André du Plessis

Complexity Theory as Paradigm when Researching Education Reform: The South African Case

Abstract

In education systems there is inter-connectedness with multiple sub-systems which interact with each other. This paper argues that complexity theory is well suited as a lens to research education reforms. Key elements of complexity theory that are particularly useful are applied to the South African case. Aspects of complexity theory include: interaction of the elements which constitute an education system; feedback based on these interactions; the connectedness of these elements; the emergence of new properties and behavior based on the interactions and feedback; the contexts of the different elements of the system; and the non-linear nature of the causes and effects of educational reform. Complexity theory not only enables researchers to research education reforms from a whole system perspective, but also accommodates the dynamic nature of an education system.

Keywords: complexity theory, education systems, education reform, South African education system, education research

Introduction

In the South African education system, the elements or agents that constitute the system can be grouped into macro (national and provincial structures) and micro levels (local schools). Interactions among these elements happen both horizontally and vertically. For example, at the macro level, Section 9 of the National Education Policy Act 27 of 1996 (RSA, 1996b) determines that a Council of Education Ministers must be established, consisting of the Minister and Deputy Minister of the Department of Basic Education, and the nine provincial political heads of education (Members of Executive Council for Education). Also to attend the meetings of the Council, is the Director-General of the Department of Basic Education in order to report on the proceedings of the Council and to advise on any matter relating to the responsibilities of the Department of Basic Education. The chairpersons of the Portfolio Committee on Education in the National Assembly and the Select Committee on Education in the National Council of Provinces may also attend the meetings.

At the micro level there are the interactions between the different actors in the management structures, e.g. school management teams, and the governance structures of schools, e.g. the school governing bodies and their sub-committees. There are also statutory professional bodies such as the South African Council for Educators (SACE) which was established in terms of the South African Council for Educators Act 31 of 2000 and the Education Labour Relations Council (ELRC) which was established in terms of sub-section 37 (2) of the Labour Relations Act 66 of 1995. The Parties to Education Labour Relations Council are (ELRC, 2016, p. 7) the State as Employer through the collective made up of the provincial departments

of education and coordinated by the Department of Basic Education; and the teacher unions, which include the South African Democratic Teachers Union (SADTU), the largest of the teacher unions, and a Combined Trade Union grouping of smaller Autonomous Teacher Unions generally referred to as the CTU-ATU. Non-statutory bodies include school governing body organizations such as the Federation of Governing Bodies of South African Schools (FEDSAS) and the Governing Body Foundation (GBF), as well as non-governmental organizations and civil movements such as Equal Education. In addition to the above, each of these elements/agents/actors which constitute the system, have to perform their own specific function within legislative, regulatory and policy frameworks which also connects them to the system.

These legislative, regulatory and policy frameworks thus also constitute different elements of the system. Although each of these elements/agents/actors have their own specific function and purpose within the education system, requiring different skills and competencies, they are interconnected and are all obliged to work towards the achievement of a common goal and hence form a complex system.

Complexity theory

Complexity theory is becoming more prominent in educational research (Cohen, Manion & Morrison, 2011, p. 28). The origin of complexity theory can be traced to the fields of chemistry, physics, biology (Mason, 2008a, p. 36), archaeology, psychology, law and sociology (Haggis, 2008, p. 165). Complexity theory also shares the focus that chaos theory places on, as articulated by Mason (2008a, p. 36), "the sensitivity of phenomena to initial conditions that may result in unexpected and apparent random subsequent properties and behaviors". As in the case of chaos theory, complexity theory is concerned with "wholes, with larger systems or environments and the relationships among their constituent elements or agents, as opposed to the often reductionist concerns of mainstream science with the essence of the 'ultimate particle'" (Mason, 2008b, p. 5). As stated by Larsen-Freeman and Cameron (2008, p. 201), "complexity theory works at the system level, and explanation is in terms of the system's behavior, not at the level of individual agents or elements". According to Walby (2003, p. 1) complexity theory not only "offers a new set of conceptual tools to help explain the diversity and changes in contemporary modernities undergoing globalization", but it also "offers a new way of thinking about diverse inequalities and social change …".

Complexity theory requires the researcher to investigate a dynamically interacting system of multiple elements or components (actors) from the 'inside', rather than from the 'outside' or the 'view from above' (Haggis, 2008, p. 172). According to Haggis (2008, p. 172), "this conceptualization of the researcher looking as if from 'within' larger dynamic systems of connected factors is quite common in sociological research, but less so in many forms of small-scale educational research". Key aspects of complexity theory are the interaction aspect, the aspect of feedback, the aspect of connectedness, the aspect of emergence (Cohen, Manion & Morrison, 2011, p. 29), the aspect of context (Haggis, 2008, p. 167), the aspect of unpredictability (Haggis, 2008, p. 168) and the non-linear aspect (Cohen, Manion & Morrison, 2011, pp. 28, 30).

