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Ben Lockerd

Grand Valley State University

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BEN LOCKERD

Teaching Across the Curriculum and General Systems Theory

In my undergraduate days I was uncertain whether to aim at becoming a doctor of medicine or of philosophy, and in my desire to be both, I frequently saw one being transformed into the other. When I learned in a quantitative chemistry course that crystals forming in a solution continue to both lose and gain molecules until they reach a critical size, after which they no longer dissolve but only grow, this natural law struck me as being analogous to the law of human nature asserted by G. I. Gurdjieff, who said that a point was reached in the development of higher consciousness at which the self no longer both declined and grew but crystalized so that it never again could be lost. It was striking to discover that a psychic law put forth by a Sufi mystic corresponded so perfectly to a physical law demonstrated by empirical chemistry. The most interesting area of biology seemed to me developmental biology, and the most exciting figure in that field was Hans Driesch, who demonstrated that if the two blastomeres of a cleaving sea urchin egg are separated each will turn into a complete (though small) sea urchin. In contemplating the mysterious process by which one cell can either become half of an organism (when the two blastomeres remain together) or a whole organism (when they are separated), Driesch eventually turned philosopher and joined Aristotle in positing an entelechy, an immaterial guiding force giving form to matter. Just as it becomes impossible to say whether certain sub-cellular organelles are living or not, so the dividing line between scientist and philosopher becomes blurred when certain basic questions are asked.

Non-empirical thinking occurs not only in biology but in the more mathematical “hard” sciences. Perhaps the best example is the famous story of the chemist August Kekulé, who is said to have discovered the structural model of the benzene ring in a dream. This story nicely illustrates the importance of intuition and analogical thinking in scientific inquiry.

As I was oscillating between biology and literature, my brother was firmly resolved on engineering, which is so practical in its orientation as scarcely to be scientific at

all; but he heard Buckminster Fuller speak and became deeply interested in the philosophical implications of modern knowledge of the natural world, delving into *The Tao of Physics* and other such integrative studies. In his writing about the physical universe, Fuller uses analogies and creates new words to such an extent that it would be nearly impossible to categorize his work as either literary or scientific. In this, Fuller's thinking follows that of Ludwig von Bertalanffy, whom he acknowledged as a leading theorist, and whose General Systems Theory is the subject of this paper.

"Science" and "philosophy" may never again be synonymous, as they once were; science is now experimental more than speculative and has proven its usefulness as such. But it seems that science has begun rediscovering its philosophical roots even as it was about to sever them forever, and it is in the attempt to understand how empirical science is rooted in philosophical tradition that we may see some hope of reintegrating the scattered, overspecialized disciplines of the modern university.

Writing Across the Curriculum and the more inclusive concept, Language Across the Curriculum, may have as their deeper and less conscious value the reunion of the Academy. Of course, programs that come under these headings have been developed with other purposes in mind. First of all, they aim at improving our students' use of language by encouraging teachers in disciplines other than English to make assignments that involve writing and speaking. English teachers also see Writing Across the Curriculum programs as a way of taking from our shoulders what we view as unwarranted responsibility for students' language proficiency: if "English" is important in no other classes but English class, students will see it as being of limited, specialized value.

Further, by sharing the responsibility for teaching language use, we resist being defined as a "service" department in the sense of a department existing only to teach a basic skill that then can be used unconsciously in the rest of the student's career — rather like shoe tying or driving a car. We define "English" instead as a medium or discipline for *thinking*, for teaching and learning — a discipline never perfected or perfectable, and one which cannot achieve the purpose we set for it when used unconsciously. When writing is used in those other courses, it should not only be on the assumption that remediation is needed but with the understanding that writing and speaking are the ways in which we clarify our thinking about any subject — that all disciplines develop from this discipline.

This last reason for Writing Across the Curriculum begins to contradict the first one: language arts cease to be seen as basic skills students did not get in the fourth grade and appear as the basic medium of higher education, the medium through which the teachers themselves continue to think and teach and learn. Language is therefore

a unifying element in all the academic disciplines. It seems a short and natural leap from this point of view to the one I am proposing. It is really only a reversal of perspective to go from the aim of remediation to that of integrating the Academy. While there is no question that remediation must remain an important goal of such programs, it makes a great difference to think of using language study as a way of integrating the entire curriculum rather than thinking of using the entire curriculum to implement language study.

