

## Reflections on the Nature of Critical Thinking, Its History, Politics, and Barriers, and on Its Status across the College/University Curriculum Part I

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### Abstract

This paper is a response to *INQUIRY* editor Frank Fair's invitation to me to write a reflective piece that sheds light on my involvement in the field of Critical Thinking Studies (some 35 years). My response is in two parts. The two parts together might be called "Reflections on the nature of critical thinking and on its status across the college/university curriculum." The parts together have been written with a long term and large-scale end in view. If successful the two parts will shed light on why the critical thinking movement has not yet contributed significantly to human emancipation or to more just and fair-minded communities (world wide). It will also present some strategies for making such a contribution.

**Key words:** critical thinking, Richard Paul, barriers to critical thinking, critical thinking across the curriculum, critical thinking in everyday life, philosophy of education, critical thinking theorists, critical thinking studies, egocentric thinking, sociocentric thinking, weak-sense critical thinking, selfish critical thinking, strong-sense critical thinking, fair-minded thinkers, money in academia, politics in academia, emancipatory thinkers, Socrates, force and reason, education administration, critical thinking conference, critical thinking professional development, substantive critical thinking, Linda Elder, Gerald Nosich.

### Introduction

My perspective, as everyone's, is only partially shaped by research in the tight sense of the word. I believe that the integrity of my views, including those views shaped broadly by experience and not precisely by scientific study, require representation in this paper (if those who read the paper are to grasp truly what has come to embody my personal perspective). The reader should keep in mind that I was invited to write a reflective piece based on my personal experience. This is what I have done. I was not asked to write a traditional research paper, and I have not done so. I have summarized some of the scientific studies that support my views in general; but I have not assembled further "hard data" than what is readily available on the Foundation for Critical Thinking website [www.criticalthinking.org](http://www.criticalthinking.org). Finally, I will be calling for research in virtually all the major sections of the paper. The field of Critical Thinking Studies is in need of on-going systematic research. My perceptions do not substitute for it.

To those readers of this paper looking to see the development of my conception of critical thinking "anchored to specific events, people, etc." let me suggest review of the archives of the international conference for critical thinking and educational reform. Each program of conference proceedings documents the historical events which provide a rich context for the development of my views in relation to the views canvassed in the many sessions of the conference. For example, review of the program of the 15th international conference program documents what I have called the first, second, and third waves of critical

thinking research. The development of my own views parallels these three "waves."

This paper, then, is the first of two. Its first half is mainly personal and historical in nature. The second, forthcoming in *INQUIRY* Vol. 27 No. 1 (Spring 2012), highlights difficulties one faces in contextualizing critical thinking in multiple domains. It might be called, "Critical Thinking: Foundations Applied Across the Disciplines." In these reflections I focus on the important pay-offs of critical thinking, the issues we face in advocating it, and the strategies we must adopt if we want to be successful in achieving it as a personal, social, and cultural paradigm.

The first of the two parts focus on the observation, or claim if you will, that insofar as the critical thinking movement is viewed against the backdrop of a worldwide struggle of "force versus reason," force has been dominant in the struggle. The opening of the struggle might well begin with Socrates against the government of ancient Athens. Socrates' struggle was motivated by his personal conviction that human intellectual freedom is, though unrealized, a universal right. The struggle, from Socrates to this day, I argue, has been one-sided. The side of "force" has been manifested in a series of historical decisions and acts in favor, if you will, of the views, vested interest, and dominance of self-aggrandizing politicians, government and tribal representatives, warriors, kings, popes, priests, and many other authority figures.

The second part of this two-part article focuses on the fundamentals of critical thinking theory. All the ideas in it have been expressed in non-technical terms and expressions, readily intelligible to literate language users.

Thus the paper is expressed in “ordinary” language. Going further, the account I provide of critical thinking and its application can be verified or “validated” in a range of academic fields as well as in a set of domains of knowledge not yet officially recognized as fields of knowledge by academia. Thus, if readers of this paper understand the fundamentals of critical thinking as I have expressed them, they should be able to contextualize them in any given domain of knowledge. In these projects there were two principal authors: myself and Linda Elder. The collection of monographs is entitled *Thinkers’ Guides to Critical Thinking*. Thus far we have constructed these monographs in the following diverse subjects:

- Clinical Reasoning
- Engineering Reasoning
- Analytic Thinking
- Essential Questions
- Scientific Thinking
- Critical reading (How to Read a Paragraph)
- Critical writing (How to Write a Paragraph)
- Media literacy (How to Detect Media Bias and Propaganda)
- How to Study and Learn
- The Human Mind
- Fallacies: The Art of Mental Trickery and Manipulation
- Foundations of Ethical Reasoning
- How to improve Student Learning
- Socratic Questioning
- Critical Thinking for Children
- Critical and Creative Thinking
- Critical Thinking Competency Standards
- Educational Fads
- Critical Reading and Writing Test

Of course, the degree to which the critical thinking constructs we have framed will be intuitive to theoreticians reading them, will depend on whether the contextualizations represent domains of thought with which the theoreticians are independently and intellectually familiar. This point is illuminated in Gerald Nosich’s personal experiment with this model (Nosich, 2011). Unfortunately, many researchers and scholars in higher education have not become sufficiently motivated to test our approach to critical thought in a personal and experiential way. For a range of institutions encouraging their faculty to test our model across the disciplines, visit [www.criticalthinking.org/pages/institutions-using-our-approach-to-critical-thinking/865](http://www.criticalthinking.org/pages/institutions-using-our-approach-to-critical-thinking/865) For research on the model, visit [www.criticalthinking.org/pages/research-from-the-center-for-critical-thinking/595](http://www.criticalthinking.org/pages/research-from-the-center-for-critical-thinking/595).

In my personal perspective, I see three especially significant domains of problematic work in the field of Critical Thinking Studies: 1) theory developed without adequate regard to practice (for example, philosophers who see philosophical issues in critical thinking as stand-

ing alone largely independent of practice ), 2) practice developed largely independent of theory (for example, educators who think that strategies for teaching critical thinking can be developed without theory), and 3) theory and application developed without adequate attention to politics (for example, educators who see economics and politics as a distraction rather than as a reality that must be dealt with intellectually). These fragmented approaches to critical thinking obscure the ethical responsibility academicians owe to the university and the public. My view is that, taken as a whole, higher education has not fulfilled its commitment to critical thinking and hence to the concept of education it generates. Higher education has often fallen prey to lower order politics, inadequate theory, ineffective practice, and, in general, an impoverished sense of history.

Historically (from Socrates to the present), the overriding problem of a potential field of Critical Thinking Studies has remained the same. Collectively speaking, we face in the field a messy, multilayered, three-fold set of questions whose settlements are so intertwined that no single question in the set can be adequately answered without taking into account how one proposes to answer the other two question (in the set). In this case, the layers consist in 1) basic theory of critical thinking, 2) pedagogy appropriate to the teaching and learning of that theory, and 3) integration of both into the struggle for power in everyday life. By treating each question in this intertwined set as if each were open to isolated settlement, one renders it likely that little progress will be made on any, and, instead, that inquiry will descend into fruitless argumentation.

Ultimately, what we need are people skilled in fair-minded critical thinking to work together to construct intellectual structures essential to communities and societies that honor critical thinking as a core value. In other words, critical thinking as a core value implies academics and insightful citizens with special skills and traits, namely, persons so educated that they can think multilogically, who can move up and back between theory and practice, and who, ultimately, can articulate the interrelations between pedagogic practice and practice that transfers beyond academics into the messy world of everyday human realities.

The thoughts above are intended to provide a broad scope to this paper and its background logic.

## I. MY INTELLECTUAL JOURNEY

My journey with critical thinking started some fifty or so years ago when I first began to question my own education or, more accurately, the lack thereof. But it started to crystallize a few years later in graduate school (University of California, Santa Barbara (1962), St. Louis University (1963), UCLA (1964), and the University of Cambridge (1965-66).