The interaction aspect of complexity theory

This interaction aspect of complexity theory can for example be applied where the principle of co-operative government and its influence on the interactions between school governing bodies and especially provincial departments of education are analyzed. Complexity theory concerns itself, as Mason (2008b, p. 6) puts it, "with environments, organizations, or systems that are complex in the sense that very large numbers of constituent elements or agents are connected to and interacting with one another in different ways". Accordingly, Haggis (2008, p. 169) explains that this distinct arrangement of interactions is to a degree created by the interactions of other larger systems, for example systems of governance, culture, language, policy or funding.

In their explanation of this interaction aspect of complexity theory Cohen, Manion and Morrison (2011, p. 28) go a step further:

> The interaction of individuals feeds into the wider environment, which in turn, influences the individual units of the network; they co-evolve, shaping each other, and co-evolution requires connection, cooperation and competition: competition to force development and cooperation for mutual survival. The behavior of a complex system as a whole, formed from its several elements, is greater than the sum of the parts.

Haggis (2008, p. 166) conveys this point by explaining that specific forms of rearrangements will occur from time to time if a sufficient number of such interactions happen over a sufficiently long period of time. Therefore, complexity theory suggests that, as expressed by Mason (2008a, p. 38), "it is in the dynamic interactions and adaptive orientation of a system" that new occurrences and behaviors emerge, resulting in the development of new arrangements and old ones being changed. Therefore, complexity theory holds that "the system is characterized by a continual organization and re-organization of and by these constituents" (Mason, 2008a, p. 36). An example of such organization and re-organization of interactions in the South African education system is found in what may be construed by many as an attempt by the government to limit the powers of school governing bodies. The draft Basic Education Laws Amendment Bill (RSA, 2017) seeks to adjust the powers of SGBs with regard to recommending candidates for appointment to management positions in schools in favor of the provincial Head of Department. If passed into law, the relationship and the level of interaction between school governing bodies and the provincial departments of education will change into one where as far as the appointment of staff school management positions are concerned, the role of school governing bodies will change from an active participant in the appointment process, to a recipient at their school of a person decided on by a provincial Head of Department.

The feedback aspect of complexity theory

The notion of feedback is a key element of complexity theory in that feedback must occur between the interacting components of the system (Cohen, Manion & Morrison, 2011, p. 29). In this relationship between the interacting components which are interacting dynamically at local level (Haggis, 2008, p. 166), interactions are non-linear (Cohen, Manion & Morrison, 2011, p. 29; Haggis, 2008, p. 166) and

there is a "multiplicity of simultaneously interacting variables" (Cohen, Manion & Morrison, 2011, p. 28) with complex feedback loops being enmeshed which "continually adjust and modify both the 'parts' of the system, and the system itself". Haggis (2008, p. 166) explains further:

> As the system is open, the interactions can also affect the boundaries of the system itself, and indeed have effects beyond it. Moreover, because the interactions are always local, such effects are distributed, rather than emanating from any central cause.

The feedback may be either negative or positive. Cohen, Manion and Morrison (2011, p. 29) explain that negative feedback is regulatory, whereas positive feedback brings increasing returns, uses information to change, grow and develop and "it amplifies small changes". This feedback aspect of complexity theory is found in the Constitutional Court judgment in the ruling of the combined cases *Head of Department, Department of Education, Free State Province v Welkom High School and others and Head of Department, Department of Education, Free State Province vs Harmony High School and others.* In these cases, the Court held that, as a matter of legality, supervisory authority must be exercised lawfully in accordance with the Schools Act (RSA, 1996a) concluding that, because the Head of Department had purported to override school policies without following the relevant procedures set out in the Schools Act (RSA, 1996a), he acted unlawfully. However, it was acknowledged that the pregnancy policies of the two schools at face-value infringed upon the constitutional rights of pregnant learners, including the right to human dignity, to freedom from unfair discrimination and to receive a basic education. The two schools were ordered to review the policies in the light of the requirements of the Constitution (RSA, 1996c), the Schools Act (RSA, 1996a), and the considerations set out in the judgment. The schools were further ordered to meaningfully engage with the Head of Department in the process of reviewing their policies, according to the principles of cooperative governance enshrined in the Schools Act (RSA, 1996a). An approach which places the learners' best interests as the starting point must contextualize disputes within the parties' duties to engage and cooperate.

The connectedness aspect of complexity theory

A key feature of complexity theory is connectedness. Connectedness exists everywhere (Cohen, Manion & Morrison, 2011, p. 29). The interactions between the components in the system are not only multiple, but they are "multiply connected" (Haggis, 2008, p. 167). As explained by Haggis (2008, p. 167), it is the diverse range of the interactions through time that generates effects because, in this situation, causality cannot be relegated to a single or a limited number of factors. Haggis (2008, p. 167) explains further:

> ... because of this connected, multi-factor causality, elements that are isolated and conceptually 'removed' from the system of connected interactions, in effect cease to have meaning in terms of understanding that system (though they might have meaning in relation to other such isolated elements abstracted from other systems). The system itself has to be studied, and studied in terms of its interactions (rather than defining 'key elements' in relation to smaller units within the system and comparing these to elements from other systems). However, studying systemic

interactions involves understanding that some of the interactions pertaining to the system being investigated are at the same time also interactions of other, larger/different systems which the system that is the focus of attention is embedded in and connected to.

