Public Policy as a Complexity Paradigm

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Abstract

According to the linear methodology, the whole is broken into parts, each part is examined and studied independently, and then the parts are reconstructed along with their collective meanings in hope of understanding the whole. The process is controlled, hierarchal, lacks subjectivity, and utilizes rationality, planning, and prediction. Irregularities and errors are dismissed as outliers. Such a model is successful in explaining stable phenomenon when a system is at equilibrium and changes in the environment are not yet necessitating internal changes within the system.

However, when a system is at a state of disequilibrium, as the new globalization dichotomy dictates, changes in the environment requires internal and corresponding systemic self-organization through feedback mechanism, and when information is scares, unpredictable and flux, the linear model is unacceptable of neither observing nor explaining the transcendent phase shifts in both the system and its environment. This is due to the linear model's constraint with traits such as prediction, long-term planning, objective reality, rationality, and controlled methodology that all play as obstacle elements in the understanding of a complex, unpredictable, flux, non-reductionist, and randomly changing dynamics. The examples of the Iraq War, the Afghanistan War, the financial crisis of 2018, and the pro-democracy movements in the Middle East are illustrations of such failure.

Complexity sciences, on the other hand, utilize subjectivity, network, process, relationship, holistic observation, and autonomy. These traits enable them better deal with the flux and unpredictable nature of change and better prepare for random self-organization without control, hierarchy, long-term planning, prediction, and objectivity. Instead, they employ cooperation, anticipation, forecasting, subjectivity, process, network, and relationships.

Because of this, using dimensions from the complexity sciences as a teaching strategy can be beneficial and useful in explaining the unpredictable and non-linear nature of public policy from a holistic (global) perspective while appreciating the vast and complex interplaying factors playing in the emerging dynamics of a particular phenomenon. This does not mean, however, that the traditional linear methods in teaching public policy ought to be abandoned or replaced with a non-linear approach. Rather, this paper suggests that the current methods in teaching public policy could benefit much greater as citizens are shifting toward global participant-observers if such methods adapted dimensions of complexity sciences in their teaching strategies.

Keywords: Complexity Dimensions, Teaching Strategy, Public Policy, Flux, globalization, and Unpredictability.

Introduction

Public policy is a complex, global phenomenon. This means that it exhibits complex and chaotic behaviors that cannot be fully uncovered and understood through the traditional linear observation which promotes concepts such as control, local causality, instrumentalism and breaking the whole into building blocks. This article addresses the inability of the linear model in teaching public policy and its global flux and unpredictable nature. The article offers a strategy to apply complexity dimensions in the teaching of public policy in global context that emphasizes autonomy, network, relationships, flexibility, forecast, and subjectivity.

The research design used in this article is qualitative because of the depth of information that words, and content analysis can provide in explaining the application strategy of a complexity-based model in teaching public policy.

The article does not suggest that the current strategy in teaching public policy to be abandoned or replaced by a complexity-based model. Rather, the non-linear and unpredictable nature of public policy can benefit much more if taught by incorporating dimensions from the complexity sciences in its teaching strategies.

The world of public policy, like any other living system, is not static and continually changing, moving through cycles of equilibrium, oscillation, chaos, collapse, emergence, equilibrium, disequilibrium-equilibrium, oscillation, and so on. The cycle of birth and rebirth is continuous for public policy as a dynamic system to live within changing conditions in its environment (Smith, 2007). Such transformation is irreversible, non-predictable, determined, and interconnected (Richardson and Goldstein, 2007). Delaying the systemic evolution of public policy through artificial engineering will create catastrophic results (Brown, 1995). Therefore studying public policy through complex models is important in order to allow for the participant/observers to examine its natural progression and cyclical dynamics and prevent any attempt artificial engineering that will result in more harm than good (Harrison, 2006). Systems, including public policy, do not live independently in the world (Harrison, 2006). There is no starting or ending points in the system's web of associations and interconnected networks (Newman, Barabasi and Watts, 2006).