At this time I was reading in such thinkers as Wittgenstein, Ryle, Berlin, J.L. Austin, and John Wisdom. These readings pushed me in the direction of the critique of contemporary analysis of the logic of language, the logic of concepts, and the logic of questions. I began to ask questions like:

What does it take to develop the mind, deeply and truly? Are there inherent flaws and traps in human thought and if so how can we address them? What role does thought play in human life and how can we intervene and correct it when it is going wrong? How can we most effectively assess the role of thought in everyday life? What criteria do we habitually use to assess thinking, and which should we use? How can humans develop intellectual virtues (such as intellectual humility, intellectual empathy, intellectual integrity, intellectual autonomy, intellectual perseverance and fair-mindedness)? How can we overcome those who use critical thinking skills sophistically to serve vested interests at the expense of justice and the public interest.

My year of study under John Wisdom at Cambridge (1965), followed by two years of correspondence with him (principally on the logic of questions) played a significant role in my development. I became convinced that there were, and are, fatal flaws in the present theory of logic focused, as it is, on validity and formal deductive inference. As it is, logic, both formal and informal are inadequate as instrumentalities appropriate to the analysis and assessment of reasoning (and other forms of human thought). The “substance” of reasoning is not focused upon in either. I argued that if we want to use logic to analyze and assess human thinking, our logic should be question-centered. I wrote a monograph entitled *The Logic of Questions* (1968), followed by a dissertation on *Logic as Theory of Validation* (a critique of classical and formal logic as a tool for assessing human reasoning) (1969). (Available from the library of the University of California at Santa Barbara and the Foundation for Critical Thinking web site at [www.criticalthinking.org/files/Dissertation.pdf](http://www.criticalthinking.org/files/Dissertation.pdf)).

Throughout the subsequent years to date, it became increasingly clear to me that critical thinking has an affective, and an ethical, side, without which much skilled thinking simply serves narrow vested interests and, more often than not, is used to suppress intellectual freedom. For example, much human intelligence is routinely used in everyday life to rationalize unjustifiable force, to justify coercion, intimidation and oppression. A crucial question becomes, “How can we design education so that the routine misuse of intelligence is routinely exposed?” “How can we make self, and social critique a routine part of our thinking?” “How can we construct personal narratives that highlight the history of our lives as thinkers struggling to

make sense of our world?” I have tried to keep challenging problems such as these central to my reflection and my life.

In the 1970’s I wrote extensive notes on the potential contribution to self and social critique of such important thinkers such as: Marx, Freud, Wittgenstein, Piaget, Max Weber, John Henry Newman, Bertrand Russell, Erich Fromm, Thoreau, William Graham Sumner, C. Wright Mills, Erving Goffman, Gilbert Ryle, J. L. Austin, Machiavelli, Edmund Burke, E. H. Carr, Stephen Toulmin, William Appleman Williams, Thorstein Veblen, Sartre, and many others. I became convinced that many of the great thinkers — such as these — deeply internalized many of the concepts and principles inherent in critical thinking theory. Of course great thinkers are typically **great critical thinkers** as well. However, they are not necessarily great critical thinking **theorists**. Much research would be needed to spell out the implications of this important point.

My work has been based neither on the development of theory for theory’s sake, nor on the pursuit of metaphysical puzzles (with the fruitless argumentation they predictably engender). Nor have I been interested in the maintenance, or forwarding, of existing theories of critical thinking. Rather I am interested in intellectual constructs adequate to real world problems, and thus adequate to the development of processes by which humans can progressively create critical communities and societies. For these reasons, the abstract theory of critical thinking is of importance to me only insofar as it is integrated into a theory of application, and the theory of application is important only insofar as it is integrated into a theory of human emancipation. Such large-scale constructions require the work of thinkers from an array of disciplines working in loose collaboration over generations of self-critical intellectual work. Much research is needed on these constructs over an extended period of time.

My focused involvement in the critical thinking movement began explicitly in the later 1970’s and the 1980’s.

Beginning in the 1970’s, as I read and reflected, I gradually came to form the view that many people live ego-centric and sociocentric lives grounded in self-validating illusions, and, as a result, systematically confuse their own selfish uncritical thinking with fair-minded critical thought. Whatever critical thinking most people engage in is rarely self-disclosing at a deep level. Most humans are in need of critical thinking not only to protect themselves from those who will otherwise exploit them, but also to protect others from them, since the exploited often exploit and abuse others. This is exemplified in the fact that powerful nations (typically governed by skilled selfish thinkers) exploit weak nations; rich nations take advantage of poor ones. So common is this pattern of self-aggrandizement and sociocentrism that many consider it to be inevitable (see *The Prince* by Machiavelli and other writers in the Machiavellian tradition and beyond). These are themes I find in explicit form in my personal notes (from the 1970’s to this day)

Most importantly, my focus on uncritical and sophistically critical human thought has convinced me of the need for self-critique, as well as social, political, and economic critique on the level of politics, culture, and economics. I became convinced of the need to explore and construct practical ways of thinking in everyday life that advance emancipatory critical thinking as a slowly emerging world-wide need (This work I began seriously, and in a highly focused manner in 1980's through to the present).

It seems to me that accelerating change, intensifying complexity, and increasing danger are now everyday realities. The only way humans can create a just world is to educate just thinkers to live and act in that world. We need to strive for this higher end in every subject we teach (in other words, we need Critical Thinking Across the Disciplines). We need to foster it across nations and cultures, and in all dimensions of life. We must document, with appropriate research, the many obstacles to its development.

## II. BARRIERS TO THE CULTIVATION OF CRITICAL THOUGHT

At present (2012), there are still formidable barriers to the cultivation of fair-minded critical communities. I will comment briefly on some manifestations of these barriers. Though I will consider both academic and non-academic sources of impediments, I will emphasize the academic. Among the academic I will focus on those created by higher education departmental politics, especially those resulting from the vested interests of academic departments. I will touch upon impediments created by faculty and academic departments in general and, to a lesser extent, those created by collegiate bureaucratic interests. I focus on these particulars: 1) because they represent paradigm cases of a lack of serious intellectual activity in the bureaucratic life of higher education and 2) because I have lived first-hand the problems I lay bare in what follows. Finally, I will emphasize the barriers created by egocentric and sociocentric thought in general. I will begin with some reflections suggested by the history of critical thinking.

### A. Insights From the History of Critical Thinking

To me, Socrates (470-399 B.C.E.) is the most original and influential figure in the history of critical thinking. He not only recognized the defining role that thinking plays in the lives of humans (that we are *homo sapiens*, the species that thinks), he also saw that we are not by nature *critical* thinkers (*homo criticus*, the species that thinks critically). He recognized that human thinking is often deeply flawed and that many intelligent humans (principally those whose thinking is characteristically sophistic, manipulative, and self-deceptive) are interested in thinking not to gain insight into the flawed nature of their own thinking but rather to gain control, influence, and status in the struggle for wealth and power in everyday human affairs.

This duality continues in the human struggle for power to this day, that is, Socratic vs. sophistic thought: what I have often characterized as critical thinking in a "strong" vs. critical thinking in a "weak" sense. Sophistic critical thinking, which is critical thinking tailored to win in a power struggle, continues to thrive and indeed is arguably the more dominant of the two. Many, if not most, people reflect on their thinking not to serve the ends of emancipation and intellectual integrity, but rather to acquire skills and insights that advantage them in the struggle for power in human affairs.

Socrates "claimed the right of independent criticism of all institutions and of politicians who did not seem to know what they were doing or [who] compromised their principles" (Kidd, 1967, p. 482). So too should we all. All conscientious thinkers should weigh-in on the side of commitment to the ideal implicit in Socrates' life and practice: hence to the importance of intellectual integrity, intellectual autonomy, intellectual humility, intellectual empathy, intellectual perseverance, and human emancipation.