This connectedness aspect of complexity theory suggests that phenomena must be looked at holistically (Manion & Morrison, 2011, pp. 29-30). According to Manion and Morrison (2011, pp. 9-30), complexity theory suggests that educational research should move away from, for example, individuals, institutions, communities and systems so that the unit of analysis becomes a web or ecosystem. This is because individuals, families, students, classes, schools, communities and societies exist in symbiosis.

This connectedness aspect of complexity theory featured prominently when examining the possibilities for distributed leadership in South African policy documents (Du Plessis & Heystek, 2020). Public school principals not only have to frame their interactions with the provincial departments of education and their school governing bodies through their connectedness to the accountability framework in which they must operate, but also, through their connectedness with the provincial Head of Department, district offices, their management team, parents, the community and the specific context of their school. This connectedness influences their leadership and management interactions.

The emergence aspect of complexity theory

One of the most important features of complexity theory is that it provides insight through the notion of emergence (Cohen, Manion & Morrison, 2011, p. 29; Haggis, 2008, p. 168; Mason, 2008a, p. 37). This notion of emergence is closely associated with the notion of self-organization (Cohen, Manion & Morrison, 2011, p. 29). As Mason (2008a, p. 37) suggests: "The dynamics of complex systems are inherently dynamic and transformational". According to Mason (2008a, p. 37), the notion of emergence implies that, "given a sufficient degree of complexity in a particular environment, new (and to some extent unexpected) properties and behavior emerge in that environment". Therefore, as stated by Cohen, Manion and Morrison (2011, p. 29), "systems possess the ability for self-organization, which is not according to a prior grand design … self-organization emerges, it is internally generated …". This means, according to Mason (2008a, p. 37) that "the whole becomes, in a very real sense, more than the sum of its parts". This is because the surfacing or manifestation of new characteristics and behaviors are not limited and thus cannot be predicted. At the center of this process is the creativity and knowledgeability of actors. This results in the establishment of new social systems "within and through the self-conscious, creative activities of human actors" (Fuchs, 2003, p. 147). Fuchs (2003, p. 147) explains that in this context the term self-organization refers to "the role of the self-conscious, creative, reflective and knowledgeable human beings in the reproduction of social systems" (Fuchs, 2003, p. 147).

This notion of emergence manifests itself in the draft Basic Education Laws Amendment Bill (RSA, 2017). Through such amendments to legislation, the South African education system is constantly evolving. This dynamic character of the system adds to the complexity of the system.

The context aspect of complexity theory

The context aspect of complexity theory is particularly relevant to the South-African education system with its multiple sub-contexts and features strongly throughout the study. Complexity theory recognizes the relationship of a system with its external environment and the influence this environment may have on the system. In other words, complexity theory not only concerns itself with the multiple relationships within itself, but also recognizes the multiple relationships that exist with the external environment. Complexity theory posits that, as the (open) system evolves through time, "it is in 'constant interaction' with environmental factors, i.e. forces that exist beyond its boundaries" (Haggis, 2008, p. 167).

This distinction between a system and its environment in combination with the, with conceptualizing of systems being "self-organizing and self-reproducing, provides the basis of a new way of thinking about systems" (Walby, 2003, p. 7). By making contextual factors parameters or dimensions of the system, the connectedness of the system to context is exposed (Larsen-Freeman & Cameron, 2008, p. 204).

The non-linear aspect of complexity theory

Complexity theory argues for multiple causality and multi-directional causes and effects, as opposed to methodologies based on linear views of causality (Cohen, Manion & Morrison, 2011, p. 30). As explained by Cohen, Manion and Morrison (2011, p. 30), this is because "organisms (however defined: individuals, groups, communities) are networked and relate at a host of different levels and in a range of different ways".

Conclusion

In education systems there is inter-connectedness with multiple sub-systems which interact with each other. In turn, this implies that a relationship exists between the different elements or agents which constitute the system (Mason, 2008a, p. 37) and through this relationship they influence one another and their wider environment (Cohen, Manion & Morrison, 2011, p. 28). This underscores the dynamic nature of an education system. Because an education system is constituted by multiple inter-related elements or sub-systems, each having a unique but related purpose, complexity theory permits researchers to view education reform, not in a reductionist or narrow manner but rather in a broader and holistic way. Such holistic way allows for recognizing the influence(s) different elements or sub-systems within an education system may have on each other and the system as a whole. Complexity theory therefore not only recognizes the different relations that exist within a system, but also the relationships that exist with the external environment.

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Dr. André du Plessis, University of Pretoria, South Africa