Changes within these systems are not predictable and thus it is fruitless trying to anticipate the nature and timing of these changes or planning to deal with them (Miller and Page, 2007). Rather, these systems are in continuous state of flux, unpredictable, interconnected, and involve mutual causality through negative and positive feedback that trigger multiple internal and external changes within a pattern of association and interconnected relations (Morgan, 2006). Every trigger in the environment will be corresponded with changes within the system's internal dynamics, while such changes result in impacting the environment in return within series of interactions and feedback. Triggers can vary in size and magnitude (Nowak, 2006). Most triggers are small in magnitude yet the resulting changes within the system's internal dynamics can be large (Lorenz, 1996). Hence, Lorenz's famous question "Does the flapping of the butterfly wings in Brazil cause a tidal wave in Texas?"

Most natural sciences are linear. Social sciences, on the other hand, are complex (Miller and Page, 2007). Yet, the complex nature of social sciences is often misunderstood. This is because we, as human beings, inherit our knowledge linearly and it is difficult transferring it to complex domain (Taleb and Blyth, 2011). Nevertheless, we live in both the linear and non-linear worlds simultaneously. Our linear domain is characterized by predictability and the low degree of interaction among its components. This allows us use mathematical methods to make forecasts (Guastello, 2002). In the complex domain, we are devoid of visible causal links between elements and rely, instead, on interdependence and extremely low predictability (Kauffman, 1993). This is where a complexity-based model can become useful in explaining causality, interdependence, and low predictability.

One of the errors we do when we are in the linear domain is we have an urge to control (Capra, Juarrero, and Uden, 2007). We do this in our daily routine interactions, or in public and economic policies (Harrison, 2006). Although all indicators point to the contrary and results demonstrate the fatality of such behavior, we, nevertheless, persist on maintaining this trait (Buchanan, 2003). In addition to control, we also exhibit another fatal tendency that we inherit from the linear domain, which is the propensity to predict (Brown, 1995). After the financial crisis of 2007-8, for example, many people though that predicting the subprime meltdown would have helped. It would not have, since it was a symptom of the crisis, not its underlying cause (Taleb and Blyth, 2011). Life is not predictable (Barabasi, 2003). No matter how much time we spend on devising models and instruments for predictability, we will never be able to trace chance (Capra, 2004). Because of this, we fear chance and randomness (Juarrero and Rubino).

However, when we live in our complex domain and allow for complexity to assist our analyses and observations, we can rescue ourselves from control, prediction, and fear of randomness. Therefore, we ought to welcome variation as the source of information. We also ought to observe the system itself and its fragility, not events. And we ought to apply percolation theory by studying the properties of the terrain rather than single elements (Capra, Juarrero, and Uden, 2007).

By understanding public policy globally and through a complexity lens we can create a new way of thinking about changes in governance and citizen participatory that will enable us better to understand the flux nature of our world and its shared-reality construct (Kiel and Elliott, 1997). A complexity-based model can enrich the teaching of public policy by helping us better deal with changes without control, predictions, long-term planning, and artificial engineering (Harrison, 2006). Perhaps the most fatal and dangerous element we had inherited from the linear domain is our tendency to prevent systemic volatility and persisting on the illusion of maintaining “stability” through artificial engineering (Goldstein, 2007). This type of error, often adapted by policymakers, is the recipe for disaster and often results in catastrophe (Brown, 1995).

Research Questions

1. Why the need to teach public policy as a global, non-linear science?
2. What are the problems caused in teaching public policy according to a linear strategy?
3. What are the benefits gained in applying complexity dimensions to the strategy of teaching public policy as a global concept?

Research Design

This research uses qualitative methodology and analysis with the investigator as a participant-observer. The analysis involves tracing concepts that compose evolving themes. The behavior of these themes is utilized through content analysis in order to explain the contrast between two strategies in teaching public policy, one according to a linear model and another according to the application of complexity dimensions to the teaching strategy. Ethnograph is used to help in identifying emerging concepts. Group A involves teaching public policy as a traditional linear model. Group B involves teaching the same subject while applying complexity dimensions to the teaching strategy. No personal information of participants is collected. For Group A the investigator assigns a syllabi, readings, textbooks, and assignments. Traditional role of an instructor is emphasized to set objectives, structure, and assess learning outcomes through evaluating performance, participation, presentation styles, and exams. For Group B, the investigator restrains from a hierarchal and controlled methodology. Instead, he acts as a facilitator who encouraged autonomy, self-assessment, subjectivity, and growth. Learning assessments are measured collectively as a network through students' interaction and coordination. No textbooks, schedules, or syllabi are assigned by the instructor.