Again, if there is one truth that the history of critical thinking teaches, it is that reason is regularly ruled by force. If there is one truth that all Socratic critical thought assumes, it is that force should be regularly ruled by reason. Much of the history of human thought (critical thought especially) demonstrates how force has traditionally triumphed over reason. The Middle Ages, for example, testify to a period of time in which reason was forcefully subjugated by religious authorities. During this time, the feudal hierarchy and the Church controlled virtually all authority and power, and used the two in tandem to suppress dissenting views. Reason functioned mainly as a rationalization of the status quo. If you happened to be an orthodox believer (as, for example, Thomas Aquinas was), you were free to use reason to defend established views. All critical thinking was, in effect, selectively used, since all public discourse was guaranteed to come down on the side of the reigning power (or be suppressed). A history that documented the relationship of force and reason would be a many-volumed set.

Of course, force and violence may be on the decline. But we can't be sure of this, for we lack a benchmark history of sophistic thinking in human life. In time such a history may be written. Where force rules, freedom of thought, and hence fair-minded critical thought, cannot. As long as people are punished for dissenting from the status quo, most people will keep their criticisms of the status quo to themselves. While a few people may be ready to make sacrifices for freedom of speech, the vast majority of people tacitly chose lives of silent conformity. Most quickly learn that punishments are meted out to those who do not line up behind the views and thinking of those dominant in the structure of power. In short, though the extent of the use of force has fluctuated historically, it has repeatedly played a powerful, if not a defining role, in human life.

The society envisioned by Socrates is at best a long time coming, and, to my eyes, doesn't seem even distantly on the horizon. The field of critical thinking studies would be well served by multiple histories of critical thinking each written from a different point of view. Well-documented histories of critical thinking represent an area of research still needed.

Nevertheless, a brief look at the recent history of critical thinking (the last 50 years) may be useful in suggesting the barriers we face today in fostering critical thinking in education and human societies. In the next section I will offer some of my thoughts on this history (I am under no illusion that my view tells all the tales that need to be told. I will emphasize some of the problems that some academic departments have created for those who advocate substantive critical thinking. In my view, these problems are stumbling blocks to bringing critical thinking across the curriculum and, thus, ultimately into everyday social, political, and economic life. (It goes without saying that many historical questions could usefully be raised about the bad faith politics in this era).

### **B. The History of Education: Money and the Long View**

At every step along the way in the history of schooling, economics (money) rears its ugly head. In my view, no one can ignore the role of wealth in academic affairs and still construct a faithful account of education as it exists in the real world. At every level, in every subject, in every important decision, money is there opening and closing doors, creating and destroying research, privileging and marginalizing persons, subjects, movements, ideologies and perspectives. As one modest example, I will suggest how philosophy departments in California have worked to control classes in critical thinking for their own funding.

### **C. Critical Thinking Rescues Many Philosophy Departments: A Personal Perception (and Call for Research)**

In this brief section I will share my view of what I consider to be a destructive trend in higher education. Again, I focus on my experiences in higher education in California to exemplify my point. How far this trend has spread nationally and internationally needs to be researched so we can determine its extent and begin to reverse it. Remember that this is my view based on many years of working in the field of philosophy.

Every academic department has an interest in teaching students to think well within the discipline it represents. At the same time, most faculty, including philosophy faculty, do not, it seems to me, understand the role of critical thinking in this process. For instance, I well understand the fact that academic philosophers in California, more than faculty from any other discipline, "control" critical thinking through their frequent control of student requirements in critical thinking. Such faculty, in my experience, often do not sincerely and in good faith study to determine how accomplished practitioners in other disciplines engage in

critical thinking. The end result is that philosophers who gain windfall numbers of FTEs by gaining control of courses that fulfill the state-wide critical thinking requirement do not discuss the problem of laying the foundations of critical thinking in such a way as to determine how foundations for critical thinking in freshman studies should be followed up in every other university course (to serve the need for critical thinking, ultimately, for all peoples in all nations). Much research could usefully be done in this area.

The mindset behind this troublesome practice comes in many forms. For example, when I became persuaded, while teaching a course in philosophical reasoning, that a sizeable percentage of philosophy majors were learning to be argumentative rather than learning to be fair-minded reasoners, my colleagues took immediate action against me. First, they tried to prevent me from teaching the course. Secondly, the department refused to consider the evidence I had that documented the problem in teaching and learning: namely, philosophy majors developing into "argumentative" rather than "empathic" reasoners. The dodge used to avoid discussing what I observed centered on the claim that the students in my philosophical reasoning class had not given me official permission to "study" them. My response to the department was that professors do not need permission to study the characteristics of their students' work. Quite the contrary. In my view faculty studying the strengths and weaknesses of student reasoning is not only a professional right; it is a responsibility.

A more general illustration of bad faith in the politics of numerous philosophy departments is the common practice of allowing courses in *formal* logic to count as fulfilling critical thinking requirements, even though virtually no one (including the philosophers who teach formal logic) uses the cumbersome language of formal logic to critique human thought. To show how empty such a procedure would be, one need only examine the kinds of exercises typical of formal logic courses (see page 12 below). There is, of course, no reason to believe that what is taught in formal logic (or informal logic for that matter) will automatically transfer to other disciplines, nor is there reason to believe that those engaged in disciplinary thinking across the curriculum would have their thinking improved if they could somehow inject formal or informal logic strategies into their subject's methodology.

The temptation, of course, is vested interest. If philosophy departments gain funding for their small upper division courses by teaching large critical thinking courses, then the very existence of the department will be protected. Thus it is reasonable to expect that there will be a strong temptation to seek control of institution-wide critical thinking requirements by philosophy departments (and/or by any other departments similarly threatened).

At the California university where I was a full professor for 35 years, the philosophy department specifically set out to persuade colleagues in other departments, and

key administrators as well, to accept a required course in critical thinking and to accept that course being taught and administered exclusively by us, the philosophy department. I naively, and now with regret, supported this effort. Initially the department was unsuccessful (the school of natural sciences designed a course that focused on critical thinking in science, Science 101 Critical and Scientific Thinking). After a few years of teaching Science 101 as a general education “alternative” to a course in critical thinking (taught exclusively by the philosophy department) the school of natural science only irregularly taught the scientific thinking-centered course.

The result was that the philosophy department gained de facto control of the university wide requirement (A-3). The philosophy department gained control of the design and the hiring (hiring only philosophers to teach the course in “Critical Thinking” identified as “Philosophy 101”). Then the philosophy department gained support for formal logic (over my objection) as an option to the course labeled “Critical Thinking.” Philosophy controlled the design and hiring of the formal logic course, hiring only philosophers to teach it.

At the same time, the local junior college gained control of the design and hiring for required critical thinking courses at the college. The philosophy department there was successful in requiring a degree in philosophy as a necessary qualification to teach the basic critical thinking course. Thus, when a scholar with outstanding qualifications in research and pedagogy in critical thinking applied to teach a section of critical thinking at the junior college, her application was refused, the explanation given was that, though she had many significant publications in critical thinking studies, she lacked a degree in philosophy.

This junior college “explanation” implies that those who have degrees in philosophy are qualified to teach critical thinking while those with other degrees are not. I know of no evidence that supports the claim that philosophy graduates are routinely better critical thinkers (or better at teaching critical thinking, for that matter) than graduates of any number of other departments’ graduates. Research in this area is needed.

I do not know to what extent philosophy departments across the higher education institutions in the country at large mirror the pattern of events regarding critical thinking and formal logic at the California State University and California state community colleges. Research that brings out the extent of these practices is needed. The fact is that critical thinking is relevant to all college and university courses and thus no subject area should be given, a priori, a proprietary right to it. The funding for critical thinking should go to those academic departments that conduct research and offer advanced courses in the theory and application of critical thinking, as would be the case with any other aspiring field of studies. In point of fact, all departments have the responsibility to teach whatever they teach in a critical manner. Students have a right to learn critical

thinking by having to exercise it while thinking their way through all the disciplines they study. Philosophers are not in fact routinely qualified to teach students critical thinking in a single stand-alone course nor are they, in my view, qualified, without special preparation, to instruct other faculty in how to teach critical thinking systematically across the disciplines.

