Fall 2004

Radical, Getting to the Root: A Review of Curriculum Dynamics: Recreating Heart

Dewey I. Dykstra
Boise State University

This is an author-produced, peer-reviewed version of this publication. The final, definitive version of this document can be found online at the *Journal of Curriculum Studies* published by Taylor and Francis at: http://www.informaworld.com/smpp/title~content=t713741620~db=all. Copyright restrictions may apply. DOI: 10.1080/0022027041000169858

Radical, Getting to the Root: a review of Curriculum Dynamics: Recreating Heart[1]

by Dewey I. Dykstra, Jr.

Curriculum Dynamics, volume 200 in Counterpoints: the Studies in the Postmodern Theory of Education series, by M. Jayne Fleener, published by Peter Lang Publishing, Inc., contains an interesting introduction to postmodern perspectives and their sources from many fields. Parts of the book together with its bibliography constitute a possible course of study in postmodernist thought. Some might take issue with this description by pointing out examples of missing works considered important or items they consider soft in the bibliography. If the reader has wondered about postmodernism, yet has never read about it, the bibliography and the references in the entries are not a bad introduction. This is especially true if one were to focus more on references to primary sources and less on popularizers and secondary sources in the bibliography.

Fleener presents the book in three sections: perspective, technique and creation. The section on perspective portrays a postmodernist perspective in contrast with a description of a modernist perspective and justifications for departure from this modernist perspective in part motivated by developments in 20th century science. I will come back to this material on scientific revolutions and subsequent references to it, later in this review. The section on technique, sub-titled: Holographic Images, promotes an emphasis on process, relationships and systems. In the final section on creation Fleener suggests the curriculum should be viewed as other than linear, invoking Doll's (1993) notion of richness in the form of curriculum as matrix. Fleener's notion is not a curriculum based on things to be known, but curriculum as process---curriculum as process should be the organizing essence of schools.

For many readers, this one included, there is much to agree with in the issues presented in the book concerning the modernist perspective as a major source of the failures of education as it is today. In particular the notion of the logic of dominance in the prevailing modernist perspective and the violence perpetrated in the name of this notion on students as individuals and thereby on society as a whole is a problem that can be seen daily in school. (Trabal, 1997; Blades, 1997) Reflected in Fleener's words: 'What they learn is not more about … concepts but that either they are not good at mathematics or that mathematics is stupid or irrelevant to their lives.' (p. 192) the negative effects resulting from this domination point of view can be seen. One can substitute the name of any academic subject in a paraphrase of these words and still be right on the mark.

Education driven by competition and the desire to select the best cannot really be in the best interest of all students. It is not education. It is vocational selection and

---

[1] The book reviewed here is M. Jayne Fleener, Curriculum Dynamics: Recreating Heart (Counterpoints, vol. 200), (Peter Lang Publishing, Inc., New York, 2002), 215 pp., $29.95 (ppb), ISBN 0-8204-5540-7

training. Selection and training, whether for the trades or the professions, has its place in society, but this is not education. Education should be about process, relationship and the invocation of the potentials that exist in all students, as Fleener points out. Education as it is practiced today serves as an important demonstration that education and vocational selection and training may in fact never mix well.

In *Curriculum Dynamics*, the notion of a learning organization is suggested as an alternative to "education" as it is practiced today. A learning organization, teachers and students driven by the desire to engage in meaning making and being in a state of constant process, is a collaboration of many individuals each of whose experience of the process is personal. Each individual's participation and experience in this organization is that person's curriculum. This way of conceptualizing curriculum as a dynamic entity is neither a linear and completely predetermined collection of things to be known, nor exactly predictable.

These two positions, the modernist logic of dominance and curriculum as individually experienced process, have major implications concerning developments in education in the USA such as high-stakes testing and the nature of pressures brought on by such testing on the curriculum, teachers and students in this country today. Fleener comments on such matters and a number of other related points, as well.

Fleener makes reference to scientific revolutions and draws implications from these in weaving the new cloth of curriculum dynamics in the book. In particular, explanations of developments in the first half of the previous century in physics are used to explain and justify the author's ideas. It may be that the reviewer's formal preparation and background in physics, in physics teaching from middle school through the university level and studies in pedagogy and the nature of knowledge had something to do with the invitation to produce this review. It may help the reader to be aware of these perspectives in this reviewer's take on Fleener's book.

