

Deep Reflection on My Pedagogical Transformations

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Abstract

This retrospective essay contains my reflection on the deep concept of ambiguity (uncertainty) and a concomitant epistemological theory that all of our human knowledge is ultimately self-referential in nature. This new epistemological perspective is subsequently utilized as a platform for gaining insights into my experiences in conjunction with the design and teaching practices manifested in an introductory economics course that I taught for more than thirty-five years at an American university. This exposition is in the first person because I believe that is the primary way that we gain a meaningful grasp of the educational (transactional) enterprise that many of us participate in.

Keywords: ambiguity, constructivist paradigm, self-referential knowledge.

1. Introduction

Several years ago I presented a research paper with the title of “Teaching Introductory Economics with Some Ambiguity” at a conference on the teaching of economics (Suzawa, 2000). As I started to make my presentation, someone in the audience impatiently raised the question: “Do we need more ambiguity in the way we teach economics?” As the purpose of my paper was to present a statistical assessment of the efficacy of what I was doing in my course, my response to the question was quite terse. I said that “ambiguity was a central focus in my constructivist’s approach to course design and teaching conduct.” Only in retrospect did I realize that my answer should have been longer. In most economics instructors’ minds at that time, there were no strong association between the term “ambiguity” and the nexus of teaching and learning based on a constructivist paradigm. Thus a clarification of the concept of ambiguity and an elaboration of how this “deep” concept (metaphysical) was influencing my teaching design and practice at the time were clearly warranted.

But as in the case of many active university educators, there was always a scarcity of time to reflect on the epistemological foundations of one’s pedagogy. Now that I have retired from teaching, I have some time for undertaking additional philosophical thinking and elaborating on my experiences undergoing pedagogical paradigm shifts during my university teaching career. These are the dual themes of this retrogressive essay (Note 1). Incidentally, writing this essay also enables me to indulge in my love of the subject of philosophy as well as to share some of the wisdom that I may have earned serving as an instructor of introductory microeconomics economics for over thirty-five years.

2. Our Words Have Multiple Layers of Meaning (Vygotsky, 1962)

Do I believe that we need more ambiguity in the way(s) that economics is taught? My answer is yes and no. It clearly depends on the sense, or meaning, in which the term is being understood. Ironically, the word “ambiguity” itself is ambiguous. It has several possible interpretations. For the most part, economics instructors make extensive use of the blackboard and verbal explanations. This has been dubbed “chalk and talk” by (Becker & Watts, 1996). Ambiguity can occur in the language that we use to teach. In semantics, ambiguity refers to a word, phrase, or sentence having more than one literal meaning. Consider the statement: “I’ll give you a ring tomorrow.” The sentence has more than one literal (lexical) meaning because a particular word in the sentence (i.e. a component) has more than one meaning. The word “ring” could refer to an engagement ring or to a call on the telephone. In this case, semantic over-determination prevails if only one meaning is intended. Some process of disambiguation would have to be undertaken to delineate the intended message (Bach, 1994). In many cases, the context in which the statement is made would serve that purpose. If not, there are some formal techniques for disambiguation that can be applied. Over-determination is not intentional (except in situations were “strategic

ambiguity” is advantageous) and needs to be corrected. You might say that I made this kind of error in my use of the term ambiguity in the title of my conference paper. To be sure, we need less of this kind of semantic ambiguity in our teaching of economics.

Another kind of semantic ambiguity, which I believe we should minimize is syntax, or logical, ambiguity. This sense of ambiguity relates to the manner in which language and mathematics serves as the *modus operandi* for the human reasoning processes. In this context, we are dealing with both the “chalk” aspect of economics instruction as well as the “talk” aspect. In language, a sentence or phrase can have more than one meaning, not because of any words in the expression having more than one meaning, but because of the structure or arrangement of words (syntax) in the sentence is ambiguous. A good example of this is the sentence: “Everybody loves somebody.” There are two distinct logical (symbolic) propositions embodied in this sentence: One proposition is that each member of the group loves another member of the group. (The mapping is within the set.) The alternative proposition is that all members of the group love a particular member of another group (The mapping is between sets). Thus, when it comes to the matter of determining the truth or falsity of this sentence, it is not clear which of the propositions we are to test. Is it the first or the second?

One can see that the above mentioned meaning of ambiguity implies vagueness in both symbolic (logical) and linguistic (syntax) reasoning and is generally not considered to be desirable in teaching economics. Of course, there may be some exceptions to the rule. For example, from a pedagogical perspective, one may find it useful to employ examples of bad logic to teach good logic. A generally accepted invalid statement (or statements) can be expressed in the classroom with the hope that the students will eventually come to realize its valid counterpart. In other words, the teaching strategy could be based on attempts to dispel economic fallacies. This strategy could also be used in conjunction with economic “myths.”