Complexity dimensions are introduced to observe the complex and unpredictable nature of the nonlinear public policy in global context. Teaching is bottom-up through empowering participants to become active participant-observers. A new state of awareness is encouraged through dynamic participation (Capra, 2004). Attention shifted from a particular unit (building-block) in the observation process to the overall relationship and pattern created by the system (Kelso, 1995). As such, the complexity-based model in the teaching strategy acts as a pedagogical agent in transforming participants from passive individuals to cognizant global participant-observers (Kiel, 1999).

Teaching Public Policy in Global Context

There are various dimensions driven from complexity sciences that can be applied to the strategy of teaching public policy in global context. These included the **nature of change, relational operations, non-locality, continuous flux, the paradigm of Taoism, shifting objects to events, Kondratev Cycle,** and **removing theory from abstract** (Dawoody, 2011).

Nature of Change

The Nature of Change is when dynamic systems exhibit temporal behaviors. Change becomes uncertain, unpredictable, emergent, and transcending and the system's parameters with its environment become fused, allowing through ongoing relationships. A typical dynamic system can exhibit a variety of temporal behavior. When the behavioral history of a system is examined, the nature of change becomes the core of its inquiry (Brown, 1996). If a system becomes unstable, it will move first into a period of oscillation, swinging back and forth between two different states. After this oscillation stage the next state is chaos, and it is then the wild gyrations begin (Wheatley, 2006).

If we look at public policy as a dynamic global system and examine the nature of changes within it, we can see these changes requiring oscillation, chaos and the birth of new order. However, often these changes are artificially engineered in form of reforms to stop the systemic collapse and prolong its decaying structure beyond its natural time. When observing public policy as it reacts and interacts with its environment, we need to realize that fluctuations can take place (Kendall, Schaffer, Tidd and Olsen, 1997).

Fluctuations are initiated by changes in the environment and lead to corresponding changes within the system through positive and negative feedback. Positive feedback translates changes in the environment to more changes in the system's internal dynamics, and fewer changes in the environment will lead to fewer changes within the system. Negative feedback, on the other hand, is when more changes in the environment lead to fewer changes within the system while fewer changes in the environment lead to more changes within the system (Morgan, 2006).

This environmental stochasticity increases the probability of some policies of program extinction. Policies and programs that evolve are those who are selected against (Kendall, Schaffer, Tidd and Olsen, 1997). The evolutionary feedback, according to De Greene, is characterized as non-equilibrium conditioning which leads a dynamic system toward crossing a critical threshold. Beyond this threshold the system becomes structurally unstable, which leads to dissipation for further evolution (1996). The system's interactions with its environment are continuous, fused through its parameters that act as sensory receptors to capture changes in the environment and transmit them to the system's internal dynamics for corresponding changes (Kauffman, 1995). The resulting configuration within the system's internal order is emergent, allowing for new structures, patterns, and processes to emerge through self-organization to fit best with the changing dynamics in the environment (Vesterby, 2008).

Relational Operations

The relationship between the system and its environment is an active relationship that benefits from feedback and translates into systemic morphology (Ruelle, 1993). Stimuli from the environment and the system's response are based on short or long-term transitions and corresponding changes in the system's internal dynamics are irreducible, unpredictable, and complex. Relational Operations is when interactions between a dynamic system and its environment are relational based on feedback. Kicks that take place in the system's environment are stimuli, causing internal disheveling within the system's structural order and processes. The self-organization process is the system's response to environmental stimuli. These relational operations are random and irreducible (Dawoody, 2011).