There are a number of problems with the science in the book. First, there are problems with the science as it is presented in the book. Einstein did not propose a theory of specific (p. 60) relativity in 1905. The relativity theory he first proposed in that paper was, and is still, called the theory of Special Relativity. To use another adjective at this point, nearly 100 years later, without explaining why, is very disconcerting to anyone who has studied or read Einstein's work some of which is intended for the lay reader. (Einstein, et al., 1924; Einstein, 1995) It might be better to explain that the adjective, Special, was adopted to distinguish the fact that Einstein's first foray into relativity theory applies only to situations in which the objects involved move with constant velocity, neither speeding up nor slowing down. These situations are called inertial frames of reference. His later work, General Relativity, was developed to apply to situations involving objects possibly speeding up or slowing down or changing direction. The adjective, general, was adopted because the theory was more broadly applicable; that is, it is not restricted to objects that only move with constant velocity, inertial reference frames.

Einstein did not 'interpret' gravity as a 'magnet field' (p. 62). Instead, he proposed the existence of something called, spacetime, as what could determine the motion of an object such as the Moon, instead of another object removed from it by some distance, such as the Earth, as those before him did. To attribute the motion of one object to the influence of another object not in contact with the first is the hypothesis of action-at-a-distance. An example of this would be the claim that the planets in our solar system orbit the Sun because of some action by the Sun on them through the intervening, largely empty space. Another example of action-at-a-distance would be to claim the action of the Earth on a compass needle to cause that needle to move to a particular orientation.

The explanation for such actions attributed to universal gravitation through intervening empty space has been a problem since well before Newton [in the late 1600s]. Newton got around the problem essentially by saying, in his famous book, The Principia [originally written in the 1680s] (Newton, 1999), he made <u>no hypotheses as to why</u>, but that the behavior of the planets and Sun could be explained very well, if we assumed that forces existed between the objects and that these forces conformed to certain particular mathematical expressions. Later, the notion of field was invented and invoked by others such as Maxwell [in the middle of the 19th century] to explain apparent action-at-a-distance in electric and magnetic phenomena. One often given reason for Newton's avoidance of the issue and the later efforts to make up an explanation for examples of apparent action-at-a-distance, is the modern scientists' [scientists since the Renaissance] aversion to relying on insensible entities for explanation.

About 200 years after Newton, Einstein proposed another alternative. In this alternative he suggested we think of matter, what objects are made of, as distorting something they are immersed in called spacetime. Up to this time people in general had considered space independent of the matter immersed in it. Einstein was suggesting otherwise. Furthermore, he suggested in effect that objects naturally move with the background "pattern" of this spacetime. When spacetime is distorted, the motions of objects through such a distorted region will be distorted. As John Wheeler (1999) has put it on many occasions: 'Matter tells space how to bend and space tells matter how to move.'

To sum up, Newton avoided the problem of explaining action-at-a-distance by refusing to propose an explanation as to how a force could be exerted at a distance, merely supplying a mathematical description of the force. Later, gravitational fields whose source is the mass in objects were proposed to explain these forces at a distance. Einstein's proposal is that we think not in terms of fields with sources, but in terms of something else called spacetime, the source of which is not matter and which is both affected by matter and affects the motions of matter. Einstein was distinctly not proposing a field explanation for gravity's action-at-a-distance in the same sense that gravitational fields are typically referred to now in textbooks in association with Newtonian mechanics. It is very telling about "education" as it is practiced today that even physics majors can go a remarkably long way into and even all the way through their preparation and be blissfully unaware of these distinctions.

There are a number of other issues with the science in the book. To treat each one in the same way as above would make for a long review and the beginnings of a textbook. These issues are much less to have occurred in the book had we all experienced *education* in a learning organization as Fleener suggests. A list of a few of these follows. The list is in no particular order nor is it exhaustive.