3. The Deep Meaning of Ambiguity (A Metaphysical Perspective)

So far I have said no to the sense of ambiguity as semantic ambiguity, i.e. multiple meaning of words, phrases or sentences. When I say specifically “with some ambiguity,” in what sense of ambiguity do I want to infuse the teaching of economics with? The lexical meaning that I have in mind is uncertainty. For the full and proper sense of this meaning of ambiguity we need to explore the roots of our Western mindset-Greek philosophical thought. Early Greek philosophers grappled with three fundamental concepts of epistemology (and ontology): (1) presupposition (necessity), (2) ambiguity (possibility) and (3) negation (impossibility). In one branch of Greek philosophical investigations, the three epistemological concepts were considered to be completely autonomous, i.e. not reducible to any of the other two concepts. However, starting with Aristotle (384-323B.C.), presupposition and negation gained supremacy in Western “logical” thinking and this bivalent form of logical reasoning has prevailed for more than two-millennium. Together with Plato’s (428-348B.C.) foundation for the mathematics of geometry, this “rational” way of thinking served as the epistemological platform for the development of what is now known as the Scientific Method.

According to physicist Basarab Nicolescu, the proper ambiguity concept is essentially ignored in the axiomatic system that generates the logical structures that are used by the various scientific disciplines. The three postulates (axioms) of the prevailing logic are: (1) axiom of identity, i. e. A is A , (2) axiom of non-contradiction, i.e. A is not non- A , and (3) axiom of the excluded middle, i.e. There does not exist a term T such that T is both A and non- A , or is not both A and non- A . With the third postulate of this prevailing axiomatic approach to scientific inquiry, there is no way of over-riding the mutually exclusive nature of reasoning (dichotomy) cognitively in any scientific discipline using this logical system. The alternative is to change postulate (3) to (3') axiom of the *included middle* and develop a multivalent logical system which allows for contingent reasoning. However, the downside of this modification is that it could also lead to situations in which contradiction (inconsistencies in reasoning) could occur. This aspect of the logical system would tend to make many lay-people and some specialists uncomfortable with the validity (truth) of the reasoning process employed by physicists.

There is an old adage: “If it works, why fix it?” If the “Old Logic” has been so useful in assisting the various disciplinary sciences in increasing knowledge, why change the *rules* of scientific inquiry at this juncture? But the fact of the matter is that the Old Logic, or way of thinking with strict bivalent logic, has been impeding progress in the scientific discipline of physics and a few others. Theoretical physicists are not making much progress in developing new knowledge of the physical universe beyond the level of what can be called quantum mechanics. In their concerted attempts to resolve the discontinuities that they have encountered in their endeavors to expand the knowledge of their field of inquiry, they (or at least some of them) have reached the point of seriously challenging the basic postulates of their science. Thus, the perception of the problem-solving utility of altering the third postulate of the Old Logic has gained momentum in theoretical physics. And some physicists have

become advocates for a form of multivalent logical system yet to be fully developed and functionally applied. (Note 2)

I believe that what is transpiring across a multitude of scientific disciplines is something beyond what Kuhn (1962) has characterized as a “scientific paradigm shift.” Paradigm shifts can occur within the context of what I have called the Old Logic. What appears to be happening currently, I believe, is a transformation in our way(s) of thinking (metaphysics); which in turn is transforming many of our scientific paradigms. Many intractable problems (paradoxes and contradictions) in various fields of study appear to be yielding to the onslaught of an amalgamation of new, powerful ideas from across various disciplines as they remove the restraints of the rules of the Classical Greek logic developed by Aristotle.

As a social science discipline, how has economics been influenced by this on-going metaphysical transformation. I believe the title of a book surveying economic methodology and contemporary science theory by Hands (2001) says it succinctly, *Reflection without Rules*. Economics has not been immune from this “epidemic-like” transformation that has been occurring. It should be pointed out, though, that as a discipline, economics has several unique features relative to other scientific disciplines. First of all, there are some practitioners who classify what they do as an art rather than a science. Secondly, many practitioners who accept the mantle of a social science distinguish their scientific methodology as “soft” compared to the “hard” methodologies of such disciplines as physics, chemistry, and biology. And thirdly, in terms of teaching economics, many instructors seem to be more concerned with differentiated approaches to the subject (e.g. institutional, neoclassical, Marxist, Austrian, feminists, etc.) rather than their teaching pedagogy. Nevertheless, regardless of their orientations, their economic methodologies rely on the epistemological platform of Aristotle (and Plato). This Classical Greek platform (mindset) has been undergoing a significant transformation for many years now.

