission to reflective approaches, most educational leadership programmes have remained heavily teacher-centred (Barr & Tagg, 1995; Ng & Ng, 2011). There are increasing calls for involving participants in the learning process, eliminating participant anonymity and personalizing instruction (McCarthy, 1999). The need to rethink programme delivery has been given further impetus by call for changes in programme content (Cheng & Tam, 2007; Dimmock & Walker, 2005; Hallinger & Snidvongs, 2005).

The competency-based model has been viewed as inadequate in the preparation of educational leadership, particularly in the increasingly complex and fast-paced changing world (Cheng & Tam, 2007; Hallinger & Snidvongs, 2005; McCarthy, 1999; Ng, 2004). Competency-based programme development and training has been the dominant design for the past 50 years (since 1947). The theoretical underpinning for the competency-based design rested upon the behavioural science era where knowledge is viewed as a set of prescribed skills, roles and behaviours. While we acknowledge the continual importance of the behavioural sciences, there is also a recognition that such prescription is no longer sufficient to prepare leaders to lead and to thrive in the new landscape.

2. Overview of leadership theories

To consider leadership functions that may be the focused for development according to the times, Leithwood and Duke (1999), in their study of all articles on leadership for schools published in four major administration journals from 1985 to 1995, identified six distinct leadership functions:

(1) Instructional (influencing teachers in ways that will impact students' learning).

(2) Transformational (increasing the commitment and capacity of staff).

(3) Moral (appealing to others by appealing to notions of right and wrong).
(4) Participative (involving other members of the school community beyond the Principal).
(5) Managerial (operating the school efficiently).
(6) Contingent (adapting behaviour to fit the situation).

Leadership functions and development would be more suitably discussed from dominant leadership theories.

2.1. Instructional leadership

Instructional leadership was predominant during the 1980s and has also seen a resurgence in the last few years. There are two general concepts of instructional leadership—one is narrow, while the other is broad. The narrow concept defines instructional leadership as actions that are directly related to teaching and learning, such as conducting classroom observations. This was the earlier conceptualization of instructional leadership in the 1980s and was normally applied within the context of small, poor urban elementary schools (Hallinger, 2003; Meyer & Macmillan, 2001). The broad view of instructional leadership includes all leadership activities that indirectly affect student learning, including school culture and timetabling procedures, by impacting the quality of curriculum and instruction delivered to students.

2.2. Transformational leadership

Besides instructional leadership, the other foremost leadership model, as measured by the number of empirical studies, is transformational leadership (Hallinger, 2003).Transformational leadership focuses on developing the organization's capacity and commitment to innovate (Leithwood & Duke, 1999). Correspondingly, transformational leadership is supposed to enable change to occur (Leithwood & Riehl, 2005). Among the six key leadership models, transformational leadership is the one most explicitly linked to the implementation of change. Caldwell and Spinks (1992) noted that Burn's study of leadership over the centuries suggested that the most successful leaders "in terms of bringing about changes in direction or new levels of achievement have … exhibited transformational leadership" (p. 49). Bass and Avolio (1994) compared transactional leadership to transformational leadership, with the former focusing on maintaining ongoing work (similar to the role of management) and the latter focusing on achieving change in performance. The literature on transformational leadership looks to Burns and Bass as the forefathers of this concept of leadership. Burns observed that transformational leadership occurs when "when one or more persons engage with others in such a way that leaders and followers raise one another to higher levels of motivation and morality" (as cited in Geijsel, Sleegers, Leithwood, & Jantzi, 2003, p. 230). The most fully developed model of transformational leadership in an educational context is provided by Leithwood and his colleagues (Leithwood & Duke, 1999; Leithwood & Jantzi, 2006). This model conceptualized transformational leadership along the following dimensions:

(1) Building school vision.
(2) Establishing school goals.
(3) Providing intellectual stimulation (behaviour which challenges followers to re-examine their thinking, beliefs and performance).
(4) Offering individualized support (behaviour which indicates the leader respects and is concerned about his/her followers as individuals and professionals).
(5) Modelling best practices which are consistent with important organizational values.
(6) Demonstrating high performance expectations (behaviour which indicates to followers the leader's high expectations with regard to their performance).
(7) Creating a productive school culture (behaviour aimed at developing school norms, values and beliefs that are student-centred and that support professional growth by teachers).
(8) Developing structures to foster staff participation in decision-making.