A philosophical foundation for further development of this interdisciplinary purpose may be found in the General Systems Theory of Ludwig von Bertalanffy. Of course other writers have worked on the problem of reintegrating the disparate fields of study — Alfred North Whitehead and Michael Polanyi, for example. Perhaps I choose von Bertalanffy because he came to this problem from developmental biology and I have some familiarity with that field. Also, as will appear, von Bertalanffy considers symbolic language the essential implement for increasing knowledge in any field, which supports the contention that *Writing Across the Curriculum* is not only one way of integrating the curriculum but the natural way of doing so.

Von Bertalanffy realized the interdisciplinary ideal to a remarkable degree in his own career. Early on, he made a conscious choice between biology and philosophy, with the intention of integrating the two, no matter which he began with. In fact, though he chose to take up biology as his area of specialization, one of his early essays was on Nicholas of Cusa.

Though he once belonged to a group dedicated to reducing all of biology to physical and chemical explanations, von Bertalanffy's entire approach repudiates the mechanist, or positivist, philosophy, while likewise rejecting the teleological vitalist approach instituted by Aristotle and still current in the ideas of Driesch, Teilhard de Chardin and others. Von Bertalanffy argued that physical laws could explain non-living, "closed" systems but not living, "open" systems, which he saw as actively responding to the environment rather than merely reacting. One manifestation of the active nature of living systems is what von Bertalanffy called "equifinality," the ability of an organism to reach a goal by alternate means if one way is blocked. Driesch's experiment with sea urchin embryos demonstrates equifinality, as does the ability of many amphibians to regenerate lost limbs.¹

The general principle that living systems are not fully explainable by properties of closed systems rests on von Bertalanffy's observation that the world is structured as a hierarchy in which there is a newly "emergent" property at each new level that is not derivable from the properties of the level below it. This is an extension of the Aristotelian dictum that the whole is greater than the sum of its parts. In von Ber-

talánffy's view, the emergent properties of a higher system arise from the organization or interrelation of the parts rather than from a guiding entelechy, and the general laws of organization are held to be discoverable scientifically, though they are not reducible to chemical and physical laws. This principle leads, then, to a biological theory that is neither mechanist nor vitalist: von Bertalanffy called it the "organismic" theory.

Perhaps the most striking and important application of the organismic approach is von Bertalanffy's position on evolutionary theory. He acknowledges that "the transition toward higher forms of life on earth in geological history is an empirical fact," but he scorns the generally accepted explanation that this evolution came about through random mutations and "differential reproduction" (that is, the survival of larger numbers of mutants particularly well adapted to a given environment):

I must confess that I do not see a scintilla of evidence that evolution in the sense of progression from less to more complex organisms has anything to do with improved adaptation, selective advantage, largest production of offspring, or in whatever way the Darwinian concept is couched. Adaptation to environment appears to be possible at any level of organization, as is testified by the presence, in almost any environment, of organisms belonging to many levels of organization.²

The point here is that bacteria or insects or reptiles are as well adapted to the environment as mammals — perhaps better — so the idea of better adaptation will not explain the emergence of higher levels of organization.

Von Bertalanffy turns the tables (perhaps too neatly) on the scientists who renounce metaphysics when he writes,

Structure and formation of physical entities at any level — atoms, molecules, high-molecular compounds, crystals, nucleic acids, etc. — follow laws which are progressively revealed by the respective branches of science. Beyond this level, we are asked to believe, there are no "laws of nature" any more, but only chance events in the way of "errors" appearing in the genetic code, and "opportunism" of evolution, "outer-directed" by environment. This is not objectively founded science, but preconceived metaphysics. (*Robots, Men and Minds*, 84-5)

Again, while exposing the positivist bias, von Bertalanffy divorces himself from the vitalists by maintaining that there must, in fact, be *natural* laws of open systems (laws of organization rather than of physics) which bring about the emergence of higher forms. He concludes a brief sketch of his thinking on this subject,

It appears, therefore, highly probable that present evolutionary theory is only a partial aspect. Instead of the empty claim that everything is maintained by random mutation and selection — of what I called the Tibetan prayer wheel of selectionism . . . — there is a wealth of researchable and fascinating problems which, we believe, will open new perspectives and bring evolution into the framework of organismic and systems thinking. (*Robots*, 86)

According to this point of view, emergence of higher organisms can be neither completely accidental nor completely purposive: thus von Bertalanffy finds a delicate balance between two opposed philosophies of science.