4. Perspective of Self-referential Knowledge: A New Mindset?

What could be the salient features of a “new” epistemological platform for the advancement of scientific knowledge? There is an ample source of philosophy of science literature for us to draw upon for an extended annotated survey on this question. However, for the purpose of this essay, I would like to take a more personal track and just focus on three published works that have had a “game-changing” (U.S. business strategy slang) kind of influence on my thinking with respect to teaching introductory economics. The first is a very thought-provoking reinterpretation of Plato’s dialogue entitled *Theaetetus* done by Desjardins (1990). The second is some exposure to the work of the twentieth century Italian existential philosopher, Nicola Abbagnano (1900–1990), via his American translator, Langiulli (1992). And the third is a volume by cognitive scientist Lakoff and Johnson (1999).

Unlike his mentor Plato, Aristotle recorded his philosophical thoughts in the format of a treatise. Plato did so in the format of a series of written dialogues. The systemization of thought manifested in Aristotle’s writings became the standard format for the dissemination of the results of Western philosophical and scientific inquiries. To understand Plato’s philosophical views, on the other hand, one has to sort through the contents of his many written dialogues and to interpret the intended “meanings” of their contents. Plato is generally credited with the “idea of forms.” His development of “forms” (symbolic representations) is scattered over several of his dialogues. The significance of the seminal idea of forms was that it served as the foundation for Aristotle’s system of abstract reasoning based on the rules of a bivalent logical system. Beyond this fundamental idea of “conceptualizing and abstract reasoning,” did Plato ever develop a comprehensive philosophical system of knowledge? On this question it seems that Plato’s reflections were highly concentrated in his dialogue *Theaetetus*. For many centuries, interpreters of this particular dialogue have concluded that Plato failed to elucidate a comprehensive philosophical “theory of knowledge.” Recently, however, Desjardins (1990, p. 15) has concluded otherwise:

The ostensible subject of the *Theaetetus* is introduced by what must surely be one of the most lightheartedly ironic of all Plato’s understatement: ‘I am puzzled about one small matter...this is what I am perplexed about and cannot fully grasp by my own efforts: what knowledge is.’ To all appearances, the question is never answered. In reality, so this study will argue, we are provided with a carefully worked-out answer---an answer recognized as explicit, however, only if the dialogue is taken *self-referentially* (emphasis added).

I found her interpretation of Plato’s dialogue to be very persuasive. Essentially, she argues to restore the independent role of ambiguity to Greek thinking on *logos* and accepts the fundamental idea of *spontaneous emergence* in order to generate a comprehensive and complete epistemological perspective. Her work serves as my prime reference for this “new” (actually the “rediscovered”) perspective of the “epistemology of

self-referential knowledge.” According to Desjardins (1990, p. 163) “...the cross-examination of Socrates” dream points to the sense in which knowledge must be recognized, and actually achieved, as not only many but also ‘one’: an emergent whole born in generative interaction between its constituent elements”. In simpler terms, the full and proper sense of deep ambiguity can be expressed as the notion of *unity and multiplicity*, or *nothing and something*, which on the surface appears to be a contradiction (or paradox) from the perspective of the rational duality principle. In other words, this notion of ambiguity was *irrational*. This statement, of course, is “true.” But it is true by virtue of our mindset exclusion of the notion from our modes of thinking ever since Aristotle. His predecessor, Plato would probably not have agreed to this kind of fundamental logical exclusion.

There is an ontological side to Desjardins investigation of Plato’s dialogue. But I found her exposition to be difficult to understand, particularly because she resorts to the original Greek language to decipher the ontological aspects of Greek *logos*. So I thought about the refractive (dual) relationship between existence (physical being) and cognition (mind). This duality enabled me to establish a relationship between “ambiguity” and “possibility,” and then to philosophically examine their respective full and proper meanings. Desjardins’ study of Plato’s dialogue was essentially a very extensive investigation of the meaning of the word “ambiguity” in ancient Greek reflections on knowledge (epistemology). Italian philosopher Nicola Abbagnano searched for the proper sense of the word “possibility” as an essential foundation for his philosophy of existentialism (ontology). According to his American translator, Langiulli (1992, p. 127), Abbagnano’s positive definition of possibility is “...that which can exist or [and] not exist and [which] obtain only as such.” Another, somewhat negative, formulation of the third sense of possibility might be this: A possibility is neither that which is necessary nor that which is impossible.” Thus, it would appear that Abbagnano affirmed the autonomy of possibility from an ontological perspective. Possibility in this proper sense could be interpreted as the (apparently) paradoxical *being and not being*, or *becoming*. Another interpretation is *some degree of being and not being*, which suggests a dynamic *flux*, or *continuum*, idea of human existence. Returning to the epistemological side of the ambiguity/possibility first principle, cognition would not be complete, that is, as *comprehensive or full as it possibly could be*, unless it entails black, white and all shades of grey as well. Confining cognition to either black or white (binary logical system) reasoning would constitute *incomplete* cognition.