The relationship between a system and its global environment operates on feedback that is either positive or negative (Morgan, 2006). Feedback as stimuli is retransmitted by the environment and cause random changes in the agent's internal processes (Wheatley, 2006). This behavior contains the agent's morphology from static equilibrium to a state of chaos and disorder. Disorder then leads to new structures and practices (Prigogine, 1996). The phase-shifts from equilibrium to disequilibrium to equilibrium are self-organizing and irreducible, and unpredictable (Nicolis and Prigogine, 1989). Understanding public policy through phase-shifts dynamics and relational operations instead enable us capsulate the bigger picture in change dynamics and have better appreciation of the multilayered dynamics that interplay during their display (Richardson and Goldstein, 2007).

Non-Locality

Non-Locality is when reality has fuzz indeterminacy. Something that occurs in region A can have an effect in region B instantaneously regardless of how far apart these two regions happen to be. It runs against the traditional local causation in traveling the space between building blocks (Dawoody, 2011).

Something that occurs in region A can have an effect in region B instantaneously regardless of how far apart these two regions happen to be (Albert, 1999). This notion is known as nonlocality or non-local causation. It runs against the traditional local causation in traveling the space between building blocks (Morcol, 1999). No longer are we able to assume that our experiments and observations tell us anything concrete about reality. Whatever reality is out there, it has fuzzy indeterminacy (Evans, 1999). The world is a world of participatory collusion among particles in which entities separated by space and possess no mechanism for communicating with one another can exhibit correlations in their behavior (Overman and Loraine, 1996). Structures collapse and evolve because of consistently small reasons that grow larger and become more complex (Brem, 1999).

Continuous Flux

Continuous Flux is when the nonlocal way of nature is characterized by a continuous flux. A flux system is a dynamic, non-static system. It is always evolving, always changing, and always responding to stimuli from its environment. During such a system one never steps into the same waters twice since these waters are continually moving (Dawoody, 2011).

Public policy's nonlocal way of nature is characterized by a continuous flux. A flux system is a dynamic, non-static system. It is always evolving, always changing, and always responding to stimuli from its environment. During such a system one never steps into the same waters twice since these waters are continually moving. Public policy, like any other public service program, is a political process. For a political process to function linearly, incremental measures are taken instead of a comprehensive approach (Lindblom, 1959). Whenever government engages in a comprehensive systemic approach, the result often yields unintended consequences that the linearity-trained decision-makers unable to accept or understand.

The Paradigm of Taoism

A Complex approach better understands flux, living-in-the moment and anticipating change than controlling. Tao is when the flow of opposite energies determines the nature of dynamic system, and all trends eventually reverse themselves (Dawoody, 2011). Complexity is an encompassing perspective (Wheatley, 2006). It builds on Western as well as Eastern philosophies. One of those contributors is Taoism. According to this understanding, contradictory elements in the world are complimentary elements. The flow of opposite energies determines the nature of dynamic system. All trends eventually reverse themselves shaped by the dynamic interplay of yin and yang, a metaphor referring to the dark and sunny sides of a hill (Capra, 1991). To build on this perspective, public policy can benefit from the understanding that all things are relative, and all things matter.

Shifting Objects to Events

Shifting Objects to Events is when truth is seen not as an attribute inherent in a system but as the meaning we attribute to that system. This kind of ontological liberation is evident in the paradigm shift from part to whole, from structure to process, from objective to epistemic science, and from building block to network (Dawoody, 2011).

We are no longer constrained by a single ontological model. Truth can now be seen not as an attribute inherent in a system or event but as the meaning we attribute to that system (Buchanan, 2003). This kind of ontological liberation is evident in the paradigm shift from linear observation to the world of complexity sciences (Wheatley, 2006). These types of shifts include moving from structure to process, from objective to epistemic science, and from building block to network (Evans, 1999). Complexity and its model free us from the burden that comes from needing to control rather than to evoke process and relationship (Overman and Loraine, 1996). This understanding forces us to examine public policy not through the isolated observation of its building-blocks, but in relationship of these particles with themselves and the environment of the system (Johnson, 2002).