These dimensions were organized by Leithwood, Jantzi, and Steinbach (1999) into three main categories:

(1) Setting directions (includes school vision, goal building and the development of high performance expectations).
(2) Developing people (individualized support, intellectual stimulation and modelling).
(3) Redesigning the organization (culture building and developing structures to encourage staff participation in decision-making).

3. Evolution of leadership development: emergence of a new era

In facing challenges of globalization and information technology, how education should be reformed and what paradigm shifts (PSs) should be conducted have become a major concern in policy-making (Ayyar, 1996; Brown & Lauder, 1996; Fowler, 1994; Green, 1999; Henry, Lingard, Rizvi, & Taylor, 1999; Little, 1996; McGinn, 1996; Pratt & Poole, 2000). There are different views about the patterns of PSs in education with the support of information technology and various types of local and global networking. Some are more concerned with the relevance of education to globalization (Green, 1999; Henry et al., 1999), and some other emphasize individualization in education reforms in terms of fostering individuals' multiple intelligence, creativity and self life-long learning (Mok & Cheng, 2001). Some countries and scholars particularly in the Asia-Pacific region are more concerned with localization in education in terms of community involvement, local partnership and indigenous relevance in education.

Cheng (2005) postulates that there is an emerging wave of educational reform with heavy emphasis on future effectiveness, often defined by the relevance of education to the future developments of individuals and their society. In particular, this has been seen as meeting changed purposes and function of education in the new millennium. It has been viewed as a new paradigm of education embracing contextualized multiple intelligences, globalization, individualization and complexity. As a consequence of globalization and international competition, this new paradigm of educational reform is driven by the notion of world-class education movements. Effectiveness and improvement of education are thus defined by world-class standards and global comparability so as to ensure that the future of both student and social development is sustainable in such a challenging era.

Pivotal to the quest for reform in this new era is a need to seriously reconceptualize educational leadership development to meet new challenges in the twenty-first century. In the past 50 years, educational leadership programmes have often seen incremental improvements rather than discontinuous change within a dominant design. NIE conducted an extensive review of literature and traced the evolution of educational leadership development to three eras: prescriptive era, behavioural era and the proposed complexity era. During each era, the design and delivery of programmes were based on the conceptual framework of the era (Tushman & O'Reilly, 2013). In each era, the discontinuation of the dominant design came about because of a technological substitution and deep dissatisfaction of the current limitations of the design. The following sections highlight the conceptual framework of each era and discussed how the framework determines leadership learning (Ng, 2004) (Figure 1).

4. The prescriptive era (1900–1946)

There was little formal training in this era. Most school administrators learned their profession on the job through the trial-and-error processes during the prescriptive era. The little formal training that was provided taught courses on basic pedagogy, philosophy, school management principles and leadership characteristics. The emphasis was on the "great man" and trait theories (Cooper & Boyd, 1987) and the application of philosophical knowledge to schools (Murphy, 1998). The "great man" theory was based on identifying leadership traits of successful leaders in the political, business and battle field. These successful leaders were deemed to have certain traits such as being bold and being decisive. Leadership development then was designed based on how best to teach these

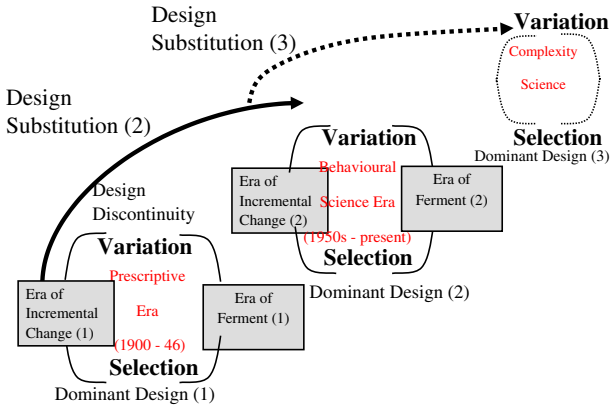

Figure 1. Evolution of educational leadership development.

Source: Adapted from Tushman and O'Reilly (2013).

successful traits to participants. For close to 50 years, every leadership programme in the world was more or less designed the same way.

In every design, the era of incremental improvement will take place where a programme will be refined within the parameters set by the dominant design. Inevitably, the law of diminishing return sets in where the degree of improvement becomes significantly diminished—causing dissatisfaction in the design outcome. This dissatisfaction leads to the start of an era of ferment where institutions begin to seek for alternative theoretical frameworks. The emergence of scientific research provided the platform for technological substitution ushering in the next dominant era of the behavioural science.