The (Lakoff & Johnson, 1999) volume represents an attempt to resolve the mind/body dichotomy that has long baffled philosophers and scientists. Basically, they argue that the *refractive* relationship that we presented earlier between mind and body is not the same as the relationship between the human mind and other nonhuman entities. They adhere to the cognitive science theory that the mind is an *emergent* entity of the human brain. Instead of conceiving of the mind and body as a mutually exclusive (“the excluded middle”) *duality*, one should conceive of the two as *complementarities* (embodied mind). Thinking becomes a *reflexive* process when it is focused inward onto the self. The question of “How do I know that what I know is certain?” can only be answered (or proven mathematically) *self-referentially*. In more esoteric terms, ultimately there are no other axioms to ground (or anchor) the logical thinking processes of humans other than to the human brain where all of the information from the human senses are transmitted via a very complex neurological network. Our symbolic reasoning (cognition) is ultimately based on our human senses. Thus, all of our knowledge is based on our experiences and our experiences in turn are forever changing as we humans biologically evolve. What we are ultimately evolving into is unknown (uncertain). Thus, the knowledge that we generate via our cognition is forever surrounded by a “fog” of ambiguity.

5. Pedagogical Transformations of an Economics Instructor

I began my tenure-track university teaching career during the 1972-73 academic-year of the American higher education system. With the exception of a research sabbatical during the 1979-80 academic-year, I taught a section (some times two) of the microeconomics half of a two semester introductory economics course entitled “Principles of Economics” at the University of Rhode Island until my retirement at the end of the 2007-08 academic-year. In the beginning of my teaching career, if someone were to ask me: “What was the pedagogy of my introductory microeconomics course?” I would have responded “Samuelson.” In other words, Paul Samuelson’s textbook (1948) served as my *de facto* way of teaching introductory microeconomics theory. I was no different than a large percentage of American instructors of introductory economics who relied on the use of the Samuelson textbook in their courses. According to Skousen (1997, p. 137): “Paul Samuelson’s *Economics* ranks with the most successful textbooks ever published in the field, including the works of Adam Smith, David Ricardo, John Stuart Mill and Alfred Marshall.” The popular neoclassical approach developed by Paul Samuelson and reflected in his textbook implied that I was a “mainstream” economics instructor. This distinction became necessary when some American authors of economics textbooks began to adopt “heterodox” approaches to economics during the decade of the 1980s.

The pure Samuelson pedagogy served as my educational beliefs for over a decade of teaching. As a graduate student of economics, first at the University of Hawaii (Manoa campus) and subsequently at Brown University (Providence, Rhode Island), I had gained mastery of Samuelson's *Foundations of Economic Analysis* (1947). Consequently I was very "comfortable" in my course on the principles of microeconomics at the University of Rhode Island, doubly so because I used the Samuelson textbook (*Economics*, 8th edition) as a course complement. However, towards the end of the first decade of my teaching career I began to experience a growing dissatisfaction regarding how my students were learning the "content" of the course. Also, the expanding number of textbooks manifesting heterodox approaches to economics in the marketplace during the 1980s began to weaken my confidence in the Samuelson pedagogy. Eventually I came to the realization that "good" instructors (effective teachers) must not only have a deep understanding of the subject that they teach, but also they must also develop a deep understanding of how their students learn the subject as well. Furthermore, "good" instructors must learn how to craft an educational framework that optimizes the teaching and learning processes.

My initial effort to move away from the pure Samuelson pedagogy was to search for an alternate textbook to replace Samuelson's popular text. My primary intention was to find a textbook that adhered to Samuelson's neoclassical methodology of microeconomics but yet one that provided more student-appealing examples of the applications of the economic models that they were being exposed to. Prior to my sabbatical leave to undertake research on technological change during the 1979-80 academic-year, I utilized several semesters experimenting with some "Samuelson-imitations."