Konddratev Cycle

Kondratev Cycle is when evolution shows movement from non-equilibrium to equilibrium to equilibrium, and so on. This process is irreversible. Because of the irreversibly of structural change, the specific structures would not be the same. Features within a cycle can spill over to the next cycle. These cycles of non-equilibrium, complexity, instability, and structural change is known as the Kondratev Cycles (Dawoody, 2011).

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Removing Theory from Abstract

Finally, Removing Theory from Abstract is when the purpose of theory becomes making the world stand still while our backs are turned. Complexity shifts theory to an engaging and participatory forum that will change students from observers to citizen participant-observers able to cycle theory through practical observation (Dawoody, 2011). Complexity enables us to transform theory from an abstract notion to an engaging and participatory forum (Barabasi, 2003) that will change us to citizen participant-observers. The understanding enables them to learn how chaos really works, and the forces that interplay in shifting a system through continuous cycle of change (Buchanan, 2003). Out of this chaotic behavior new structures emerge that are sustainable since they are a better fit with the changing environment (Strogatz, 2001). This understanding can transform students from blank slates into autonomous agents of change within the dynamic and evolving system of public policy.

Findings

Data resulted in the emerging of 97 concepts that were utilized by Ethnograph in the content analysis. These concepts formed eight themes that included **control**, **breaking the whole into parts**, **one-best-way**, **prediction and planning**, **clockwise movement**, **artificial engineering**, **instrumentalism**, and **one-dimensional**. By observing the contrast in the behavior of these themes between Group A and Group B, a contrast is drawn between two strategies in teaching public policy, a strict linear strategy and a complexity-dimensions applied strategy in a global context.

Control

In relation to Control, teaching public policy as a complex system required empowering students in Group B to be autonomous, self-organizing within groups, self-governing during the observation process, and examining the administrative system as an interconnected web (Dawoody, 2011). The educator's role was to be a facilitator to guide the learning trajectory. In serving as a facilitator, the educator became a strange attractor (Gleick, 1988), thereby creating instability within the status quo of the students' observation that eventually led toward the emergence of new form of learning that is complex, in-depth, holistic, and comprehensive (Wheatley, 2006).

This new form of learning and the resulting awareness identified internal patterns of adaptation (Juarrero and Rubino, 2008) within the students through networking and engagement. The class acted as a network to observe public policy as a complex system (Miller and Page, 2007). The autonomous and empowered students in Group B and while interacting with one other and perceiving their subjective views were encouraged and welcomed, they were able to demonstrate their potentials for generating findings in ways that was not possible in Group A whereby “control” was applied, the instrcutor acted as a guru (Caplan, 2002), and students were perceived as blank-slates in a top-down teaching methodology.

Controlling the systemic order within an autocratically structured dynamics deprived the classroom in Group A from autonomous decision-making process of the affected students/agents (Gilbert, 2008). This rigidity had opposed internal changes necessary to deal with environmental changes outside the classroom (Vesterby, 2008) and rendered the learning process incapable of dealing with emerging conditions (Johnson, 2002). Because of this, the second strategy applied in Group B opposed control (Lewin, 1999) and encouraged students’ autonomy (Gilbert, 2008) and networking (Kelso, 1995). Under this strategy control shifted to influence with students moving through the processes of learning to acquire awareness of emerging dynamics (Buchanan, 2003).

Breaking the Whole into Parts

In relation to Breaking the Whole into Parts, the linear strategy applied in Group A had adapted the methodology of inquiry by breaking a system into parts, studying each part separately, and then composing all parts together to understand the whole (Wheatley, 2006). This methodology, however, was ineffective and students missed the “bigger” picture when they broke it into parts (Dawoody, 2011). To understand the function of a system it must be studied as a functional whole, not through isolated and separated parts (Richardson, 2005).

It is the interconnectedness of the various complements of a system while interconnected gives us an understanding of how the whole works and functions, not the other way around (Kauffman, 1995). The second strategy applied in Group B had resolved the linear dilemma with students observing issues in public policy as a system and within its entirety as series of interactions and process (Barabasi, 2003), connecting both internal and external factors and players (Nowak, 2006), and observing internal and external changes that morphed through phase shifts, continuous cycles of structural changes (Miller and Page, 2007), birth and rebirth (Smith, 2007), and equilibrium-disequilibrium-equilibrium (Prigogine and Stengers, 1984).