5. The behavioural science era (1947–current)

In the late 1940s to about 1985, theoretical and conceptual material drawn from the social sciences began to influence training programmes. This was also a period of ferment in the field of school administration. Much criticism was levelled against "the naked empiricism, personal success stories and maxims or untested principles that constituted the knowledge base of educational administration" (Murphy, 1998). This resulted in considerable changes to the structure and content of training programmes to mirror the perceived higher status of school administration in society. Three major changes were noted: (1) educational administration was now viewed as "an applied science within which theory and research are directly and linearly linked to professional practice" (Sergiovanni, 1991); (2) social science content was the predominant yardstick used to indicate a high-quality programme (Miklos, 1992); (3) almost universal adoption of behavioural sciences' research techniques and instruments for research (Culbertson, 1988); and (4) a multidisciplinary approach to principal preparation (Culbertson, 1988).

Scientific research in this era provided evidence-based decisions on learning and development. In particular, learning could now be supported by evidence of changes in the three domains of cognitive, affective and psychomotor.

The behavioural science era typically have the following features: a set of learning objectives, a specific body of knowledge (content) to be taught in order to achieve the objectives, and adopting the right pedagogical approach to deliver the body of knowledge. These characteristics meant that learning could now be efficiently and effectively taught.

While the behavioural science era is still relevant to a certain extent, there are inherent weaknesses in the design that again gave rise to discontent and ferment in further refining any programme. One of the inherent weaknesses of the behavioural science is that learning is predetermined knowledge. In addition, the increasing complexity of organizations, the influence of external factors such as globalization and information technology, has significant impact on emerging knowledge of how

educational leaders need to lead and manage schools differently. The awareness that predetermined knowledge and the body of knowledge which is based on known and past knowledge is no longer suitable to meet the new and current challenges. The world is changing rapidly and new knowledge is generated at a fast pace, the behavioural science era is no longer suitable as the only way to design any teaching and learning programmes.

6. The emerging era (complexity theory)

As stated earlier, the dominant design for educational leadership programmes has been centred within the behavioural science era. However, in the last decade, there is no lack of new theories such as strategic choice theory to learning organization theory, to open systems theory, and now to chaos and complexity theory as competing theories in teaching and learning design. This progression suggests a move to take into account the complexity of interactions, uncertainty, unpredictability and their relationship with diversity and creativity within an organization.

Cunningham (2000), in a conference paper submitted to the Institute of Education University of London, proposes, "Complexity theory may provide a tool for tracing the emergence of simple organizing principles from the complexity of social interaction and have implications for the study of schools and their communities". Morrison (2002) shares Cunningham's views and opines, "Complexity theory incorporates, indeed requires, unpredictable fluctuations and non-average behavior in order to account for the change, development and novelty through self-organization".

The following section will extrapolate from the main diagram and focus on the complexity theory era. It briefly describes the concepts within this new cycle. The section also discusses the approaches to learning and delivery of educational leadership programmes based on the concepts discussed (Figure 2).

7. Complexity theory

This section briefly looks at the key concepts of complexity theory. A relatively new perspective in the field of educational leadership, complexity theory, provides an explanation in understanding the school as a complex organization. Complexity appears in the twentieth century in response to criticism of the inadequacy of the reductionist analytical thinking model in helping us to understand learning, and suggests an alternative approach for knowledge in general and the knower, the object of knowledge, method and truth.

Morrison (2002) noted that, "Complexity theory incorporates, indeed requires, unpredictable fluctuations and non-average behaviour in order to account for the change, development and novelty through self-organisation". The ability to successfully self-organize is a vital characteristic for any organization to possess in order for it to flourish in the complex world it exists in. Leithwood and Day (2007) add, "Schools are dynamic organizations, and change in ways that cannot be predicted" as they have observed from leadership studies they reviewed from eight different countries. By looking at the complex system of an organization, leadership should consequently be viewed in a different light. A complex system is a functional whole, consisting of interdependent and variable parts. In other words, unlike a conventional system (e.g. an aircraft), the parts need not have fixed relationships, fixed behaviours or fixed quantities; thus, their individual functions may also be undefined in traditional terms. Despite the apparent tenuousness of this concept, these

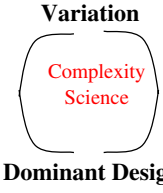

Figure 2. Complexity science era.

systems form the majority of our world and include living organisms and social systems, along with many inorganic natural systems (e.g. rivers).

