Reshaping Teacher Education in a Knowledge Society: Chaos and Collingwood

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Abstract

There is a widely held belief that we have entered a new age—an age defined by terms such as the global economy, the global village, and the information age. As the political and business world act and react to this new age, these sectors seek to influence higher education by demanding positivistic and pragmatic approaches to planning, pedagogy, and curriculum development. As institutions of higher education respond to the demands arising from the knowledge society and as the uncritical use of new technologies multiplies, it is incumbent upon teacher educators to clarify their purposes and procedures. The authors argue that exhilarating and empowering ways of thinking and doing in teacher education could arise out of the convergence of the metaphorical application of chaos theory and the type of historical thinking proposed by Robin George Collingwood. To demonstrate how these ways of thinking might come together to counteract the dominant mythologies of positivism, they provide brief outlines of the salient features of chaos theory and of Collingwoodian thought and then explore how these ways of thinking could be utilized to shape teacher education.

Introduction

In Faculties of Education across Canada, teacher educators are asking: what do teachers need to know and be able to do these days? How do we help them develop this knowledge and these skills? What is the appropriate balance between theory and practice? How or should new information technologies be integrated into learning and teaching? How do we deal with the 'intrusions' by the increasingly results-oriented world of politics and business? How do we deal with real or possible changes in public...
policy regarding funding of post-secondary institutions, teacher certification, and so on, and so on...?

In the effort to address such questions and lay plans for the future, teacher educators must devise a well-thought-out approach to reshaping teacher education at the dawn of the twenty-first century. The larger question then is: What approach or approaches should be used when re-examining our role as teacher educators and in our pedagogy, planning, policy-making and curriculum development?

There is a widely held belief that we have entered a new era - an era defined by terms such as: the global economy, the global village, and the information age. As the political and business world act and react to this 'new age', these sectors seek to influence teacher education by demanding positivistic and pragmatic approaches to planning, pedagogy, and curriculum development. As institutions of higher education respond to the demands arising from the knowledge society, and as the uncritical use of new technologies multiplies, it is incumbent upon teacher educators to clarify why they think and act as they do, rather than simply apply customary 'modern' approaches.

We suggest that approaches and procedures based on assumptions arising from the positivist way of thinking have not served us well. Positivism, which has a dominant influence in western ways of thinking, emerged out of the 17th century European Scientific Revolution and the 18th century Enlightenment. While the use of human reason, replicable, experimental methodology, and mathematics have been powerful tools to help people make sense out of the natural world and their experiences in it, we posit that the use of the scientific method to understand human beings and their interactions is fundamentally flawed. The positivist approach supposes that human behavior can be understood through the simple process of observation, categorization, and labeling - a process which presumably leads to the discovery of the 'laws' of human interaction and behavior. If pedagogy, planning and policy-making in teacher education were to continue to be based upon positivistic thought, and if positivistic thought is correct, we should assume that our questions could be answered and that 'things could be fixed' simply with more and better observations and planning based on our understanding of the laws of human interaction. We suggest that human behavior is far too uncertain, unpredictable and 'chaotic', to be understood in a positivistic way and therefore propose that approaches to re-examining pedagogy and planning in teacher education must arise from alternate ways of thinking.

It is our contention that chaos theory and historical thinking, as proposed by Robin George Collingwood, could come together to present new ways of thinking, doing and planning in teacher education. In order to demonstrate how these ways of thinking might come together to counteract the dominant mythologies of positivism, we will begin by providing a brief outline of the salient features of chaos theory and of Collingwood's thought. Next we will explore how these ways of thinking could be applied in particular situations. First, we will consider how alternate ways of thinking could be utilized to deal with information technologies that seem to be a driving force in our new era.
Using Acadia University as a case in point, we will explore how R.G. Collingwood’s epistemology could provide a sound model for understanding teaching and learning in a technology rich environment. Second, we will briefly explore the relationship between Collingwoodian thinking and ways of thinking about planning and policy-making in teacher education as developed by theorists who have applied chaos theory to social organizations. Through this discussion, we will explore how these alternate ways of thinking provide us with alternate suppositions upon which we could base our approaches to answering questions and planning for a future in teacher education during this time of change and uncertainty.