One-Best-Way

In relation to One-Best-Way, in most institutions of higher learning, public policy is taught according to one-best methodology. One-best-way finds its roots in Scientific Management (Taylor, 2010). This approach was also used in Group A, emphasizing time and motion, division of labor (such as assigning team leaders, moderators, and presenters in groups), breaking the system into part and then analyzing each part independently, managing information and its flow, and emphasizing bureaucratic structures over processes, methods over substance and instrumentalism over human factor (Dawoody, 2011).

This approach stood in contrary to common sense. How could a single methodology apply to all areas in public policy? How could one tool be adequate to be used in all applications? The complexity-based model in Group B offered students a new direction. It was perceived as a perspective that opened possibilities for consideration of multiple perspectives and unexpected order (Wheatley, 2006). In Group B, there was no one-best-way. Instead, the teaching and learning strategy emphasized the approach of "it depends", especially when every situation and condition examined was different and unique that required unique observation and solutions (Lewin, 1999). "It Depends" lacked control, rigidity, top-down, and one-size-fits-all methodology.

The application of complexity dimensions to the teaching strategy for Group B had utilized the Agent-Based Model instead of one-best-way approach (Gilbert, 2008). Each student in the group was autonomous and interacted with other students and the environment outside the classroom through networking. Each student had the potential of influencing the entire network as well as other associated networks in the environment, benefiting from the "butterfly effect" in which a single event can be dramatically magnified into an exponentially increasing dynamic.

Within this transformation, both the student (the agent) and the network went through self-reorganization and restructuring to cope with the changes in the environment (Goldstein, 1994). Within this model, there was no starting or ending point, top-down relationships, control, or one-size-fits it. Each event that was observed by any student/agent in the network was the shared experience of the entire network (Newman, Barabasi, and Watts, 2006). Solutions were applied as situation dictated and required by each autonomous student/agent. Decisions were also made by each student/agent autonomously and while in cooperation with other agents in the network. These decisions were process-based and responded to changes both internally within the classroom's learning dynamics and in the outer environment (Hazy, Goldstein and Lichtenstein, 2007).

Prediction and Planning

In relation to Prediction and Planning, in a world of uncertainty, we can no longer rely on a naïve confidence that long term results can be accurately predicted (Strogatz, 2000). Instead, the emphasis needs to shift to a much greater flexibility which prepares any current structure to respond to unprecedented changes (Dawoody, 2011). When changes occur in the environment, we need to allow a dynamic system the capacity to change from within to the degree of collapsing its existing order to for the new order to emerge (Vesterby, 2008).

Lorenz's butterfly effect teaches us that small changes within the initial conditioning will result in larger changes in the longer trajectory of a dynamic system's morphology (Lorenz, 1996). Since many forces interplay in the system's morphology, attempting to map out its long-term trajectory is fruitless because such a trajectory is always changing due to the constant interplay of internal and external forces (Saunders, 1980). In public policy, Lorenz' formula holds. If it is fruitless trying to predict the weather accurately beyond five days, it is also fruitless trying to predict changes in policy dynamics beyond the foreseeable future. This will also negate the necessity for long-term planning (Juarrero and Rubino, 2008). Instead of prediction and long-term planning, complexity moves us to anticipation and prepares us live in-the-movement (Richardson and Goldstein, 2007). The learning outcome of this was to accept the unexpected consequences, acknowledge the uncertain outcome of deterministic system, and include patterns of observation in uncovering the processes of change (Kelso, 1995).

Clockwise Movement

In relation to Clockwise Movement, the linear application in Group A described a phenomenon clockwise. Time and motion, according to this model, were reversible (Hawking, 1998). A phenomenon was reduced to parts, functions, and building blocks (Wheatley, 2006). The complexity-based application in Group B, however, did the opposite (Dawoody, 2011). It welcomed pluralistic and multi-dimensional view of an observed phenomenon (Lewin, 1999). Time and motion, according to the complexity-based model, were irreversible. The main prism of such approach was that simple systems demonstrated complex behaviors which were self-organizing (Morcol, 1999).