By evaluating leadership learning through the lens of complexity theory, it provides a different and new perspective on how individuals learn. This is especially for leadership development programmes that are designed with elements of complexity theory incorporated into the learning structures. The process of learning takes on a non-linear and unpredictable manner that makes setting fixed learning objectives meaningless.

The following is a brief explanation of key concepts of complexity theory:

(1) Emergence

Emergence is related to the dependence of the whole on parts, the interdependence of parts and specialization of parts. While studying the parts in isolation does not work, the nature of complex systems can be probed by investigating how changes in one part affect the others, and the behaviour of the whole.

Emergence refers to behaviours and patterns that emerge as a result of the patterns relationship between elements. More specifically, emergence involves two, interdependent mechanisms:

(i) Reformulation

Reformulation is defined as the expansion, parsing, amplification, transformation and combination of multiple interacting, often conflicting elements (Kauffman, 1993), the reformulation of existing elements to produce outcomes that are qualitatively different from the original elements.

(ii) Self-organization

Marion and Uhl-Bien (2001) defines self-organization in terms of resonating reformulation of events. Resonance refers to situations in which the behaviours of two or more agents are interdependent.

(2) Autopoiesis

Maturana and Varela (1980) developed the concept of autopoiesis to define the characteristics of life at the biochemical/cellular level. This concept refers to the dynamics of living systems, and attempts to answer the question "what is the characteristic organization of living systems?" The process of Autopoiesis lies at the heart of the answer. Autopoiesis is a pseudo-Ancient Greek word, formed through the conjunction of two Greek words, "auto" meaning "self", and "poiesis" meaning "creation" or "production". Under Autopoietic theory, features like knowledge and beliefs arise in the domain of the observer—someone watching a system interacts with its environment in such a way as to prompt the use of such terms—they are not found "in" systems. Maturana and Varela's work offers a very different way of understanding cognitive phenomena. In simple terms, it suggests that individuals in a social setting self-create knowledge (learning) during interaction with the components of a system and with fellow human beings.

(3) Self-organization

Self-organization can be defined as the spontaneous emergence of global structure out of local interactions. "Spontaneous" means that no internal or external agent is in control of the process: for a large enough system, any individual agent can be eliminated or replaced without damaging the resulting structure. The process is truly collective, i.e. parallel and distributed over all the agents. This makes the resulting organization intrinsically robust and resistant to damage and perturbations. As

noted, the components or agents of a complex system initially interact only locally, i.e. with their immediate neighbours. The actions of remote agents are initially independent of each other: there is no correlation between the activity in one region and the activity in another one. However, because all components are directly or indirectly connected, changes propagate so that far-away regions eventually are influenced by what happens here and now. Because of the complex interplay of positive and negative feedback, this remote influence is very difficult to predict and may initially appear chaotic.

Mansfield summarized a dissertation that suggested the application of complexity theory to organizations. Mansfield (2003, p. 2) wrote:

"Complexity theory seeks to encourage spontaneous self-organisation and the emergence of new effective developments. Thus disequilibria within organisations are seen as no bad thing as long as the necessary preconditions for survival ('the boundedness') are in place. Complexity leadership will throw out challenges rather than solutions; it will encourage diversity, creativity and paradox, expecting disagreement as a necessary element in innovation. There will be no imposition of top-down pressure to deliver, indeed diversions from the norm will be amplified and supported. The organisation will support the creation of informal networks or teams that seek to work flexibly to find best-fit solutions. It will be assumed that off-the-shelf solutions will not work and that change takes time. Indeed as a result of continuous feedback, the organisation will constantly re-jig its vision and goals and recognising that long-term strategic planning is often unhelpful. Relationship between colleagues is foundational to the complex organisation as staff learning, planning and development all stem from group sharing and communicating".

8. A case example of complexity-based learning in the leaders in education programme

The leaders in education programme (LEP) in Singapore is a 6-month full-time principalship development programme that is designed to meet the educational reforms in Singapore. The programme goal is to develop current and future "principalship capability" in an increasingly complex world. Such principalship capability will be values-driven, purposeful, innovative and able to succeed in ill-defined conditions. The achievement of the programme's broad and deep goals demands a vibrant learning structure that is based on active and on-going participation in a community of professional practice. What participants will learn is determined by the deep interactions and the active participation in the rich processes such as action learning, dialogue, reflection, external perspectives and so on. In other words, participants will be actively creating personal and content knowledge. The section will provide an example of complexity-based learning in the programme that has incorporated elements of complexity theory in the design of the programme (Ng, 2013). Complexity theory establishes the founding knowledge in understanding the school as a complex organization, as well as an important stakeholder in addressing the demands of the nation.