#### **D. An Area of Bad Faith?**

Since much of the funding that philosophy departments in the US receive from the university/college is generated by the large scale enrollment of students in introductory courses in critical thinking, and since universities and colleges expect the instruction students get in critical thinking courses to lay the foundation for all disciplines to be taught and learned in a **critical** manner, philosophy departments have the responsibility to do the research into pedagogy and application that will enable them to provide leadership in critical thinking instruction across the university. Unfortunately, in my experience, very few departments are prepared to accept that responsibility. Certainly, it was not accepted by my department. For example, most philosophy departments have shown little interest in the research that the Foundation for Critical thinking has conducted (over 32 years) (1980-2012) in how critical thinking can be contextualized into content domains.

Much research has been conducted as a result of the sessions of the annual conference on critical thinking and educational reform (See Foundation for Critical Thinking International conference archives at [www.criticalthinking.org](http://www.criticalthinking.org)) However, much more research is needed that demonstrates how to contextualize critical thinking into diverse subject domains. Of course, one might assume that philosophy departments (to the extent they lay claim to a priority interest in critical thinking) would conduct the research necessary to develop explicit ways and means for how other departments can “follow up” on their putative, but in my experience typically superficial, example. In other words, as far as I can see, there is little motivation in academic disciplines generally to explore the interface of critical thinking and the thinking essential to all academic disciplines.

For example, canvassing the many hundreds of sessions of the International conference as a measure (from 1980 to 2012), I can only conclude that few departments are interested in developing the interface of critical thinking and the logic of their discipline. Consult the 22 Thinker’s Guides on the web site of the Foundation for Critical Thinking for extended examples of how one might begin to structure contextualizations of critical thinking across the disciplines. See the list (page 2 above).

In my experience, both philosophers and non-philosophers tend to take the easy way out. It is rare for philosophers to arrange meetings on how to foster critical thinking across the disciplines. Once the political goal is achieved — i.e., once philosophy departments gain control of the critical thinking courses — perhaps there is little

motivation remaining to do anything further. This certainly was my experience (40 plus years, six years as chair) with the politics of the philosophy department at a California State University. In any case, such (“how-can-we-teach-critical-thinking-across -the- disciplines?”) meetings are, in my experience, uncommon. Only a small number spring to mind. And these are at a college- or university-wide initiative, not usually at the initiative of philosophy departments themselves. This area needs further research to determine the extent to which my perceptions are not idiosyncratic.

### E. Administrators Follow Suit

Many college and university administrators I have talked to have their own rationalizations for evading responsibility to insure that critical thought is in fact taught effectively across the curriculum. 1) In my experience, they rarely ask academic departments to explain how they are fostering critical thinking in their various courses and 2) they nevertheless include in their mission statements the claim that critical thinking is a primary university goal (and expected outcome) at their institution. By and large they allow those involved in teaching critical thinking to make of critical thinking what they will. Once again, I am generalizing from my experience. Further research would be welcome to verify or falsify my generalization.

The result seems to me predictable. Philosophy departments that gain control of critical thinking courses continue teaching their upper division classes as ever they have (often in a didactic manner), while those philosophers teaching stand-alone courses in critical thinking restrict their “research” to examining a variety of textbooks in formal or informal logic. They choose such a text and then teach it as if critical thinking were achieved in everyday life by applying the concepts of formal and informal logic to it. Again, more research would be welcome.

I know of no philosopher who uses formal logic to deal with everyday problems. Indeed, it is my bet that very few who teach formal or informal logic do so critically. If you want to see for yourself, ask philosophers to discuss some examples that illustrate how they apply formal logic concepts to problems calling for critical thinking in everyday life. Also ask them to illustrate how they teach formal or informal logic in a critical manner. If they say “yes” then ask them to explain what changes they have made that demonstrate a divergence from the traditional didactic ways logic is classically taught. For my critique of traditional and modern formal deductive logic, see my dissertation *Logic As Theory of Validation* (1968).

### F. Philosophers Gain Advantage in California

In academia as elsewhere in society, if you want to know what is going on, follow *the structure of power* by exposing where vested interests lie and what and whom they serve. Assume that money is playing a significant role in all decision-making. You will soon find that important affairs are rarely disclosed by their public

representations. In my experience, the important issues are rarely on the surface of academic politics. Let’s look at a few examples.

In 1980, just as the critical thinking “movement” was beginning to fire up, chancellor Dumke of the California State University issued an executive order (No. 338) defining and requiring six units of instruction in critical thinking (with impact on approximately 300,000 students). (Lazere, 1987).

Here is the essence of the order:

“Instruction in critical thinking is to be designed to achieve an understanding of the relationship of language to logic, which should lead to the ability to analyze, criticize, and advocate ideas, to reason inductively and deductively, and to reach factual or judgmental conclusions based on sound inferences drawn from unambiguous statements of knowledge or belief. The minimal competence to be expected at the successful conclusion of instruction in critical thinking should be the ability to distinguish fact from judgment, belief from knowledge, and skills in elementary inductive and deductive processes, including an understanding of the formal and informal fallacies of language and thought (p. 1).”

Let’s unpack this lofty language. First, this ambitious “executive order” is calling for much more than someone teaching a three or four unit course could reasonably hope to accomplish. Even the most highly skilled teachers, I would argue, could not accomplish this task as defined. In fact, most of the required learning outcomes in this directive are more reasonably expected from the best students after three or four years of excellent (Socratic) teaching at the graduate level rather than after one semester of standard didactic instruction. *In fact, a single college course (no matter how it is designed) cannot produce a disciplined critical mind.*

Consider each of these goals separately:

1. Achieve an understanding of the relationship of language to logic
2. Develop the ability to analyze ideas,
3. Develop the ability to criticize ideas,
4. Develop the ability to advocate ideas
5. Learn to reason inductively,
6. Learn to reason deductively
7. Develop the ability to reach factual or judgmental conclusions based on sound inferences drawn from unambiguous statements of knowledge or belief
8. Develop the ability to distinguish fact from judgment
9. Develop the ability to distinguish belief from knowledge
10. Develop skills in elementary inductive and deductive processes
11. Come to an understanding of the formal fallacies of language and thought

12. Come to an understanding of the informal fallacies of language and thought

Many philosophers teaching critical thinking focus on one or two of these tasks, usually numbers eleven and twelve on the list above. Most have had to take at least one course in deductive logic and that instruction usually included some formal and informal fallacies. So most philosophers have a model they can fall back on without having to develop new teaching strategies or understandings, let alone deep-seated dispositions or traits of mind.

Philosophy departments are not expected by their departments to do any research on critical thinking. Neither are they expected to be up to date on research in critical thinking. They are not expected to study the research into critical thinking pedagogy. Philosophers are not expected to attend critical thinking conferences. In fact, philosophers commonly describe Critical Thinking courses as courses in “baby logic.” By this term they imply that such courses are not academically deep.

This is an easy way out of critical thinking, no doubt. But it is not a good faith response to the growing call, and the growing need, for critical thinking in everyday life. It is clear that educational leaders and public citizens calling for critical thinking across the college curriculum want faculty to develop practical ways to cultivate critically educated persons. They are looking for higher skills of literacy (critical reading, critical writing, critical listening, critical speaking). They want students to learn to think at a higher level within content areas (for example, critical thinking in the learning and use of physics, chemistry, biology, math, sociology, anthropology, history, art, literature, engineering, medicine, law, and so forth). They want to raise the quality of political and ethical thought. They want a more reflective citizenry. They want more reasonable and humane people. They want, in short, a better world for everyone, a world that is more fair and just, where people are more fulfilled. *Academia, despite the propaganda of universities to the contrary, has hardly begun to effectively teach for critical thinking across the disciplines.*

**G. How to Insure That Critical Thinking Is Not Robust**

One of the best ways to prevent critical thinking across the curriculum is give one particular discipline proprietary rights to it. When this happens, that favored discipline will likely control the criteria for hiring faculty to teach critical thinking — a state of affairs that exists in many universities today where fulfilling a “critical thinking unit requirement” is defined in terms of the successful completion of one or more critical thinking courses taught by philosophers. Once in control of the critical thinking requirement, philosophy departments in the U.S. are typically allowed to designate courses in formal or informal logic to fulfill the requirement.