Self-organization is the idea that living systems are capable of self-organize themselves in ways that all their components and processes can jointly produce the same components and processes as autonomous agents (Vesterby, 2008). This concept is also known as autopoiesis (Maturana and Varela, 1991). A key notion of this concept is self-referentiality (Sandri, 2008). The idea of self-reference designates the unity that a dynamic system is for itself, and that unity can be produced through relational operations (Little, 1999).

Autopoiesis and self-referentiality cannot be observed clockwise. They must be understood within processes of change that are multi-dimensional, multi-layered, multi-directional, and continually morphing in a state of flux within an irreversible trajectory of time and motion.

Group B followed this multi-dimensional, multi-layered, and multi-directional trajectory of irreversible movement in time. Group A, however, and by observing public policy clockwise, had deprived its members seeing the entire encompassing picture of public policy and captured only a glimpse of its trajectory within limited sectional aspect that was both incomplete and inadequate.

Artificial Engineering

In relation to Artificial Engineering, linearity is the science of mapping events along a linear line. Causal relations between these events are local (singular). There are corresponding elements along the line between events and their environments. However, emphases are on gravity, inertia, control, goals, future, and predictability (Wheatley, 2006). The line has both starting and ending points and it is one directional (Dawoody, 2011).

In Group A, students observed linear trajectories as these trajectories adhered to rigid structures for the purpose of setting goals to their projects as well as plans for modifications (Morgan, 2006). However, when the structural elements in their projects were incapable of dealing with continuous environmental changes of an observed policy, more modifications (artificial engineering) were induced to sustain these projects beyond their natural lives instead of abandoning them and design better projects that best fits the changing requirements (Saunders, 1980). Emphases in Group B, on the other hand, were on synergy, in-the-moment, selforganization, relationships, patterns of similarities and differences across time and space, mutual causality, awareness, and transformation through emergence (Juarrero and Rubino, 2008; Nicolis and Prigogine, 1989). Instead of a line, there were loops in students' observations and analyses.

Students in Group B utilized networks and interconnected dialogue with one another (Brown, 1995). Interactions with the outer environment of the classroom were on-going based on continuous relationships that the students had established with outside networks (Johnson, 2002).

Changes that take place outside the class acted as "kicks" to generate changes within the group's learning dynamics and internal dialogue. Communications, as such, was based on positive and negative feedback (Morgan, 2006).

Environmental kicks were received by the students in Group B through the group's sensory receptors (personal relationships, professional association, and ICT) which acted as strange attractors to prepare the group internally to reshuffle its internal dynamics and change its older to correspond with changes outside the classroom. If the internal order in the group was incapable of change, then the group's entire structural order had to collapse to allow for a new structural order emerge and deal with the new environmental changes (Prigogine and Stengers, 1984). Sustaining the older structures through artificial engineering may had bought the group some time, but it would not prevent its ultimate collapse (Brown, 1995).

Group A, instead, had refused the concept of collapse in totality and focused instead of series of modifications to its group dynamics and project goals. Without the collapse of older structure there will be no birth of a new order. This concept is also referred to as bifurcation (Kuznetsov, 2010), and translated in phase shifts in the order of the system's dynamics (Wheatley, 2006). As the self-organizing order emerges out of the interaction of elements within the system, the system own parameters become unstable, and the older order starts to collapse (Brem, 1999). Public policy must be understood according to this perspective to safeguard it from costly errors of resisting change or attempting artificial engineering (Richardson and Goldstein, 2007). This is what Group B had understood best and was ready to apply to their project and anticipate the consequences of collapse (if took place, which meant terminating their project) than Group A.