Chaos Theory

In the late nineteen-eighties, a Virginia commission charged with the development of a master plan or vision for higher education in that state, used chaos theory as an analytical framework. The short definition of chaos theory given in that report serves us well as a beginning point:

A mathematical concept called, somewhat misleadingly, "chaos," holds that at certain points small changes within systems will produce great and unpredictable results ... The mathematics created to conceive ... 'chaotic' situations is nonlinear: the future does not follow trends established in the past ... What [chaos theory] represents to us is the probability that the future will not be simply a linear extrapolation of the past, that small events happening today will cause new patterns to emerge downstream. (Commission on the University of the 21st Century, inside back cover)

Chaos, in the physical sciences, is not the random activity that the common use of the term suggests. Chaos theory, instead, holds that many seemingly random activities and systems, in fact, show complex, replicated patterns. The behavior of these systems is nonlinear, that is, behavior feeds back upon itself and modifies the patterns. Further, predictability of the system’s behavior is restricted to a relatively short time frame.

Chaos theory’s roots in science go back more than a century to Henri Poincare’s proof that the gravitational and orbital behavior of bodies in the solar system could not be explained with simple Newtonian linear physics (Hayles, 1990; Ruelle, 1991). But ongoing attention to chaos theory is broadly considered to have begun with the work in more recent decades of MIT meteorologist, Edward Lorenz.

Lorenz had been working on computer models of the weather in order to enhance predictability. In one noted episode from the early sixties, he entered a number of weather conditions into a simple computer and graphed the resulting weather patterns. He sought to replicate the patterns, but this time rounded the mathematical measurements of weather conditions to three decimal places instead of six. He expected only slight deviations in his findings and for the two graph patterns to reflect similarities. Instead, after only a few iterations of the
compartments, the patterns began to vary greatly from initial findings, to the point of no correlation at all. Yet within this seeming randomness, boundaries existed on the behaviour of the system, and certain weather patterns reoccurred. These are conditions that characterize actual weather (Gleick, 1987).

Chaotic functions demonstrate extreme sensitivity to initial conditions and extreme sensitivity to influx. Following from Lorenz’s work, this notion is popularly called the butterfly effect, where the flapping of a butterfly’s wing in Asia may eventually alter the course of a tornado in Texas (Lorenz, 1993).

The explanation of the importance of small factors comes through the circumstance that chaotic systems are dependent upon feedback. As opposed to Newtonian concepts that more clearly differentiate between cause and effect and their predictability, feedback is the notion that an effect becomes part of the cause in subsequent iterations of the pattern. Depending on the presence, nature, and timing of turbulence and the resulting iterative patterns, small factors can—but not necessarily will—become multiplied over time. Seage (1990) explored this concept as related to organizations in The Fifth Discipline.

What, then, allows chaotic systems to develop any sense of pattern, to stay within boundaries? It is the existence of attractors. Attractors are those elements in a system that have drawing or organizational power. The presence of multiple attractors, while establishing boundaries on a system, results in unstable, complex patterns, with the attractors acting upon one another, and demonstrating greater sensitivity to influx. It is the presence of attractors that also gives chaotic systems the quality of self-organization, the ability to recreate order and pattern, at least temporarily, despite continuous compensation for internal and external shocks to the system, or turbulence (Fischer & Stacey, 1994).

Chaotic systems demonstrate self-similarity at their various levels. The pattern of the whole can be seen in the part. In natural systems, self-similar structuring, called fractals, is shown in cloud formation, plant structure, landscapes, circulatory systems, wherever chaotic organization appears. Schwartz and Ogilvy (1979) described this structural principle as holographic, in which the whole is contained in the part.

To summarize, a chaotic system is one in which apparently random activity is, in fact, complexly patterned. Patterns, created by attractors, are disrupted and modified by the presence or influx of smaller or greater levels of turbulence. Attractors work to keep the system within boundaries. Chaotic systems demonstrate self-similarity, or fractal structuring, at various levels of the system. The infinitely varied interactions of attractors and turbulence make pattern predictability difficult in the near term and impossible over the long term. Despite limited predictability, patterns do emerge and are substantially the creation of system conditions and inputs.