To give you a sense of the technical nature of modern formal or symbolic logic imagine yourself spending a semester determining the validity or invalidity of “arguments” such as the following (Copi, p. 25):

1. If I work then I earn money, and if I don’t work then I enjoy myself. Therefore, if I don’t earn money then I enjoy myself.
2. Had he married a beautiful woman he would have been disgusted. Had he been either jealous or disgusted he would have been unhappy. He was not unhappy. Therefore he did not marry either a beautiful woman or a homely one.
3. All mattresses are either soft or uncomfortable. No soft mattress is uncomfortable. Some mattresses are uncomfortable. Therefore some mattresses are not soft.

To the vast majority of students a steady diet of practice in analyzing and assessing arguments such as the above is proof that critical thinking is hopelessly irrelevant to their education and their life. This, I believe, is easily shown by interviewing students completing a course in formal logic. I suffered a special penalty as a professor by having to observe the tortured faces and hear the tortured voices of a formal logic practice room adjoining my own office. Semester after semester they droned on. For years I argued that formal logic courses should not be accepted to fulfill a university critical thinking requirement, to no avail. No one could offer any empirical research that established a correlation between skill in formal logic and skill in critical thought (in general). But lack of evidence does not concern the “true believers” in the efficacy of formal logic.

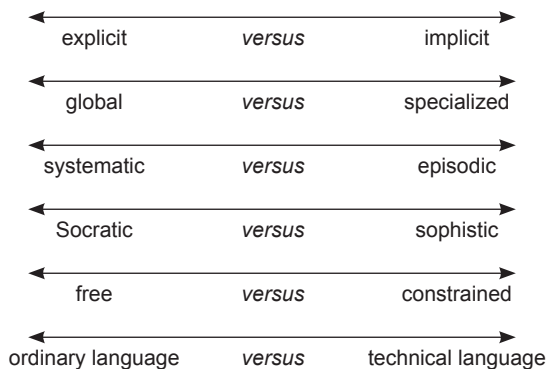
A better case can be made for informal logic. But in my experience informal logicians have emphasized theory of informal logic (as against theory of critical thinking across the disciplines) and have largely ignored the mass of research by those who have recognized the inseparability of theory and practice of critical thinking. More on this presently.

**III. FORMS AND MANIFESTATIONS OF CRITICAL THINKING, MAPPING THE FIELD**

Philosophers claiming to teach students critical thinking in an authentic way owe the faculty at large a robust and intelligible conception of the diverse forms and manifestations of critical thinking and the manner in which those forms interrelate. With such a conception it becomes possible to account for the unity and diversity of critical thinking studies. Instead of fruitless argumentation as to which approach is “correct,” diversely oriented theoreticians can make clear why they have chosen a given approach.



### A. Assessing Frameworks for Thinking Using Six Polarities



Every approach to critical thinking can be better understood by mapping it systematically on each of the following six polarities. For example, you can use them to identify where your approach to critical thinking falls in each of these categories.

***Is your approach to critical thinking implicit or explicit?*** Most faculty approach critical thinking in an implicit rather than an explicit manner. They believe that one can learn critical thinking best by working under mentors who model critical thinking in their reading, writing, speaking, and listening — without calling explicit attention to the fact that they are doing so. (See Cosgrove, 2011).

***Is your approach global or specialized?*** There are concepts that apply to critical thinking across the disciplines. To the extent that there are, the nature or character of critical thinking in one discipline re-enforces the nature and character of critical thinking in the others. Nevertheless, there are also discipline-specific critical thinking concepts and principles, skills and abilities.

***Is your approach systematic or episodic?*** One can approach critical thinking as a set of concepts and principles inherent in all thought within a discipline, on the one hand, or restrict it to periodic relevance, on the other. Those who approach critical thinking as episodic think of it as relevant only in special circumstances, usually when facing a difficult or complex problem. In such a case, critical thinking typically shows up in textbooks in stand-alone boxes, titled something like “Critical Thinking Problem” or “Critical Thinking Questions.”

***Is your approach Socratic or sophistic?*** This distinction is crucial because humans often use their criticality to “win” an argument or gain advantage over others. They are concerned with their vested interests above all else. In contrast, there are some people who develop as fair-minded thinkers and strive to face the truth, even if the truth does not put them in a favourable light. Socrates symbolizes this latter case (people with intellectual integrity and intellectual empathy). Most

politicians are more likely to think habitually in a sophistic manner.

Sophistry, in contrast, symbolizes those interested only in winning. We sometimes mark this distinction by the terms “strong sense” or “weak sense” critical thinking. For example, when philosophers attempt to persuade the faculty to restrict the teaching of critical thinking courses to those candidates with an advanced degree in philosophy, or claim that philosophers have a special competence in critical thinking (that makes them uniquely qualified to teach critical thinking), they use critical thinking (in my view) in a weak or sophistic sense. Highly skilled intellectuals can be self-deceived in their thought; as can, indeed, any given human whatsoever, when her or his vested interests are involved. If the danger of sophistic critical thinking is not recognized and combated, our communities and societies will continue to be dominated by sophistic thought. Where you stand in this polarity is, in my view, the most significant fact about your own criticality. I have argued for the significance of this fact for more than 30 years.

***Is your approach based in ordinary or technical language?*** Critical thinking can be approached in terms of specialized or technical concepts and principles or, conversely, in terms of natural or non-technical concepts and principles. When it is approached as a specialized language, it has limited use. For instance, when it is understood in terms of formal logic, only those who understand formal logic can use it. When it is understood in terms of theory of argumentation, only those who study argumentation theoretically have access to it. When it is understood in terms of any specialized discipline, such as informal logic, analytic philosophy, rhetoric, cognitive psychology, and so on, only those people who study and think within these disciplines have entrée into it. Further, it is questionable as to how and to what extent any such approach can actually help people reason through life’s real and often complex issues. (For instance, how many philosophers actually use formal logic formulas (or constructs in theory of argumentation) to figure out solutions to issues implicit in their personal relationships?) Conversely, when the concepts embedded in natural languages (such as English, Chinese, Arabic, Spanish, and so on) are used as foundations of critical thinking, all (potentially) who speak natural languages have access to them.

### B. On the Scope of Critical Thinking

Some theoreticians (mostly philosophers) assume that reasoning and argumentation are the only constructions in which critical thinking is manifested. For instance, consider the journal *Informal Logic*, sub-titled, *Reasoning and Argumentation in Theory and Practice*. A close examination of articles in this journal reveals that the editors of this journal believe that critical thinking is best understood as a mode of thinking exclusively studied and assessed in reasoning and argumentation studies. But reasoning and

argumentation do not begin to encompass the wide field of intellectual constructs relevant to critical analysis. For example, intellectual constructions open to critical analysis include all of the following (and more):

essays, theories, knowledge claims, assumptions, math problems, world views, concepts, information, inferences, novels, poems, plays, schools of thought, critical evaluations, editorials, news articles, news stories, budgets, financial plans, axiomatic systems, accounting documents, architectural designs, engineering designs, cases, number systems, classificatory systems, intellectual distinctions, histories, experiments, critique of mathematical constructs, critiques of art of whatever sort, background logic, understandings, interpretations, and so on, and on and on and on.