Instrumentalism

In relation to Instrumentalism, in Group A, the "instruments" used for the study of public policy became the ends of the group's function (Dawoody, 2011). The purpose of the study or the administrative function was no longer considered to be the objects of the performance. Rather, instrumentalism on its own emerged both as means and the ends (Setiya, 2010). This approach created divisions, rifts and conflicts among students that diverted their focus from stated goals toward the secondary issue of "tools." Group B, on the other hand, regarded itself as part of the process. Instruments were interactive parts of observations, not independent of it. The validity of instrumentalism held true if it was useful to the observation process. It did not replace the process, nor did it become its goal (March and Simon, 1993). Instrumentalism, in Group B, was part of the process evolving toward better observance of changes in the internal and external dynamics of the observed phenomenon (Wheatley, 2006). Most importantly, members of the group put themselves within the process of pattern-forming as tools and transformed as well during their observation of the phenomenon.

One-Dimensionalism

In relation to One-Dimensionalism, linearism is based on one-dimensional approach toward observing a phenomenon (Dawoody, 2011). Within Group A there was no room for subjective views or pluralism of ideas. Possible interpretations outside the group collapsed into one linear approach in sake of one-dimensional observation (Simon, 1997). Group B, on the other hand, looked at a dynamic system as a composite of interconnected relationships (Miller and Page, 2007). What the contrast between Groups A and B had demonstrated is that public policy suffers greatly if observed solely through a strict linear approach. The world of policies and governments, according to Little (1999) is unclear, often conflicting with top-down systems of accountability that are easily transformed into constraints. As such, this world produces policies that are inherently less responsive, less effective, and less efficient. Any attempt to observe this uncertain world and its policies through predictable lenses will be pure theoretical and lack validity in the real world. Group B emphasized on welcoming uncertainty and the shade of "gray" into their observation and shy away from abstract (Wheatley, 2006). Group members learned to shift their attention toward process and patterns building, chance, phase shifts, coordination, multiple of binders (strange attractors), collapse of older orders and welcoming the emergence of new, random structures and processes (Harrison, 2006). This type of learning is self-transcending, self-organizing, irreducible, unpredictable, incommensurable (does not have common measures), and evolving (Johnson, 2002).

Conclusion

There are clear differences between the education systems in different countries, regions, states, or even municipalities. Yet, this paper chose its samples from these different educational settings to uncover the differences not in the two educational systems but rather between two strategies in teaching public policy. One strategy applies strict linear methodology while the second strategy benefits from the application of complexity dimensions within a global context. In incorporating complexity dimensions to the understanding of public policy in global context, students can benefit greatly regardless of their educational settings.

Complexity dimensions can strengthen the traditional teaching strategy of public policy by tapping into areas that the strict linear application is incapable of explaining. This is due to the complex nature of public policy itself. In doing so, new models in teaching strategies can develop to move our understanding of public policy toward new awareness and enable students of public policy bridge between the classroom and the outer environment in order to engage as participant-observers in the true process of personal and systemic changes. To this end, this paper recommends the following as part of a new teaching strategy of public policy that benefits from the application of dimensions derived from complexity sciences:

1. Encouraging policymakers, public administrators, researchers, analysts, educators, students, and academic institutions transform their inherent linear knowledge and methodology to properly adapt dimensions from the complexity sciences.

2. Establishing a symbiotic relationships and engagements between linear and non-linear applications to emerging issues and systemic analysis.

3. We ought to be comfortable in simultaneously inhabiting both the linear and a complex domain and offer complexity analysis and solutions prior to crisis.

4. We need to train policymakers, public administrators, educators, and students to avoid control, predictability, the use of catalyst as cause, explaining systems through events (especially last events), or the low degree of interaction among components in a system.

5. We ought to be comfortable with the absence of visible causal links between elements or masking a high degree of interdependence and extremely low predictability.

6. We need to welcome randomness, uncertainty, and variation as the source for information.

7. We need to allow for volatility to take place for the complex system self-organize itself.

8. We need to avoid artificial suppression of volatility as well as artificial engineering of any sort and allow for collapse to occur naturally. This requires us welcoming collapse as a natural consequence in system morphology, instead of massive blowups.

9. We ought to expose the illusion of stability and allow the system's natural booms and busts.

10. We need to welcome conformity with the state of nature of complex systems, tolerate systems that absorb our imperfections rather than seek to change them, and allow uncertainty and low probability risks to be visible.

11. We ought to avoid confusing one environment for another.

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