A word is in order about the focus on ‘chaos theory’ when metaphorically applying these notions to social organizations, as opposed to using the term ‘complexity’ or ‘complexity theory’. The latter is thought by some to be a more encompassing concept. Others use the term rather interchangeably with chaos. Still others have switched from the use of chaos theory to complexity, perhaps because of the visceral reaction that the word “chaos” engenders when people fail
to separate the theory from the conventional description of randomness. Whatever the reasons for these shifts and decisions might be for others, chaos theory, as a framework and tenet, seems to be more than sufficient for the topics of this work. This is metaphoric work, after all, and chaos has a decided advantage over complexity in both basic accepted definition, and richness of vocabulary. Furthermore, there is a useful distinction made by Edward Lorenz himself: complexity is irregularity in space, chaos is irregularity in time (1993). Certainly our organizations have literal, spatial dimensions and physical entities, such as committees. But our organizational foci are overwhelmingly concerned with time, and particularly the future, the single element of the dimension over which we have or assert control.

In addition, we do recognize that there are dangers in the overextension of metaphors, particularly from science to social systems. Social Darwinism comes to mind, with its rationalization of racism, colonialism, and the abuses of Industrial Age capitalism. A contemporary of Isaac Newton's sought to apply the principles of the theory of gravity to determination of the veracity of courtroom testimony (Cohen, 1994). And, within our own dominant metaphor of machine-like organizations, it's sobering to recall that in the early twentieth century, Frederick Taylor and Henri Fayol were popularizing the concepts of applying physical science to social and business arrangements, just as Albert Einstein was undermining the universality of the Newtonian mechanics upon which "scientific management" was largely based (Fayol, 1984; Taylor, 1911; Einstein, 1961).

However, even in light of this caution, it's interesting to note that some of the most impassioned calls for the application of the principles of chaos theory to social systems have come from prominent scientists and mathematicians who have worked in chaos theory at developmental levels. See, for example, Gell-Mann's The Quark and the Jaguar (1994); Ruelle's Chance and Chaos (1991); and Prigogine and Stengers' Order Out of Chaos: Man's New Dialogue with Nature (1984).

Although this work seeks to connect life in the academy with metaphors of chaos theory, there are those working in social and organizational sciences who have sought with varying degrees of success to determine literal, mathematical patterns of chaos theory in human relations. These efforts have been particularly notable in such fields as electoral political science and economics, where large quantitative databases have been available for analysis (Gleick, 1987; Priesmeyer, 1992; Brown, 1995; Kiel & Elliot, 1991). In this light, metaphoric application of chaos theory to organizations is not a radical approach, but a conservative one.

While chaos and complexity theories have been explored in learning applications such as classroom dynamics and operation, brain functioning and dynamics, curriculum and its revision, and pedagogy and its adaptations for individuals, the application of metaphors of chaos theory to the functions of leadership, planning, and policy in post-secondary education is relatively recent (Cutright, 2001). These approaches are motivated, in large, by the anxiety that our dominant metaphors of organization, and hence our constructs of reality itself, are shaped by mechanical descriptions and resulting expectations of Newtonian
predictability (Morgan, 1997). We posit that this metaphor is of increasingly limited utility in a world where the pace of change is increasing and predictability is decreasing.

The Thought of R.G. Collingwood

If chaos theory provides a clear alternative to ways of thinking that arise from the dominant positivist approach, so too does the thought of R.G. Collingwood. Collingwood, who was both philosopher and historian, developed his arguments as a direct challenge to positivism. He argued that because there was a fundamental difference between history and the natural sciences, there must be different approaches taken to the construction of knowledge in each realm. The observation of phenomena, or the perception of the outside of events, and the measuring, classifying and generating of laws based on the observations was, according to Collingwood, a legitimate way of knowing the natural world. He argued that this is so because events in the natural world have no ‘inside’. In other words, the ‘events of nature are mere events, not the acts of agents whose thought the scientist endeavours to trace’(1939, p. 31). However, the object of thought for history has a fundamentally different character in that the events are not merely events, but past human actions that have both an outside, or observable part, and an inside which can only be “described in terms of thought”(1939 p. 213).