No finite list of intellectual constructs could exhaust the potential engagements about which a thinker might reflect critically. Whenever the human intellect is engaged, it can do so critically or uncritically. It can pursue pathways of the mind in any direction whatsoever. Therefore it can reflect upon an unlimited numbers of intellectual constructs. Logicians of any stripe find it hard to grasp critical thought in this way, so wedded as they are to reasoning and argumentation. Hence, critical thinking, as conceived by argumentation theorists and informal logicians, is not of much use in analyzing ways to bring critical thinking across the disciplines.

To put this another way, critical thinking across the disciplines is not illuminated by the logic of terms essential to formal logic, such as:

Affirmation, negation, conjunction, disjunction, truth values, conditionality, argument indicators, validity, formal fallacies, informal fallacies, syllogism, statistical syllogism, probability, conditionals, disjunctive syllogism, truth-functional logic, categorical sentences, Venn diagrams, quantificational schemata, polyadic problems, classes, class theory, variant theories of classes, equivalence, deductive technique, validity of quantificational schemata, existence and singular inference, identity, conversion of quantifiers, extension of quantification.

Rather it is illuminated much more by the logic of terms such as:

Purpose, goal, objective, question, problem, issue, information, data, fact, reasons, reason, observations, experiences, evidence, interpretation, inference, conclusion, solution, concept, theory, definitions, laws, principles, models, explanation, assump-

tion, presupposition, axioms, implications, consequences, point of view, frame of reference, perspective, orientation, world view, clarity, accuracy, precision, relevance, depth, breadth, significance, fairness, logic, logical, the logic of a question, the logic of a situation, the logic of a discipline, the logic of thought, the logic of action, context, contextualization, freedom, emancipation, self-direction, self-discipline, self-reflection, egocentrism, socio-centrism, self-deception, intellectual traits, intellectual humility, confidence in reason, intellectual perseverance, fair-mindedness, intellectual courage, intellectual empathy, intellectual autonomy, intellectual integrity, knowledge, subjectivity, judgment, one-system question, no-system question, multi-system question, elements of thought, standards of thought, traits of mind, insight, prejudice, way of life, way of being, critical thinking, critical mind, critical society, socialization, education, emancipation.

#### **IV. THE ESTABLISHMENT OF THE CENTER AND FOUNDATION FOR CRITICAL THINKING**

When I was an undergraduate (1955-1960), Aristotelian Catholicism provided me with a source of serious reflections about what seemed to me to be life's deepest and most significant questions. However by the time I was a graduate student, religious answers no longer seemed adequate, and I turned to philosophy (more broadly) for possible intellectual orientations that would help me make sense of the world. I became increasingly concerned with the difficulty of determining truth from fiction, sense from nonsense, reason from unreason, wisdom from hyperbole or distraction. I constructed my first serious independent intellectual work during my post graduate years centered on the logic of questions and their settlement conditions (i.e. on what must be done to meet the intellectual demands of questions of various and sundry types). My core idea was that if all reasoning is question-centered, the logic of the question at issue should determine what process or procedures were relevant to the settlement of any given question. I began to seek generic intellectual structures essential to all question-centered thought. Hence, instead of routinely asking: "What are my premises? And "what are my conclusions?" I asked "what is my purpose? What is the question at issue? What information or data are relevant to the settlement of the question at issue? What inferences am I making in interpreting those data? What are the key concepts I am using in my thinking? What assumptions am I making? What implications follow from the answers to the above questions? And what is the point

of view from the perspective of which I am framing all of my reasoning? These eight questions became the basis upon which I developed the concept of the “elements of thought.” These eight question categories I came to see as essential to all human thought (whether the thinker came to terms with them explicitly or not). More on the elements of thought in part two of these reflections.

By 1980 my intellectual orientation became clear with the establishment of the Center and Foundation for Critical Thinking, non-profit sister organizations whose mission is educational reform through critical thinking. In 1981, the Center for Critical Thinking (under my direction) held the First International Conference on Critical Thinking and Moral Critique at Sonoma State University. The goals of the conference were two-fold: 1) to provide a forum for interested persons to develop their understanding and practice of critical thinking, and; 2) to focus scholarship on conceptualizing critical thinking as a comprehensive intellectual orientation that sheds light on, and provides the intellectual underpinnings for, all possible intellectual or mental constructs.

#### A. The First Conference Goal

The first conference goal has been achieved, and next year will mark the 32nd consecutive International Conference on Critical Thinking and Educational Reform. However, we are a long way from the widespread cultivation of fair-minded critical societies — in fact none exist.

In 1990 the Foundation for Critical Thinking published an anthology of my writings (*Critical Thinking: What Every Person Needs to Survive in a Rapidly Changing World*). This collection represents, as John Chaffee put it, my “working out of the basic concepts and insights of critical thinking within an integrated theoretical framework.”

What the field of Critical Thinking Studies has needed from the beginning and still lacks are ways to engage teachers and scholars in the challenge of intellectual work that re-conceptualizes all teaching and learning within an integrated theoretical framework that both teachers (at a moderate to high level) and students (at an entry level) could command. One essential goal of critical thinking (for those working in association with our organization) was that of successfully locating the central concepts of critical thinking within a highly flexible yet integrated theoretical framework. My anthology, *Critical Thinking: What Every Person Needs To Survive In A Rapidly Changing World* (1990) was intended to spearhead this process. Here are some of the reviews of this book from theoreticians in the field (1990):

**John Chaffee.** “Paul’s book . . . is a milestone in the emergence of the field of critical thinking. As a pioneer and leader in this movement, Dr. Paul has, more than anyone, sought to place its central concepts and insights within an integrated theoretical framework,

and this volume reveals both the extraordinary breadth and depth of his thinking. . . The text will serve as an invaluable resource for educators at every level, and constitutes a significant contribution to the literature and intellectual advancement of the critical thinking field.”

**Perry Weddle.** “Paul poses a challenge not just to critical thinking instruction and education, he poses a challenge to the whole educational enterprise as presently conceived.”

**Michael Scriven.** “[Paul’s] . . . efforts in the field of education have led to a position of unmatched importance in the educational working out of the real meaning of critical thinking. . . It is fair to say that it represents the first really massive effort to deal with the huge range of pedagogical and logical issues that emerge when we really turn our critical thinking skills toward the subject of teaching critical thinking.”

**David Perkins.** “Richard Paul has contributed to the current interest in cultivating critical and creative thinking one of the simplest and most powerful notions around: the concept of “strong sense” critical thinking, that sort of critical thinking that confronts deep and genuine conflicts of values and perspectives. In doing so, Paul has given us not just a philosophical distinction but an ideal to strive for. Quite rightly pointing out that it is all too easy to settle for modest technical improvements in the practice of thinking, Paul presses the point that this is not enough — indeed, if this is all the enterprise amounts to, it is hardly worth undertaking.

In the light of these highly positive reviews, it seemed that the Foundation’s intellectual reform efforts (the integration of research, theory, and practice that I and my colleagues at the Foundation for Critical Thinking were constructing) would represent a paradigm in the field. Our conference was drawing large numbers, participants were increasingly communicating in non-technical language, and there were few objecting to the three concept sets we were emphasizing (elements, standards, traits). However, in the mid to late 1980s, a variety of problems began to emerge in part of the field of Critical Thinking Studies (some in theory, some in application, and some due to vested interest).

For one, most philosophers focused their attention on the writing of a textbook for stand-alone courses in critical thinking conceived, often, again, as formal or informal

logic. These textbooks became ends in themselves, not frameworks for critical thinking across the disciplines. For another, many of the early leaders did not seem willing to do the pedagogical experimentation necessary to bring substantive critical thinking, in any number of ways, across the disciplines.