The effort to find an adequate substitute text proved to be very disappointing, so after my sabbatical leave I started to redirect my pedagogical change efforts toward redesigning my course structure and conduct (syllabus). I started to incorporate elements of *critical thinking* and *historical accounts* into my course design beginning with the 1983-84 academic-year. My pedagogical transformations at this stage of my academic career made me feel that I was succeeding in helping my students understand the essence of economic knowledge as it relates to the "real world." This sense of pedagogical accomplishment lasted for about another decade until another dose of disillusionment set in during the 1993-94 academic-year. The study of economic concepts and models with some emphasis on historical context was too "retrogressive" in orientation. By this I mean that the historical and critical thinking approaches to the subject conveyed the impression that our past was always a prelude to our future. The addition of critical thinking exercises to my course syllabus lacked the conceptual properties to help my students comprehend the tremendous amount of entrepreneurial changes and technological innovations that were occurring in the U. S. during the 1990s ("The New Economy"). Thus the next stage was to add some form of creative thinking exercises to my course syllabus. This I thought would provide a "forward" orientation in the subject of instruction and thereby balance the regressive orientation of my previous pedagogical changes. To assist me in my efforts to modify my course syllabus, I relied on students' written critiques (feedback) at the end of each semester. I also participated in a small-group learning program conducted by my university's Instructional Development Program (IDP) during the 1997-98 academic-year and attended a National Science Foundation sponsored short course (NSF Chautauqua) for college and university instructors entitled, "Teaching Creative Thinking to Enhance Critical Thinking" (Summer, 1999).

6. Philosophical Reflection Induced by a Pedagogical Crisis

Post-sabbatical changes in my course syllabus clearly indicated that my course structure and conduct was tending to move away from the "Samuelson pedagogy." But to what "pedagogy" was it morphing to? At the time of my presentation at the teaching conference in February 2000 there was "some ambiguity" regarding the labeling (nomenclature) of my teaching approach. I was aware of alternative student learning models that were being discussed by educational specialists. One of these was the constructivist model for science education, (e. g. Mintzes, Wandersee, & Novak, 1999) and another was the dialogical model for socio-cultural education, (e.g. Wells, 1999). A common feature of both of these models was the psychological premise that students effectively learned by "actively sharing in a process of knowledge assimilation" with their instructor. Teaching was transactional in nature. In contrast to the constructivist and dialogical models, the mainstream "chalk and talk" type of instruction in economics conveyed the expectation that students would (could) "passively" gain a high level of understanding if a highly qualified instructor presented the subject matter (knowledge) in a lucid and analytically coherent manner (transmission). A failure to understand on the part of students was due to a failure to communicate (ineptitude) on the part of the teacher.

To distinguish my current pedagogy from the pure Samuelson pedagogy, I responded to the question raised at the teaching conference by indicating that my pedagogy was based on a constructivist paradigm. In "truth" my prior advanced education in neoclassical economics was still evident in my response to the question. Specifically my

beliefs manifested Samuelson's methodology of comparative static analysis (e.g. shifting Supply and Demand curves). Conceptually I was moving from an "old equilibrium state" (the Samuelson pedagogical model) to a "new equilibrium state" (a constructivist model) and expected the audience to be able to distinguish between the two. The "New Logic" mindset would have evoked a much different type of response than the "Old Logic" mindset. A *possible* "New Logic" response is: "In all honesty I was a proponent of the Samuelson pedagogy initially, but am now in the process of moving away from that pedagogy towards a new pedagogy which contains elements from a Constructivist model of learning and a Dialogical model of learning. You can say that I currently have an 'eclectic' pedagogy which is Samuelson-Constructivist-Dialogical in nature and still in the process (dynamics) of changing. And I have been concerned with this pedagogical ambiguity (uncertainty) for some time now"

Out teaching beliefs are sometimes manifested in popular metaphors. In terms of King's (1993) seductive metaphors: I was a "sage on the stage" seeking to become a "guide on the side." King's metaphors became a faddish way of distinguishing between a pedagogy predicated on the "passive learning" model and a pedagogy predicated on the "active learning" model during the latter part of the 1990s. However, if you were to evaluate King's metaphors on the basis of the deep concept of ambiguity that we discussed earlier you will find that these metaphors were conceptually very restrictive. The restrictive features of the metaphors are the spatial references implicit in the terms "stage" and "side." The meaning of these words anchor the passive learning and active learning distinctions to a strictly "either/or" kind of thinking mode. In other words, the metaphors were consistent with the logic of Aristotle's rational foundation of thinking. But it also unnecessarily channeled our organizational perceptions into (large size) lecture courses *verses* (small size) courses which were akin to seminars or workshops. This seemed to be a prevailing presumption among many faculty members and administrators during my tenure as an active university instructor of economics.