Collingwood (1939, p. 31) asserted then, that knowing anything in history must involve knowing both the outside and the inside of past events. The historian’s “work may begin by discovering the outside of an event, but it can never end there: he [sic] must always remember that the event was an action, and that his main task is to think himself into this action, to discern the thought of its agent”. Collingwood called this task ‘re-enactment’ and claimed that it was possible for historians to ‘re-think’ past thoughts because, although ways of thinking change and evolve, they never completely die out. Historians can reconstruct the past because they can recover ways of thinking by examining documents, which have survived into the present and re-think the thoughts of the people who created them. Re-enactment is not some mystical process, but a method we commonly use in trying to understand what someone means when we read their words.

Collingwood did not believe that history or philosophy could or should aim at producing or finding universal and necessary truth. He argued (1939, p. 63) that truth is “something always needing to be re-created by an effort of thought”. In other words, Collingwood challenges us to think, not simply accept or deliver given facts, laws, or rules. He argued that historians should try to get “inside other people's heads, looking at their situation through their eyes, and think for yourself whether the way in which they tackled it [their problem] was the right way”. Collingwood argued that in this process history becomes an autonomous form of knowledge, a form of self-knowledge, but not of positivistic certainty - and that this should be celebrated.

What is also pertinent about Collingwood is his metaphysical analysis of how human beings think and reason. He argued repeatedly that all historical thinking
is present thinking and that we make sense of the past by first understanding how we think, and then by analogy reasoning, how others thought and acted in the past. This means that the kinds of questions that we ask are the key to the knowledge we have - we must ask both 'what' and 'why' questions because we must know both what happened and why it happened. Collingwood claimed (1943 p.134) that the key to historical understanding is that it teaches us how to think and act in the present by understanding how others thought in the past - that through this process we uncover knowledge of self, so that we can make sound judgments for the future.

It is our contention that chaos theory and Collingwood's philosophy not only challenge positivism, but also offer clusters of suppositions from which we could devise useful approaches that would help us deal with questions and issues that have arisen in this 'new' era. In sections that follow, we will offer examples of ways in which the confluent implications of chaos and Collingwood could inform both pedagogical practice and our designs for teacher education. These suppositions are not entirely theoretical, but have been realized or suggested by our early experiences in the burgeoning area of technology in education. It can be claimed that the computer is simply another machine, like the printing press, automobile and telephone. Certainly, not every educator is convinced that the impacts of technology on education have been either extensive or positive (e.g. Cuban, 2001). However, virtually every new technological advancement has shaped society and knowledge in profound ways, and in ways that far exceed the intentions of their inventors and advocates (McLuhan, 1967; Postman, 1992). There is little basis to expect that the interface of technology and education will be any different.

Authors of this paper (Cutright and Griffith, 2000), among others, have explored the interface of technology and education at the university level. At Acadia University, where the program described as the "Acadia Advantage" has integrated notebook computers into the undergraduate curriculum, more than 85% percent of courses by 2000, had substantial Web-based content and interaction. Ongoing tracking of student opinion about this experience has yielded consistent upward trends in student assessments of academic engagement, responsibility for their own learning, ability to engage in academic discussion, control over classroom directions, and even positive impacts on their social lives.

Implications for Pedagogy

We suggest that the way most people learn, regardless of the use of technology, most closely matches Collingwood’s claims that we come to know by asking ‘what’ and asking ‘why’. In other words, learning is a more ‘chaotic’ process than posited by positivistic models. There is ample evidence to demonstrate that when left to their own devices students seek out information of interest to them. They do this in a variety of ways, as Howard Gardner (1983) has pointed out, and what they seek out can be described, to borrow a phrase from Clandinin and Connelly (1999), as ‘Personal, Practical Knowledge’.

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The problem is that formal schooling has adopted positivistic models, which are based on the assumption that learning has more to do with 'outcomes', 'truth', and 'facts', rather than processes. This is evidenced by that fact that learning, be it in grade schools, or during post-secondary schooling, is for the most part assessed through summative evaluations. This increased focus on tic-a-box outcomes – the imparting and retention of specific facts and skills, rather than broader process, including the development of critical thinking and the ability to later acquire new knowledge and wisdom – would appear to be related to many governments' increasing willingness to have public education serve as a human resource production engine for economic sectors and even specific industries (Cutright and Griffith, 1997).