But by this time the patient and curious reader may be concerned to know what these biological matters have to do with *Writing Across the Curriculum*. Besides introducing the origin of General Systems Theory, my aim here is to point up the degree to which modern science remains, consciously or unconsciously, philosophical. Von Bertalanffy is one among many to have emphasized this insight. It is ironic, he points out, that many biologists insist on attempting to reduce their explanations to physical principles when physics has itself abandoned the Newtonian model (Davidson, 98-9; von Bertalanffy, *Robots*, 96). And he carefully insists that no science, no matter how empirical its orientation, avoids all philosophical presuppositions: in fact, empiricism itself is such a presupposition. Modern physics, through the theory of relativity, quantum theory, the Heisenberg principle of indeterminacy, etc., has turned back into metaphysics, and that may be the full circle capable of reintegrating the Academy.

His opposition to the mechanistic approach in biology led von Bertalanffy to condemn it even more heartily in its appearance in psychology, a field he explored with Dr. Karl Menninger and others. Insisting that both Freudian thinking and behaviorism were reductionist, and fairly sneering at Desmond Morris's popularization of the "naked ape" idea, von Bertalanffy searched for the characteristic that would sufficiently mark mankind's categorical difference from even the highest animals. The decisive factor, he concluded, was our creation of symbols, and he later discovered that his thinking on this point had virtually coincided with that of Ernst Cassirer, Suzanne Langer and others (*Robots*, 22). Though von Bertalanffy never, to my limited knowledge, mentions the teaching of English (except obliquely when pointing out that a false understanding of our egalitarian ideal has led us to produce students who are not even competent in their native tongue), it is in this all-important area of symbolism that English departments naturally take a leading role: it is the English professor's particular business to make students aware that human thought and language depend on our ability to create symbols.

If it is granted that real thinking is always symbolic (or analogical) thinking, and that language is the primary medium of symbolic thinking, then any college department whose aim is real thinking would consider writing and speaking primary vehicles of learning. Of course, the quest for real thinking, genuine discovery of knowledge, is by no means a given in every college department, for many subjects included in college curricula today are strictly technical in orientation, or are treated that way. Only those departments whose members seek to *educate* their students — to draw out the students' own ability to create ideas — can be allied with one another by the use of writing. In a way, then, unifying the curriculum through the common aim of active symbolic thinking means reawakening in all of us our love of wisdom — our call to be doctors of philosophy, no matter what discipline we specialize in.

Once we become more conscious of our common aim and common medium, we ought to see the same issues and concerns appearing in different forms in the various disciplines. General Systems Theory prescribes an interdisciplinary study that demonstrates the principle of “isomorphism,” which states that the same patterns will be found in all content areas (*Robots*, 63). Von Bertalanffy explicitly proposes to reintegrate the specialized academic fields: “In education, such concepts may contribute toward unification of knowledge, permitting us to perceive a grand plan or structure in what otherwise are different and divergent specialties. . . .” (*Robots*, 114). Such a holistic approach is not achieved, von Bertalanffy pointed out, by general education requirements: rather, an interdisciplinary approach would have to be taken by teachers of each specialized course. As Mark Davidson explains,

Bertalanffy maintained that academic overspecialization cannot be overcome by simply asking science students to take some courses in humanities, and vice versa. . . . He advocated instead that educators prepare interdisciplinary courses from material carefully selected to highlight integrative *principles*. For Bertalanffy, a GST educational policy would produce professionals who, though they make their living as specialists, view the world as generalists. (Davidson, 187)

Perhaps most college teachers think of themselves as pursuing some such ideal, but we rarely set up structures to foster that pursuit. Writing Across the Curriculum, viewed more broadly as teaching across the curriculum, may be such a structure.