As I continuously sought to modify my course syllabus over the years, I came to believe that "active learning" on the part of both students and instructor *was possible* and did exist to "some extent" ("some ambiguity") in my changing lecture-style course. However, my thoughts on pedagogy were not consistent with the Old Logic manifested in Allison King's metaphors. As a point of fact, "an active learning lecture-style course" was generally taken to be an oxymoron kind of reference. It felt like I was butting my head against a paradox and not making any progress in my efforts at pedagogical transformation. Eventually, logical (Old Logic) contradictions and intellectual tensions became so unbearable such that I felt that I had to seek outside help in undertaking an exploration into the "meaning of learning." Thus began a period of Internet dialogue on the "meaning of learning" with Jan Visser and other individuals under the auspices of the Learning Development Institute (LDI) which culminated in a workshop and special panel session at the International Conference of the Association for Educational Communications and Technology (AECT) in October 2003. This was a crucial "tipping point" for me. During this stage in my teaching career I believe I truly became a "reflexive practitioner." (Note 3) Nevertheless, the "seeds" of my philosophical reflection were already germinating in my prior teaching conference paper (2000, p. 235):

My classroom presentations are a mixture of lectures and discussions, or 'dialogues' if you prefer, designed to not only inform students of facts, concepts and models, but also to stimulate them to think critically and creatively about the course's content. With respect to the dialogue of cognition (i.e. the Socratic Method as reflected in the dialogues of Plato), Robert Grudin (1996, p. 211) suggests the following interesting philosophical premise: 'Unless they are understood in a context that includes irony, ambiguity and contingency, conclusions are always wrong and assertions are always mistaken.' In a succinct discussion on 'teaching thinking,' McKeachie (1999, p. 328) says that: 'Learning to think usually begins by (1) bringing order out of chaos, (2) discovering uncovered ideas, and (3) developing strategies while avoiding jumping to conclusions.' Again, we have cognition implying a state of 'irony, ambiguity and contingency.'

7. Example of a Creative Thinking Exercise

During the last decade of my tenure as a university instructor of introductory economics I constructed or borrowed several creative thinking exercises to incorporate into my course. The NSF Chautauqua course was a good external source for some of the devices and techniques that I experimented with. However, the exercise that I found to be quite compatible with a constructivist strategy of learning is one that I crafted myself. The inspiration for this teaching device was derived from an interview with Kenneth Arrow. After a decade-long collaboration with theoreticians from other scientific disciplines at the Santa Fe Institute, an interviewer from the Federal Reserve Bank of Minneapolis (1995, p. 3) asked economist Arrow if this experience had proven to be

fruitful. His response was:

I think one of the things we learned from the physicists and also the theoretical biologists is the idea that when you're dealing with very complex systems you're going to get a large variety of behavior which can be interpreted as hill climbing, but hill climbing with a lot of modifications, hill climbing with big jumps occasionally. This is an elaboration of the idea of the learning model.

While Arrow used "hill climbing" as a metaphor for complex learning, I literally devised a pedagogical hill climbing exercise to help my students develop creative problem-solving skills.

About three weeks prior to lecturing on the topic of the profit maximization principle of the neoclassical model of the competitive firm, I had my students do what I merely referred to as a "hill climbing" exercise. Specification of the problem was: "Find your way to the top of a hill at night when it is pitch black and you have only a lantern to help you achieve that goal." They were allowed five-minutes to write out how they would go about solving the problem. I did not place any constraints regarding what method (plan) or strategy they devised to solve the problem. The submitted results were then screened and within a week's time returned to all students in the form of a summary selection of their written suggestions categorized on the basis of methods and strategies.³ I made no statements regarding what I considered to be "the right or recommended way" to solve the problem, but just repeated the question about how they would go about solving the problem. For the second iteration, instead of a written response, we used a portion of the class time to discuss the categorized summary that I had distributed in class. Again, I did not inject any comment about the "right way" to solve the problem. My students were left to do their own reflections on their problem solving experience and to make their own critical judgments regarding the matter of how successful they were in solving the "hill climbing" problem. Did they each do their own assessment? I don't really know for sure as I did not undertake a third iteration to find out. I presume that some did and some didn't, depending on how *vital* each student thought the problem was, i.e. how meaningful it was for their "self-realization." From my teaching perspective, the immediate goal of that classroom exercise was not to derive a solution to the "hill climbing" problem, but rather to induce students to think creatively about an ambiguous problem using their stock of conceptual knowledge (including any knowledge possessed by their classmates).

However, when it came time to lecture on the profit-maximization principle of the neoclassical theory of the firm, I did (authoritatively) resort to the hill climbing exercise as a way of demonstrating the problem-solving capabilities of the contributions the classical school of Marginalism, which Samuelson advanced so aptly in his neoclassical economics treatise. (Samuelson, 1947). I pointed out that solving the hill climbing exercise during the daytime was quite different than solving the problem during the night (assuming no full moon). During the daytime, the problem was simple. With high visibility you could generate an overabundance in information by which you could attack the problem. However at night with only a lantern, you have limited visibility, or just information about the local terrain, and the problem becomes much more complex. Consequently, it seems "rational" (or just plain "smart") that one would want to devise some kind of effective method of achieving the objective of getting to the "top of the hill." I then demonstrate to the class that the condition: Marginal Revenue–Marginal Cost = Marginal Profit is analogous to the slope (gradient) of a hill (total profit curve). If we follow the functional rule of always moving "up hill" until the slope becomes "flat," we will have achieved the goal of getting to the top of the hill (Note 4). This would be a very cost-effective method of solving the complex problem because of the limited amount of information that would be required to solve the problem. Thus, the "hill climbing" exercise was not merely a "recreational" exercise (a puzzle to solve) but it could also serve as an instructional tool to help students develop a deeper understanding of neoclassical economic principles.