Technology-rich environments, as an example of these principles in practice, simply have the capacity to allow learners to have more control over what, how, and where learning occurs. New technology does not change the way people learn, but complements the way in which learning occurs naturally. However, we do argue that if teacher educators continue to work from positivist assumptions, they will struggle with 'chaotic' impact of new technologies – that is, they will find it difficult to deal with the notion that the process of learning is as important as the outcome, and that students have more control over what is learned than do the teachers.

With this in mind, we suggest that teacher educators adopt Collingwood's epistemological model for dealing with and understanding learning and teaching. Collingwood argued that his epistemology fused all the various forms of thought, from literature to science, by placing them in the context of self-reflective knowing. We ask questions of interest to us and use whatever evidence comes our way to answer our questions. What is known, then, is what the individual thinker's question reveals.

The question is ours, the selection of evidence, or what we call facts, is ours and the conclusions is also ours. We learn about the process of thinking by examining the rational process of how we think. We do this through analogical reasoning, wherein we discover what and how we are capable of thinking by 're-enacting' the thought of others. Question and answer, re-enactment, self-knowledge are all parts of this process. These are the pillars of Collingwood's conception of knowledge. This is the way to connect the past to the present, the learner with the teacher, the learner and the learned. We believe that this is the way we should approach teaching and learning in formal educational environments.

In addition, we argue that the application of Collingwood's approach might be particularly urgent when dealing with learning in technology-rich environments. Computers and information technology offer students much broader opportunities to pursue answers to their 'what and why' questions, searching out their evidence with tools that offer them access to virtually unlimited data. Collingwood's model can assist students develop critical approaches as they ask and answer their own questions and search out evidence to reach conclusions that they can apply directly to their lives.
The magic of the computer is that it makes the way in which we learn transparent. Information technology, on its own, does not change a thing, but it does make more apparent the limitations of a pedagogy traveling on one-way, linear paths. By applying Collingwood's epistemological model, we have the opportunity in all learning environments to make learning personal. The computer has shown that this is the way students are comfortable learning. As teacher educators, it is now our challenge to adapt learning and teaching to this realization so that learning can be maximized in all contexts.

Implications for Planning and Policy in Teacher Education

As stipulated earlier, if planning and policy-making is teacher education were to continue to be based upon positivistic thought, and if positivistic thought is correct, we should assume then that 'things could be fixed' simply with more and better planning. However, keeping in mind our position that human behavior is far too complex, uncertain, unpredictable to be understood using positivistic models, it is necessary to develop approaches to planning and policy-making in teacher education that arise from alternate ways of thinking.

While it might seem odd at first glance to suggest that chaos theory is similar to Collingwood's historical thinking in its implications for policy and planning, both offer ways of thinking that challenge positivistic presuppositions. Recognizing the parallels between chaos theory and Collingwoodian thought allows us to combine ideas from the two theoretical positions.

In recent work (Coltrighth, 1999; 2001), exploring how a metaphorical perspective grounded in chaos theory might be helpful in approaching the specific institutional function of planning, ten propositions were offered which could assist in developing alternate ways of planning and doing in teacher education. These propositions are:

Proposition 1: The ideal outcome of planning is planning, not a plan.

Proposition 2: Planning begins with a distillation of the institution's key values and purposes.

Proposition 3: The widest possible universe of information should be made available to all members of the institution. This universe of information includes ongoing, rich, and current feedback.

Proposition 4: Dissent and conflict are creative, healthy, and real. The absence of conflict is reductionist, illusory, and suspect.

Proposition 5: Linearity doesn't work in strategic planning. It doesn't work in dictation--planning and plans imposed from above--or in collaboration--planning and plans created solely by the collection of unit information.

Proposition 6: The institution should budget--fiscally and psychically--for failure. Pilots are alternate futures. Not all can be realized or succeed.
Proposition 7: The considerable expense of time on the front end is an investment. It is recouped, with interest, in the future.

Proposition 8: The executive is not demoted or minimized. The executive is the most critical shaper and champion of the process. Ultimately, the executive is empowered by the process.

Proposition 9: That which can be quantified is not to be overvalued, and that which cannot be quantified is not to be discounted.

Proposition 10: The future is a creation, not a prediction. This power of agency is the distinguishing context of human-chaotic systems.