8.1. Knowledge creation through innovation project

Participants are attached to a school throughout the programme and they spend regular weekly time in that school carrying out a major innovation project. They receive support and guidance from the principal of the school, the superintendent and a university faculty member. The project is expected to help the school to improve in leadership and management practices that lead to student learning and is meant to be a profound learning experience for the participant.

The school attachment provides the platform for participants to create new knowledge. In the short time that they spend in the school attachment, they must lead others (teachers, students, parents) to do new things and must find different ways of doing existing things. The goal of creating new practical knowledge is to take the school to a higher level of achievement.

In brief, the project involves them in challenging current practices by looking at a school from the standpoint of its strengths, and then identifying a range of innovation opportunities. From these opportunities, participants will select a potential idea for a comparatively significant innovation.

The key element in this learning project is the emergence of a workable innovative idea. This parallels complexity theory's element of emergence and autopoiesis where participants self-create knowledge (learning) during interaction with the stakeholders and components in the school system.

The implementation of the innovation project is a powerful test of their leadership capability. To date, participants have successfully completed a wide array of innovative projects and many of these projects have been sustained by the schools.

8.2. Syndicates

The syndicate is a key component of the programme. Participants meet in a small group setting (five or six members) and the syndicate leader who is a faculty staff will act as a facilitator. The syndicate leader will monitor participants' learning throughout the programme, including the school attachment, the innovation project, the learning from the international visit and the broader classroom-based learning. An intensive learning relationship will thus develop between participants and their syndicate leader, and among fellow participants. The syndicate meetings take place on a weekly basis.

The basis for syndicate meetings is to encourage divergent and exploration thinking through conversations. Conversations are complex responsive processes of themes triggering themes through self-organizing associations (element of self-organizing in complexity theory) and turn taking that both reflect and create power differentials in relationships. These conversational processes within the group result in a continually emerging of thoughts of the individual. Individual and group relationships are also co-created and emerge together as they participate in the deep conversations. In essence, syndicate meetings provide the opportunity for change for the individual and the group when the pattern of conversation changes because it is this that organizes their experience.

If one takes this perspective that an organization is a pattern of talk (relational constraints), then organization changes only insofar as its conversational life (power relations) evolves. Organizational change is the same thing as change in the pattern of talk and therefore the pattern of power relations. Creativity, novelty and innovation are all emergence of new patterns of talk and patterns of power relations.

8.3. Partnerships in learning

Much of the learning is through strong partnerships with schools, business organizations and educational institutions both in Singapore and in overseas, and is supported by learning in the university class and tutorials.

These participants are exposed to leadership in the business organizations and to ideas from various sources, including government organizations. To further enhance such influences, key officers are invited from the education, civil and other ministries to engage in dialogue with participants and to observe some of the work undertaken on the programme.

There is also an international component to the programme. This is a two-week all expenses paid international visit by the participants led by the syndicate leader and a senior school principal. The team investigates successful innovative practices overseas, undertakes critical analyses and gains significant insights into how educational innovation in Singapore might be managed. The inclusion of this component, while not unique, provides an extended platform of learning on the international stage. Thus far, participants have visited Switzerland, the USA, the UK, Canada, Scandinavian countries, Europe, China, Australia and Hong Kong.

Therefore, a global approach of learning is adopted. The exposure to a larger local and international systems will inadvertently triggers thoughts and perspectives in participants. Although the larger system may seem independent of the responsibilities of the participant as a principal-in-training,

there is no doubt that the larger system is directly or indirectly connected. In other words, what happens in the social and economic aspects of the USA and Europe, for example, may influence how leaders re-shape and re-focus student learning and development in Singapore. This parallels the element of emergence in complexity theory where the influence of the larger system may cause a reformulation of perspectives and behaviour of the individual.

8.4. Action learning delivery: content as learning support

While the interest of most leadership programmes is directed at the "content" of a programme, the LEP emphasizes on "delivery" as the focus of learning. The content is there as learning support, but the delivery architecture is what sets it apart from other programmes. Action learning is a central concept in the delivery of learning. In this concept, participants know what they are taught, but they do not know what they will learn. They have to create their own knowledge though team learning, and this takes place in what is call "syndicates", group of six or seven people meeting weekly and facilitated by a university professor. They know what knowledge they have created only when they come to the end of the programme through these intensive weekly meetings.