Few philosophers, even those whose courses in critical thinking represented the bulk of their instruction, focused on research in teaching critical thinking across the disciplines. Serious educational reform presupposes serious intellectual work (targeting critical thinking across the disciplines). Working out the underpinnings of the pedagogy of critical thinking (adequate for the integration of theory, research, and practice) was pursued by a relative few. Many academics coming to the conference in critical thinking and educational reform were not leaving the conference primed to do the intellectual work that results in new ways to teach and learn (across the disciplines). This leads us to our second conference goal.

### B. The International Conference

The goal of the International Conference was to focus scholarship on conceptualizing the idea of critical thinking in diverse directions (i.e. on developing a field of studies of critical thinking across the disciplines). Regarding this second goal, our initial efforts were unsatisfactory. By the late 1980's and early 1990's, it was clear to the fellows at the Foundation for Critical Thinking that the vast majority of theoreticians invited to the International Conference on Critical Thinking and Educational Reform did not share a common agenda. Though respectful of others' work, they appeared to us to be more concerned with developing ideas (other than ideas essential to critical thinking) from their own fields of specialization (based on technical terms from their home disciplines) rather than collaborating to develop best practices for teaching CT across the disciplines. Rather than experiencing harmony and evolution at the conference, attendees were experiencing a confusing array of approaches to critical thinking, from formal and informal logic, to cognitive psychology, to critical theory, to feminism, to a variety based explicitly on specific academic disciplines, and beyond. Much of this was alienating and divisive, and by the mid 1990's it was no longer economically viable, nor intellectually justified, for the Foundation to finance non-convergent work. So we shifted our focus (Paul, Elder, and Nosich). We saw the shift we called for as choosing rigor and the long run over popularity and the short run.

In any case, we shifted our invitation focus to researchers who showed some interest in the problems inherent in decoding the logic of the disciplines: the logic of biology, the logic of chemistry, the logic of history, the logic of sociology, the logic of economics. In other words, we focused our emphasis on critical thinking across the disciplines. The response was initially less than satisfactory.

We found that part of the problem was that many academicians were not motivated to do research on problems not recognized as significant by journals within their home disciplines. Others were uncomfortable working beyond their home discipline. Many found it difficult to obtain funding for research that went beyond their discipline.

There were also problems generated by specialists attempting to communicate with conference attendees not in their specialty. For example, those who attended sessions designed by philosophers often found that they were passively listening to didactic lectures in (to them) confusing philosophical language.

After much agonizing and long discussions, we made the decision to focus our attention on actual models of critical thinking across one or more disciplines or domains of thought. At the same time we focused attention not on thinking per se, but on the interplay of the affective and the cognitive.

We were also keen to model instructional strategies that foster critical thinking in teaching and learning. Such modeling is essential to bringing critical thinking across the disciplines.

These decisions caused an apparent grievance for some (who apparently took the changes personally); and I have been *persona non grata* with some others (mainly informal logicians) ever since. My work, which was previously favorably reviewed (by such people as Siegel, Weddle, Johnson, Blair, Barell, Ruggiero, Scriven, Fisher, Michelli, Weinstein) seemed to drop from the critical interest of the informal logic and philosophical reasoning cadre. My consolation was that, ultimately, the intellectual "black ball," if that is what it is, seems confined to a relatively small and specialized few.

In the meantime, and not unaffected by these realities, the need to develop critical thinking across the disciplines had been left by many to languish. Due to a system of education (including teacher training programs) which does not embrace a substantive conception of critical thinking, few teachers can articulate or cite evidence of teaching for critical thinking (see, e.g. Paul, 1997; Thomas, 1999); evidence continues to mount that most students are not learning it either (see, e.g. Cas-Lotto, J. and Benner, M., 2006; Bok 2006; Blaich, 2007; Arum and Roksa, 2011). While many philosophers and others continue to re-hash theoretical debates with little practical value to teachers, students, or individuals trying to live self-examined lives, the Foundation for Critical Thinking fellows focus on the contextualizations called for in systematically applying critical thinking across the disciplines.

The fact is that those philosophers who purport to be interested in critical thinking but who fail to make the concept accessible to people interested in developing critical thinking skills, abilities and traits, who say they are interested in the advancement of critical thinking but do nothing to foster a substantive and accessible conception of it across the disciplines, who develop theory and write

articles focused on a narrow, specialized interest, thus conceptualizing critical thinking in a narrow, specialized manner, collectively stand in the way of the development of critically-centered universities and societies. The work of the Foundation for Critical Thinking, then, is largely ignored by a cadre of Informal logicians and various other philosophers whose Interest in critical thinking is not in the development of critical societies, or in the art of living an examined life, or in the process of bringing critical thinking realistically and effectively across the disciplines.

As mentioned, in the 1980s a number of well-known philosophers critiqued my work in highly positive terms (see the appendix for more examples), but in the past two decades a number of these have largely ignored my work, as they have ignored the work of my colleagues Linda Elder, Gerald Nosich, Enoch Hale and Rush Cosgrove.

I give these examples, not because the work of the Foundation for Critical Thinking fellows is dependent on the imprimatur approval of informal logicians, or philosophers in general, come to that. Here is some general information that documents the recognition of the work of the Foundation fellows and scholars (Richard Paul, Linda Elder, Gerald Nosich, Enoch Hale, et al. in the national and international educational communities):

The Foundation for Critical Thinking receives more than 150,000 unique visits per month on our website, from more than 100 countries. It reaches out to educators at all levels, in all subjects and disciplines, and develops curriculum materials to achieve this end. The Foundation for Critical Thinking generates and publishes critical thinking books and guides for those interested in developing their reasoning abilities. In the past 32 years, scholars at the Foundation for Critical Thinking have collectively written eleven books and twenty-three thinker's guides on critical thinking. Moreover, the Foundation sponsors conferences, academies, seminars and workshops in critical thinking. Tens of thousands of educators have attended the Foundation's conferences and workshops since its inception. Each year the Foundation for Critical Thinking sends out complementary thinker's guides to somewhere between 100,000 and 200,000 educators to introduce them to a rich concept of critical thinking. In the past 10 years, more than a million such thinker's guides have been sent to educators. Approximately 700,000 have been sold (to educators at all levels in all major disciplines). The written works of the Foundation for Critical Thinking fellows have been translated into languages such as Spanish, French, Japanese, Chinese, German, Turkish and Arabic. Many of these translations

can be downloaded at no charge from the Foundation website.

The visibility and out-reach of the Foundation for Critical Thinking continues to grow through its integrated approach to the theory, research, and pedagogical application of critical thinking, and in the light of its emphasis on fostering critical thinking across the curriculum. We believe we have now developed more instructional books, thinker's guides and materials than any other group of theoreticians. We have more resources freely accessible on our website, and we offer more professional development programs, and on-line courses, and have reached more educators with our work than any other internationally active critical thinking organization.

It is ironic, then, in the light of the professional commendation that was accorded to the integration of our early work (particularly the integration of research, theory, and practice) that I was peremptorily removed from the advisory board of AILACT (the informal logic association), with no explanation. (The device used was the "removing" of everyone from the board to be followed by most of them being returned routinely).

What is significant in this transparent marginalization? In my view it stands as "proof" that academic politics are very much alive. Even academics supposedly committed to fair-minded critical thinking are not above some small blows below the belt.

## V. ACADEMIC DEPARTMENTS, FACULTY AND ADMINISTRATORS GENERALLY FAIL TO FOSTER CRITICAL THINKING

In addition to the special barriers to critical thinking created by philosophy departments already mentioned, faculty in general, and administrators and academic departments in general (including philosophy departments) create numerous barriers to the cultivation of critical thinking across disciplines, including:

1. Many academic departments and faculty presuppose that they are fostering critical thinking, when in fact their expressions of it are often vague and lack any demonstrations as to how one could teach for it. Many academic departments, faculty and administrators tend to trivialize critical thinking, giving lip service to it in mission statements, course catalogues and marketing material, while ignoring it in instruction.
2. Most faculty and administrators fail to take a long-term approach to professional development in critical thinking.