8. Closing Comment and Some Conclusions

In closing this essay, I would like to assert that a diligent instructor should always reflect: (1) on the subject they teach, (2) on how they teach it, and (3) on how students learn from their pedagogy. Even with a strong commitment to teaching, our effectiveness as educators would languish without continual professional reflections. However, many instructors are not aware that professional reflections are essentially a learning process that may require the examination of a wide scope of human knowledge (interdisciplinary) and may entail a great depth of intellectual inquiry, that is to say, some philosophical thinking. The necessity for philosophical thinking arises when there are major changes in the epistemological foundations of scientific disciplines that result in widespread paradigm shifts as well.

A fundamental conclusion that can be derived from this retrospective essay is that the "epistemology of self-referential knowledge" conveys the perspective that the disciplinary knowledge that we teach may have

layers upon layers of meanings. The deeper we delve into our knowledge of economics (alternative subject) the surrounding fog of ambiguity will always infer that there are still additional levels of complexity associated with what we know. The innumerable layers nature of our knowledge of economics (alternative subject) implies that our pedagogy of teaching economics (alternative subject) should include “lessons in how to peel an onion as well as how to recognize and utilize the onion.” My onion metaphor stands for the necessity of instructors to assist their students in developing their own critical and creative cognitive capacities to keep on deepening their understanding of the subject matter and not just to assist them to being able to identify and to function with a *current* scientific paradigm. The concepts, methods of analysis, and representative models that we teach today will surely be replaced by new concepts, methods and models in the future. There is no certainty, or finite end, to the process of knowledge generation (construction). The process extends beyond our mortality; in other words, learning should be perceived of as a lifetime endeavor and not just an activity that terminates upon graduation from college or the university.

Another conclusion that can be drawn from this essay is that as we instructors attempt to keep up with the task of extending our own knowledge of our scientific discipline (research), we should also strive (learn) to optimize our teaching pedagogies to assist our students in developing their own meaning (understanding) of the subject that is being taught. The process of optimizing our instructional devices, techniques and teaching strategies (pedagogy) may be greatly hindered by our teaching beliefs. That is to say, before we started to teach in the classroom, we learned the subject-matter on the basis of doing research (Ph.D.) to advance the knowledge of the discipline within the narrow confines of some specific paradigm and, I will add, a long-standing metaphysical mindset. As the underlying paradigms and mindset changes, our effort to transform our pedagogies will be hindered by our teaching beliefs. We must somehow overcome the inertia of our old teaching beliefs. (Note 5) Returning to King’s (1993) metaphors regarding active and passive learning models, one can readily see that in the teaching context of my “hill climbing” exercise, I was in effect a “guide,” but I was not necessarily at each student’s “side” spatially speaking. Perhaps, one can more appropriately accept the rhyme that I was a “guide along for the ride.” To reiterate, learning is a dynamic process; it is a life-long process (*becoming*). As educators, we are only temporarily “along for the ride.” Consequently, there is no contradiction if I accept an *alternative* metaphor for “active learning.” I was in effect, both a “Sage on the Stage,” and a “Guide along for the ride.” Alas, I have liberated myself from my pedagogical dilemma and have retired from my university teaching career with a sense of great professional satisfaction.