In the LEP, action learning is understood as group learning among people who are committed to action by using acquired learning for obtaining systems-wide outcomes. Its original formulation by Marquardt (1999, p. 19) is L = P + Q, where L = learning, P = programmed knowledge and Q = questioning insight. In the LEP, programmed knowledge (P) refers to what is taught in the seven modules, what is read, presentations by guest speakers and all other opinions, theories and know-how shared. Learning (L) is different from the traditional formulation, which equates learning and programmed knowledge. In LEP, the seven modules are relegated to a support role.

8.5. Evidence of complexity-based learning from the LEP programme

The following section highlights a few examples of the complexity-based learning outcomes developed and created by the participants.

8.5.1. i-CREATE Portal @ Chung Cheng High School (Main)

This project capitalizes on two key strengths of the school—a strong Chinese culture and a well-placed ICT infrastructure. The core idea behind this innovation project is to examine the potential impact of a knowledge management portal in the school where students and teachers can create, learn and share new knowledge. It is also about developing a repository for the knowledge created. Knowledge can be broadly categorized as both explicit and tacit knowledge. With the advent of technology, there has been a greater creation of tacit knowledge by our students in schools as they are now no longer mere consumers of knowledge, but rather, they are now producers or co-creators of knowledge. Hence, a key question for inquiry was as follows: how can schools tap on this tacit knowledge created by students and the school community for further learning and sharing? Based on the identification of the school's strengths and the students' readiness, as well as the objective to create value for the school, the i-CREATE Portal @ CCHM was conceptualized. The i-CREATE Portal allows teachers and students to leverage on this platform to create, share and learn from Podcast Recordings, Digital Authoring and Publishing as well as Short Filmmaking. The portal also supports other forms of ICT-driven learning and sharing. This pilot project will serve as a scalable prototype model of various ICT-based pedagogies that could be adopted or adapted by other subject areas in the school. This project is done in collaboration with both the Chinese and ICT Departments of CCHM and Ask N Learn Pte Ltd.

8.5.2. Seeds of change, growing leaders @ Yuhua

A student leadership framework, inspired by the research of Kouzes and Posner (2007), is designed to set the direction and guide student leadership development in the school curriculum. This working model articulates a clear vision, philosophy, desired outcomes, assessment structures and tools and key approaches in leadership identification, development and review.

Technology is harnessed to simplify and create value in the monitoring of individual students' learning via an E-portfolio. The E-portfolio is a multi-faceted, one-stop online portal that chronicles

the individual student's leadership journey. Features include 360° feedback and assessment that highlights strengths and areas for improvement, guided reflections, action plans, and records of training and experiences

9. Conclusion

In leadership development programmes, many hope that the participants will learn new and effective ways to bring about school innovation and reform through a well-taught programme. In programme delivery, while the international trend in education is a shift from teacher-centred to student-centred learning and from transmission to reflective approaches, most educational leadership programmes have remained heavily teacher-centred (Barr & Tagg, 1995; Ng, 2001). The need to rethink programme delivery has gathered momentum over the years and the call for changes in programme content has been much discussed in literature even in the early 1990s (Hallinger & Leithwood, 1998). Universities have to shoulder an extremely difficult task in this respect, because conventional practices of course-driven programmes have been remarkably resilient over the years in the face of efforts to effect change in programme delivery and a new understanding of complexity in the world of education. School leaders have to navigate non-linear change-paths, and learning how to navigate this kind of change is a critical competence for twenty-first century change-leaders in school systems. As Lauder and Hughes (1999, p. 135) note: "it is clear that the world is a far more complex place than they envisaged".

The complexity theoretical framework provides us the advantage of an alternative design for leadership development programmes that is able to meet current and future challenges that are mentioned by Cheng and Tam (2007) and Stacey (2001). Yearly, billions of dollars are spent on training and development. It is important to ensure that the outcome of training, learning and development must yield practical outcomes that are innovative and implementable.

One of the goals of this paper is to provide a conceptual understanding of learning and design paradigms that determine eventually the outcome of learning. For more than 50 years now, the behavioural-based design has dominated the learning, training and development landscape in schools, higher institutions of learning and training and development organizations. The alternative complexity theory-based design school be seriously considered as a viable and sustainable alternative to generate learning that matches the challenges and complexity of the twenty-first century.

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