1. The E in $E = mc^2$ stands for energy in Einstein's work. What E as an 'energy dynamic between mass and speed' (p. 64) might mean does not come from physics or Einstein.
2. 'Velocity at or faster than the speed of light is impossible (without having infinite mass)' (p. 64) seems to imply that <u>with</u> infinite mass an object <u>could</u> travel at the speed of light or faster. The problem with this implication is the following. In the theory the reason for the impossibility of traveling at the speed of light is that the effective mass of the object becomes very nearly infinite as the object approaches that speed and the necessary energy to get it moving ever faster to actually reach the speed of light does not exist in the universe.
3. Maxwell did <u>theoretically</u> determine the speed of light. I have never seen any reference to Maxwell <u>experimentally</u> determining the speed of light as suggested. (p. 65) Others, including Albert Michaelson and Albert Roemer, did determine the speed of light by various experimental means. Michaelson's name is misspelled in two different ways. (p. 61, p. 73)
4. It is suggested that Einstein published three papers on quantum theory, statistical mechanics and Brownian motion and that 'this third paper' was on Einstein's 'specific theory of relativity.' (p. 60) There were what can be considered five papers in 1905. (Stachel, 1998) But, the three of the four that appeared in Annalen der Physik are generally most prominently mentioned. These I believe are the ones to which Fleener refers. One was on the photoelectric effect and heuristically proposed the use of Planck's quantum hypothesis. One was on the Brownian motion of tiny particles suspended in water and could be associated with the field of statistical mechanics. The third paper with the title given in the book was an exposition of his theory of Special Relativity. I know from first hand experience that the photoelectric effect and special relativity papers can be read and understood with a high school background in science. A fourth paper, an additional one developing further notions in special relativity, appeared in Annalen der Physik that year. The fifth paper was a doctoral dissertation on a topic in statistical mechanics.
5. While the paper on the photoelectric effect apparently had significant influence on thought about the quantum hypothesis at the time, it had nothing to do with the paper on special relativity. Einstein's work on relativity did not 'set the stage for quantum physics'. (p. 64) Even now a century later the satisfactory integration of relativity theory and quantum theory is still a matter of speculation.
6. Waves are apparently equated with energy several times in the context of this discussion about ideas from physics. (pp. 66—67) Nowhere in physics are energy and waves equated. Energy and waves are not equivalent entities in

the explanations physicists generate about the world. In quantum mechanics whether an entity appears to act as a particle or as a wave, it always has energy associated with it.

7. Neither the Correspondence Principle nor Heisenberg's Uncertainty Principle are stated nor explained in a way most physicists would recognize. In fact each of these ideas seem to be supported as much or more by quotes from authors whose areas of expertise are business leadership and psychological self-help than from the writing of any physicists.
8. 'Newton's notions of entropy' (p. 109) are referred to, but the notion of entropy did not arise until many years after his death during an era when a number of physicists and mathematicians undertook to reformulate Newton's contributions in such a way as to eliminate action-at-a distance forces from the theory and the resulting effort influenced new developments in studies of the thermal properties of matter.
9. Kepler's laws, not 'Keplar's laws' (p. 111), are laws of planetary motion, not merely laws of motion. They are not expressions applicable in general to motion, but specifically to the observed motion of the planets of our solar system around the Sun. Newton, on the other hand, did propose three laws to describe motion in general and which are called Newton's laws of motion.
10. 'The curriculum, therefore, like the information of a hologram, is distributed throughout the image.' (p. 175) In the case of holograms, information which enables the reconstruction of the image without the original object present is distributed throughout the hologram, not the image produced by the hologram. The information received by a conventional lens is also distributed throughout the lens to enable it to produce its image.

Unfortunately, this list does not exhaust the problems with the presentation of the science. The trouble here is that Fleener is apparently trying to use this shift from classical physics and biology, with a focus is on describing order and absolutes, to modern physics and biology, with a focus is on emergent properties of complex systems, chaos and the loss of absolutes. When the science is poorly presented, the impact of the justification based on it is blunted and there is cause to question the conclusions urged from the justification. This is true regardless of the value of the conclusions urged. Just as the argument presented in the book might be weak, there can be other, stronger justifications for essentially the same conclusions.

The deeper problem in the argument presented is that the new sciences, what one might call the new physics (of the first half of the previous century) and the new biology (of the last half of the previous century), seem to be given a privileged status in the author's narrative. It seems we are being asked to replace the notion of the existence of universal laws that describe order and predictability with another notion of the existence of universal laws that invoke disorderliness and unpredictability. To claim or act as if either set of laws is a description of what is really going on is to take a realist position. Prigogine and Stengers (p. 68) are not only urging that we abandon classical physics, but realism itself---'the realism of classical physics'. Rejection of realism changes the status of the specific explanations developed in science from statements represented as at least tending toward a true description of what is actually going on to statements that at best can be said to fit experience and enable reasonable, testable predictions. The cornerstone of the logic of domination is knowledge of the truth or knowledge of the truth absolutely better than some other knowledge. Realism in particular establishes such knowledge categories and seems to lead inevitably to practices of domination. Unfortunately, the author appears to be a victim, as are most of us, of the unrelenting modernist realism with which science is preached to society in the schools and the media. Language in the section on science is often the language of absolutes, the realist, modernist language of domination. Because of this immersion in realism, no curriculum of any type can escape this logic of domination unless realism is utterly abandoned.