References

- Bach, K. (1994). Conversational Implicature. *Mind & Language*, 9(2), 124-162.
- Becker, W. E., & Watts, M. (1996). Chalk and Talk A National Survey on Teaching Undergraduate Economics. *American Economic Review, Papers and Proceedings*, 86(2), 448-453.
- Desjardins, R. (1990). *The Rational Enterprise: Logos in Plato’s Theaetetus*. Albany, NY: State University of New York Press.
- Federal Reserve Bank of Minneapolis. (1995). Interview with Kenneth Arrow. *The Region*, 9 (4), 1-3.
- Grudin, R. (1996). *On Dialogue: An Essay on Free Thought*. Boston: Houghton Mifflin Company.
- Hands, D. W. (2001). *Reflection without Rules: Economic Methodology and Contemporary Science Theory*. Cambridge: Cambridge University Press.
- King, A. (1993). From Sage on the Stage to Guide on the Side. *College Teaching*, 41(1), 30-35.
- Kuhn, T. (1962). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
- Lakoff, G., & Johnson, M. (1999) *Philosophy of the Flesh: The Embodied Mind and Its Challenge to Western Thought*. New York, NY: Basic Books.
- Languilli, N. (1992) *Possibility, Necessity, and Existence: Abbagnano and his Predecessors*. Philadelphia, PA: Temple
- McKeachie, W. J. (1999) *Teaching tips: Strategies, Research, and Theory for College and University Teachers* (11th ed.). Boston, MA: Houghton Mifflin Company.
- Mintzes, J. J., Wandersee, J. H., & Novak, J. D. (Eds.) (1999). *Teaching Science for Understanding: A Human Constructivist View* (1st ed.). San Diego, CA: Academic Press.
- Nicolescu, B. (2001) *Manifesto of Transdisciplinarity*. Binghamton, NY: SUNY Press.
- Prawat, R. S. (1992). Teachers’ Beliefs about Teaching and Learning: A Constructivist Perspective. *American*

Journal of Education, 100(3), 354-395.

- Samuelson, P. A. (1947). *Foundations of Economic Analysis*. Cambridge, MA: Harvard University Press.
- Samuelson, P. A. (1948). *Economics: An Introductory Analysis*. New York, NY: McGraw-Hill Publishing Co.
- Skousen, M. (1997). The Perseverance of Paul Samuelson's 'Economics'. *Journal of Economic Perspectives*, 11(2), 137-152.
- Suzawa, G. S. (2003). *Ambiguity and Teaching Economics*. Paper presented at Workshop and special panel session held at the International Conference of the Association for Educational Communications and Technology, Anaheim, CA, USA, October 22-25, 2003 (Unpublished paper). Retrieved from <http://www.learningdev.org>
- Suzawa, G. S. (2000). *Teaching Introductory Economics with Some Ambiguity*. Paper presented at the Eleventh Annual Conference on Teaching Economics held at Robert Morris College, Pittsburgh, PA, USA, February 17-19, 2000. Published in conference's *Papers and Proceedings*, pp. 233-245.
- Suzawa, G. S. (2013). The Learning Teacher: Role of Ambiguity in Education. *Journal of Pedagogy*, 4(2), 220-236.
- Visser, J., & Visser, Y. L. (2004). Ambiguity, Cognition, Learning, Teaching, and Design. *TechTrends*, 48(1), 40-43.
- Vygotsky, L. S. (1962). *Thought and Language*. Cambridge, MA: MIT Press.
- Wells, G. (1999). *Dialogic inquiry: towards a sociocultural practice and theory of education*. Cambridge, UK: Cambridge University Press.

Notes

Note 1. This essay has its origins in my paper (Suzawa, 2003) contributed to a workshop and special panel session entitled, "Ambiguity, Cognition, Learning, Teaching, and Design," conducted at the International Conference of the Association for Educational Communications and Technology (AECT), Anaheim, CA, USA, October 22-25, 2003. I acknowledge that this essay uses statements from the paper.

Note 2. I owe much of my thoughts on the Old Logic and the New Logic to direct communications with physicist Niclescu via our participation in an Internet dialogue regarding the "meaning of learning." For additional information refer to (J. Visser & Y. L. Visser, 2004). Niclescu belongs to the group of physicists that are disenchanted with the existing paradigm for research in physics. However, instead of waiting for a new paradigm based on a "New Logic," he is advocating a "holistic" ("transdisciplinary") strategy for research endeavors (Niclescu, 2001).

Note 3. This essay is not an adequate venue for an elaboration on the notion of a "reflexive practioner" in the educational sector. Interested readers are referred to (Suzawa, 2013).

Note 4. The mathematics of optimization points out that one must also consider that there may be more than one hill that challenges you. Thus, besides determining first order and second order conditions for maximization, one needs to develop a methodology to distinguish global maximum from local maximum as well. However I reserved this level of complexity for my graduate (advanced) students in economics to apply their creative thinking skills.

Note 5. More than twenty years ago, educational psychologist Richard Prawat published a very perceptive article. According to Prawat, teachers' existing teaching beliefs would be the main inhibitors to their making progressive changes in their pedagogies. He said that: "Most of the problems associated with implementing a constructivist approach to teaching could be overcome if teachers were willing to rethink not only what it means to know subject matter, but also what it takes to foster this sort of understanding in students. This is a tall order. Such change is unlikely to occur without a good deal of discussion and reflection on the part of teachers." (1992, p. 361). I personally found that he was "right on the mark" in his assertion. This essay attests to that.

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