In order to make the case that Collingwood and chaos theory are similar and can combine to offer useful alternatives to positivism, we will briefly explore the relationship between Collingwoodian thought and the first four of these ten propositions. We have decided to examine the first four only, in the interests of space and to reduce redundancy.

The first proposition, which states, “The ideal outcome of planning is planning argues that plans should be general, flexible and relatively detail-free. Collingwood might have understood this approach intuitively. Because he argued that we should approach a problem by asking questions, and because we know that those questions usually lead to even more questions rather than fixed or ultimate answers, Collingwoodian thought has a ‘build in’ sense that it is the process, not the outcome which is important. Both Collingwood and chaos theory acknowledge that it is the planning process, not ‘the plan’, which is important; and, when the process is seen to be more important than the ‘outcome’ we have a circumstance wherein we can respond to change and uncertainty in a flexible and accommodating fashion - unpredicted outcomes are expected, rather than perceived as ‘ruined plans’.

Proposition 2 suggests that “Planning begins with a distillation of the institutions’ key values and purposes.” Collingwood might call this uncovering the institute’s presuppositions. In the case of teacher education, it can be argued that uncovering the institute’s presuppositions is requisite to understanding their historical development, as well as being essential to understanding the thinking that lies behind present actions. Similar to Cutright’s claim that planning must begin with a clarification of values and purposes, Collingwood might argue that thought effects action, therefore assumptions must be revealed.

In Proposition 3, which states that “The widest possible universe of information should be made available to all members of the institution”, it is not being claimed that information should be shared simply for its own sake. This proposition goes on to state that “This universe of information includes ongoing, rich, and current feedback [emphasis added]”, revealing the position that information should be considered important only in relation a specific context - that information becomes important in relation to the effect it has on the organization - in other words, when it becomes feedback in the planning process.
These notions would have struck a chord with Collingwood. First, Collingwood would claim that for historians, information or 'facts' only become important in relation to the context. For example, the Rubicon River is of itself unimportant, but when related to Caesar’s crossing, the river becomes very important. In addition, Collingwood acknowledged that information was something far more important than simply data ‘dropped on a table’. He argued that there is an intimate relationship between historians and their object of knowledge because historians re-enact thought. During this process, historians do not simply gather ‘information’ about past action, but in fact become intrinsically effected by their ‘information gathering’. Collingwood (1939, p. 114) argued

“If what the historian knows is past thoughts, and if he [sic] knows them by re-thinking them himself, it follows that the knowledge he achieves by historical inquiry is not knowledge of his situation as opposed to knowledge of himself; it is a knowledge of his situation which is, at the same time, knowledge of himself. In re-thinking what somebody else thought, he thinks it himself. In knowing that somebody else thought it, he knows that he himself is able to think it.”

When the historian re-enacts the thought of historical agents involved in past action, she is, in effect, involved in a ‘feedback loop’ that leads to self-knowledge. Hence, we claim a relationship between what can be considered the appropriate use of information in a chaotic system and Collingwoodian thought — that is, information is feedback which modifies, not ‘truth’.

Collingwoodian thought is also in sync with Proposition 4, which states, “Disent and conflict are creative, healthy and real. The absence of conflict is reductionist, illusionary and suspect.” Collingwood knew that knowledge construction is the result of the tensions or ‘conflict’ between thesis and antithesis and that this is not a simple dialectic, but a ‘trialectic’ thinking process wherein the synthesis does not resolve the conflict, but merely serves to set up a new tension from which new ideas can emerge. In other words, the synthesis is not the ‘outcome’, but part of the process. This is the case because thought is a process where one idea is not separated from the next but flows with it. To assume that ideas are separate, one from the other, is a positivistic fallacy. Along with Collingwood and chaos theory, we claim that institutions of higher education must honour dissent and be open to challenge if their response is to go beyond a reaction where change is an illusion of the moment.

Conclusions

We propose that chaos theory and Collingwood equip us to deal with the uncertain world, which is intruding into teacher education. Out of Collingwood’s insistence that all action arises out of presuppositions, that all knowledge is self-knowledge developed through the process of questioning and answering, and that this entire process is actually based on the idea the knowledge must constantly be re-created through the effort of thought, we can derive a methodology which