Explanatory knowledge as constructed or made up by human beings in an on-going process and which can only be judged by its fit to experience cannot be used to justify domination because there is no way to compare it with Truth. Possession of the Truth or something closer to it than others, ultimately justifies domination. (Maturana, 1988) This is not to say either that there is no real world out there or that we just make up that real world in our heads. Instead, it is to suggest that what we make of our experiences is just that…what we make of them. As long as what we make of our experiences, the explanation we construct for ourselves, continues to fit new experiences and serve our purposes, then we keep using our constructed explanations. When these constructions cease to fit experience or serve our purposes, we make new explanations. We have no way of knowing to what extent our explanations are really what is going on nor do we have to know in order to continue to exist and pursue our lives. This is a fundamentally non-realist view of explanatory knowledge and fits the notions of which Fleener writes: learning organizations and curriculum as process and relationship to one's experiential world including other people.

Without going into detail on the science involved, one can say that the physics of the previous century places our previous ideas about the explanations of physical reality in perspective. In the past for example, every time we thought we knew what light really is we eventually found something we could not explain. To explain this new feature we had to reconceptualize light. Light had to become something different. Very early in recorded history light was something that went out from our eyes to enable us to see things. Later, it was rays that emanate from objects and enter our eyes. Then it was corpuscles, tiny material bits emanating from sources. Next, it was undulations or waves of an all-pervasive, ethereal substance called *aether*. In the 19th century it was thought to be undulations or waves of electromagnetic fields---fields which themselves were invented to explain action-at-a-distance. Einstein showed that if light could be thought of as little packets of discrete quantities of energy, one could explain the photoelectric effect, a phenomenon unexplainable via a wave explanation of light. In the title of Einstein's 1905 paper, On a heuristic point of view concerning the production and transformation of light, (Stachel, 1998) he tells us his view of the status of a quantum explanation of the photoelectric effect. He knew the lesson of history.

In this view we have never had an explanation of the true nature of light and there is no reason from historical experience to think we ever will. That is not the nature of explanatory knowledge. Explanatory knowledge cannot be about truth with an upper or lower case 't'. It can only be about what works so far---abduction constructed in the minds of human beings. As such it only exists in the minds of cognizing beings and is not independent of those minds. This is the root of the matter---the nature of knowledge.[2] In this view curriculum can no longer be the Canon, a static, memorizable entity, but instead it is exercising the skills of evolving a canon, an emergent entity---curriculum as process. Although Curriculum Dynamics has value, it misses the root that could support its conclusions.

Another thing that seems to cut short the possible impact on education is that there were no examples discussed in any detail, not even analyses of partial examples to help us understand Fleener's Erwartungshorizonten, horizons of expectation. (p. 5) Whether examples presented are taken as algorithms can depend on how they are presented as well as what the reader makes of them.

There are good examples in math education that seem to clearly fit the spirit of the book. The works of Paul Cobb, Terry Wood and Erna Yackel (1993) and of Deborah Shifter and Catherine Fosnot (1993) come immediately to mind, but examples stretch back at least to the 1930s and the work of Louis Benezet (1935a, 1935b, 1936) and Harold Fawcett (1938). In science education Eleanor Duckworth (1996) seems to advocate and practice a pedagogy that is resonant with ideas in the book. In the field of physics education research there is a growing amount of published work demonstrating the profound learning effects made possible by shifting attention from the canon to the students' understandings of the phenomena and how little change in understanding results from conventional instruction. (Duit, 2002)

These examples might not meet all of Fleener's intents, but Fleener's analytical discussion of such examples could help us understand the kinds of meaning, purpose and value intended in Curriculum Dynamics. Existence proofs, even though they may be partial, do exist and their effects on the students are powerful. Many in education are unaware of them, but should be. Some sort of discussion of such examples by Fleener could help us better understand how the intent of the book differs from or is similar to what is going on in these examples.