My proposal may startle few of those who hear it, for something like General Systems Theory is simply in the air, and has been for some time. In a recent essay in which he considers what a truly new rhetoric might be (implicitly pulling the magic carpet out from under those who claim to be new rhetoricians), Professor Jim W. Corder suggests,

We have not yet seriously begun to explore rhetoric as a portal to other fields. Rhetoric may not be able to do for other fields what their own methodologies have not done, but rhetoric can help us see things in other fields in new ways, and when we see in new ways, we may think in new thoughts.³

Writing Across the Curriculum programs, if viewed from this perspective, can be a structure for exploring “rhetoric as a portal for other fields,” and I take it that by “rhetoric” Professor Corder means something closely related to von Bertalanffy’s “symbolism,” the creation of new ideas in necessary conjunction with the invention of new forms to contain and express those ideas. Rhetoric may be a sub-category of the more general notion of symbolic thinking, but it is the category most important to all disciplines except the fine arts and mathematics, and it is, of course, the special study of the English teacher.

How would teaching across the curriculum look in practice? Like von Bertalanffy and Corder, I can claim that it is only in trying it that we will discover what it is to be. I would say, however, that such a program would call for our taking a more historical and philosophical view of each discipline (perhaps implying the need for compulsory introductory history and philosophy courses to prepare students for the endeavor). Science and social science courses might spend a good deal more time on the history of their disciplines; and rather than treating earlier scientific paradigms as simply wrong and fantastic, we should treat them as symbolic constructs based on certain assumptions current in the thinking of their times. Within each historical period, analogies ought to be pointed out in ideas concerning science, man, society, and the arts. When contemporary knowledge is studied, it ought to be with the same approach and with the awareness that we too make basic assumptions that limit all our discoveries. In short, scientists would tend to view themselves as natural philosophers again. C. S. Lewis calls for such a shift, in words that recall von Bertalanffy’s: “The regenerate science I have in mind would not do even to minerals and vegetables what modern science threatens to do to man himself. When it explained it would not explain away. When it spoke of the parts it would remember the whole.”⁴

The social sciences might challenge their students to ask continually in what way their study can be, is, or ought to be “scientific” — and to what extent it must develop ethical principles. Psychologists in particular must open to their students the profound philosophical issues their study raises by taking seriously older theories of the mind, as well as current theories that are in disrepute.

The general function of English departments in teaching across the curriculum has already been suggested. In our study of language and literature we must emphasize what may seem paradoxical to some, that the great utility of language lies in its appar-

ently impractical, symbolic nature. When it becomes only a system of automatic signs (such as can be taught to many animals), it loses its creative potential. It is our particular struggle and joy (but one all our colleagues join in) to awaken in students a consciousness of the indivisibility of form and content, symbol and idea.

Freshman Composition prepares college students for the writing they will have to do in future courses and throughout their lives. The systems approach envisioned here would emphasize that writing is thinking and would highlight the historical and philosophical questions that cross all disciplines. Readings might be chosen from the major divisions of knowledge and from major historical periods, and those readings might be treated not only as instances of good writing but as *content* which the students would be expected to understand and to write about. We would thus be introducing our students to a representative sampling of the whole universe of knowledge they will encounter at the university, and we would help them define “knowledge” not only as remembering things but as knowing about things — and knowing about knowing — that is, as philosophy. Freshman Composition would thus come to be treated less as a basic skills course and more as a general introduction to the intellectual endeavor of the university.

I must say that I do not suppose myself to be suggesting a radical innovation: I expect that good teaching has always been teaching across the curriculum. But the difficulty of reintegrating the college curriculum is so great that the effort to do so must have philosophical grounding to make us more conscious of our true goals. To think of Writing Across the Curriculum as teaching across the curriculum is a slight shift of perspective, but one that could eventually make (and perhaps is already making) a profound difference in college education.

¹ See Mark Davidson, *Uncommon Sense: The life and Thought of Ludwig von Bertalanffy, Father of General Systems Theory* (Los Angeles: J. P. Tarcher, 1983), 76-8. Much of the information for my short summary of von Bertalanffy's thought is from Davidson's book.

² von Bertalanffy, *Robots, Men and Minds: Psychology in the Modern World* (New York: George Braziller, 1967), 82-3. This is the most accessible general treatment of his ideas written by von Bertalanffy.

³ Corder, “On the Way, Perhaps, to a New Rhetoric, but Not There Yet, and if We Do Get There, There Won't Be There Anymore,” *College English*, 47 (1985), 167.

⁴ Lewis, *The Abolition of Man* (New York: MacMillan, 1947), 89-90.