Curriculum Dynamics is a mixed bag: a place to start reading references to postmodernism, a rather poor place to pick up much understanding of the science written about in the book, and possibly a source of inspiration to think differently about the notions of curriculum and education. The book is aptly described by the author in the following: 'My hope for those who read this book is that they find meaning, purpose, and value, not answers, prescriptions, or formulas to follow.' (p. 6) One might find meaning, purpose and value from the book, but a careful, thoughtful reader might

[2] Since this view goes to the root, the nature of the central issue in education---the nature of knowledge, it can be called radical in the sense of 'to go to the root of', as opposed to the sense of being extreme or on the fringe. Since knowledge is seen as construct, then this view is constructivist---radical constructivist, very similar to that of Ernst von Glasersfeld (1995).

be hindered by the distractions of the presentation of the science and subsequent references to it and of the lack of rigor in the popularizers relied upon in the text.

References:

Benezet, L. P. (1935a) The Teaching of Arithmetic I: The story of an experiment. Journal of the National Education Association, 24 (8), 241 – 244. Available on-line at http://www.inference.phy.cam.ac.uk/sanjoy/benezet/ (visited July 23, 2002)

Benezet, L. P. (1935b) The Teaching of Arithmetic II: The story of an experiment. Journal of the National Education Association, 24 (9), 301- 303. Available on-line at http://www.inference.phy.cam.ac.uk/sanjoy/benezet/ (visited July 23, 2002)

Benezet, L. P. (1936) The Teaching of Arithmetic III: The story of an experiment. Journal of the National Education Association, 25 (1), 7 – 8. Available on-line at http://www.inference.phy.cam.ac.uk/sanjoy/benezet/ (visited July 23, 2002)

Blades, D. W. (1997) Procedures of Power & Curriculum Change: Foucault and the Quest for Possibilities in Science Education (New York: Peter Lang).

Cobb, P., Wood, T. and Yackel, E. (1993) Discourse, Mathematical Thinking and Classroom Practice. Chapter 4 in E. A. Forman, N. Minnick, and C. A. Stone (eds), Contexts for Learning: Sociocultural Dynamics in Childrens' Development (New York: Oxford University Press).

Duckworth, E. (1996) The Having of Wonderful Ideas & Other Essays on Teaching and Learning, 2nd edition (New York: Teachers College Press).

Duit, R. (2002) Bibliography: Student Alternative Frameworks and Science Education, (Kiel, Germany: Institute for Science Education (IPN) University of Kiel). Available on-line at: http://www.ipn.uni-kiel.de/aktuell/stcse/stcse.html (visited July 23, 2002)

Einstein, A. (1995) Relativity: The Special and General Theory (New York: Crown Publications).

Einstein, A., Lorentz, H. A. and Minkowski, H. (1924) The Principle of Relativity (New York: Dover Publications)

Glasersfeld, E. v. (1995) *Radical Constructivism: A way of knowing and learning*, (Washington, DC: Falmer Press,)

Maturana, H. R. (1988) Reality: The search for objectivity or the quest for a compelling argument. The Irish Journal of Psychology, 9 (1), 25 -- 82.

Newton, I., Cohen, I. B. (translator) and Whitman, A. (translator) (1999) The Principia: Mathematical Principles of Natural Philosophy (Berkeley, CA: University of California)

Fawcett, H. P. (1938) The Nature of Proof (Washington, DC: National Council of Teachers of Mathematics).

Schifter, D. and Fosnot, C. T. (1993) Reconstructing Mathematics Education: Stories of Teachers Meeting the Challenge of Reform (New York: Teachers College Press).

Stachel, J. J. (ed) (1998) Einstein's Miraculous Year (Princeton, NJ: Princeton University Press)

Trabal, P. (1997) La Violence de L'Enseignement des Mathematiques et des Sciences: Une autre approche de la sociologie des sciences (Montreal: L'Harmattan)

Curriculum Dynamics: Recreating Heart (Counterpoints, vol. 200)
M. Jayne Fleener (Peter Lang Publishing, Inc., New York, 2002), 215 pp., $29.95 (pbk), ISBN 0-8204-5540-7

Wheeler, J. A. (1999) Journey into Gravity and Spacetime (New York: W. H. Freeman & Co.)

Author's bionote:

Dewey I. Dykstra, Jr. is a Professor in the Department of Physics, MS 1570, Boise State University, Boise, ID 83725-1570 USA (e-mail: ddykstra@boisestate.edu). His work has focused on the nature of understanding physical phenomena and the development of a pedagogy to induce change in student understanding concerning such phenomena. Recently this pedagogy has been demonstrated to routinely induce changes in understanding with effect sizes of 2.5 standard deviations in non-science majors as compared to typical 0.5 standard deviation effect sizes from conventional pedagogy with science majors.