### A. Faculty Lack Explicit Understanding of Critical Thinking

Critical thinking is touted as essential in today's complex world. But, again, research demonstrates that, though faculty usually believe otherwise, critical thinking is not

fostered in the typical college classroom (Gardiner 1995; Paul et.al. 1997; Bok, 2006; Arum and Roksa, 2011). In a meta-analysis of the literature on teaching effectiveness in higher education, Lion Gardiner, in conjunction with ERIC Clearinghouse on Higher Education (1995) documented the following disturbing patterns:

“Faculty agree almost universally that the development of students’ higher-order intellectual or cognitive abilities is the most important educational task of colleges and universities... Specifically, critical thinking – the capacity to evaluate skillfully and fairly the quality of evidence and detect error, hypocrisy, manipulation, dissembling, and bias — is central to both personal success and national needs (pp. 7-8)... Faculty aspire to develop students’ thinking skills, but research consistently shows that in practice we tend to aim at facts and concepts in the disciplines, at the lowest cognitive levels, rather than development of intellect or values... Numerous studies of college classrooms reveal that, rather than actively involving our students in learning, we lecture, even though lectures are not nearly as effective as other means for developing cognitive skills... Studies suggest our methods often *fail* to dislodge students’ misconceptions and ensure learning of complex, abstract concepts. Capacity for problem solving is limited by our use of inappropriately simple practice exercises (pp. iv-v).

### **B. The Ground-Breaking Critical Thinking Study: The California Commission**

Gardiner’s summary of the research coincides with the results of a large scale randomized study I conducted with my colleagues, (Paul et. al. 1997) of 38 public colleges and universities and 28 private ones focused on the question: To what extent are faculty teaching for critical thinking? Because this study was conducted for the California Commission on Teacher Credentialing, a probability sample was employed that gave education faculty greater representation in the sample than other disciplines, but subject matter area faculty from the Life Sciences, the Physical Sciences, History, English, Mathematics, Government, and the Social Sciences were also involved. In the end the sample was comprised of 101 Education faculty (a response rate of 84%) and 39 subject matter faculty (a response rate of 65%) who were extensively interviewed by telephone.

The study included faculty from colleges and universities across California, and encompassed prestigious universities such as Stanford, Cal Tech, UCLA, and UC Berkeley. In this study, most faculty claimed that they emphasized critical thinking throughout their instruction and that their students internalized important concepts in

their courses as a result. Though the majority of faculty stated that intellectual standards were important to instruction, rarely did faculty mention any specific intellectual standards (for example the importance of students thinking clearly, accurately, precisely, relevantly, or logically, etc). Very few mentioned even basic intellectual skills such as the ability to clarify purposes; gather relevant data; reason logically; identify important assumptions; trace logical implications, or reason within multiple conflicting points of view. Intellectual dispositions of mind, such as intellectual humility, intellectual empathy, intellectual integrity, etc.... were rarely mentioned.

The results were as follows:

1. Though the overwhelming majority (89%) claimed critical thinking to be a primary objective of their instruction, only a small minority (19%) could give a clear explanation of what critical thinking is. Furthermore, according to their answers, only 9% of the respondents were clearly teaching for critical thinking on a typical day in class.
2. Though the overwhelming majority (78%) claimed that their students lacked appropriate intellectual standards (to use in assessing their thinking), and 73% considered that students learning to assess their own work was of primary importance, only a very small minority (8%) could enumerate any intellectual criteria or standards they required of students or could give an intelligible explanation of what those criteria and standards were.
3. While 50% of those interviewed said that they explicitly distinguish critical thinking skills from traits, only 8% were able to provide a clear conception of the critical thinking skills they thought were most important for their students to develop. Furthermore the overwhelming majority (75%) provided either minimal or vague allusion (33%) or no allusion at all (42%) to intellectual traits of mind.
4. When asked how they conceptualized truth, a surprising 41% of those who responded to the question said that knowledge, truth and sound judgment are fundamentally a matter of personal preference or subjective taste.
5. Although the majority (67%) said that their concept of critical thinking is largely explicit in their thinking, only 19% could elaborate on their concept of thinking.
6. Although the vast majority (89%) stated that critical thinking was of primary importance to their instruction, 77% of the respondents had little, limited or no conception of how to reconcile content coverage with the fostering of critical thinking.
7. Although the overwhelming majority (81%) felt that their department’s graduates develop a good or high level of critical thinking ability while in their program, only 20% said that their departments had a shared approach to critical thinking, and only 9% were able to clearly articulate how they would assess the extent to which a faculty member was or was not fostering criti-

cal thinking. The remaining respondents had a limited conception or no conception at all of how to do this.

8. Although the vast majority (89%) stated that critical thinking was of primary importance to their instruction, only a very small minority could clearly explain the meanings of basic terms in critical thinking. For example, only 8% could clearly differentiate between an assumption and an inference, and only 4% could differentiate between an inference and an implication.
9. Only a very small minority (9%) mentioned the special and/or growing need for critical thinking today in virtue of the pace of change and the complexities inherent in human life. Not a single respondent elaborated on the issue.
10. In explaining their views of critical thinking, the overwhelming majority (69%) made either no allusion at all, or a minimal allusion, to the need for greater emphasis on peer and student self-assessment in instruction.
11. From either the quantitative data directly, or from minimal inference from those data, it is clear that a significant percentage of faculty interviewed (and, if our sample is representative, most faculty):
  - do not understand the connection of critical thinking to intellectual standards,
  - are not able to clarify major intellectual criteria and standards,
  - inadvertently confuse the active involvement of students in classroom activities with critical thinking in those activities,
  - are unable to give an elaborated articulation of their concept of critical thinking,
  - cannot provide plausible examples of how they foster critical thinking in the classroom,
  - are not able to name specific critical thinking skills they think are important for students to learn,
  - are not able to plausibly explain how to reconcile covering content with fostering critical thinking,
  - do not consider reasoning as a significant focus of critical thinking,
  - do not think of reasoning within disciplines as a major focus of instruction,
  - cannot specify basic structures essential to the analysis of reasoning,
  - cannot give an intelligible explanation of basic abilities either in critical thinking or in reasoning,
  - do not distinguish the psychological dimension of thought from the intellectual dimension,
  - have had no involvement in research into critical thinking and have not attended any conferences on the subject, and
  - are unable to name a particular theory or theorist that has shaped their concept of critical thinking.

Similar results were visible in a later study conducted in Texas (Phillips & Green, 2011) and in a study conducted by Thomas (1999).

Note that in 1990, in an open letter to educators, I summed up the problem that a robust conception of critical thinking addresses:

Many college and university professors say they have little time to focus on the students' thinking because of the need to cover content. These professors fail to see that thinking is the only means by which the mind digests content. They fail to see that undigested content is content unlearned or mis-learned. They fail to see that all content is embedded in ideas, that ideas have logical connections, that logical connections must be thought through to be grasped.... Furthermore, though this problem is ancient, the negative consequences are daily becoming more and more significant. The nature of professional and everyday life increasingly demands critical thinking. Indeed, the cost of generating a growing mass of uncritical thinkers as workers and citizens is staggering. Business and industry suffers. Political and civic life suffers. Personal and family life suffers. Many public and private problems can be attributed to the low level of thinking that dominates our lives. Intellectually undisciplined, narrow-minded thinking will not solve increasingly complex, multidimensional problems, let alone provide the basis for democratic decision-making.

Though content can only be learned through thinking, and though the concepts and principles of critical thinking are presupposed in the foundations of every subject and discipline, it remains the case that the problems I outlined in 1990 are still largely ignored in teaching and learning today.

### **C. Few Faculty and Administrators Take a Long-Term Approach to Critical Thinking**

Throughout the 1980's and early 1990's, critical thinking was one of the new "hot" ideas in schooling, or say rather, the latest fad. Sadly, as is the common way with fads, it was not integrated in a substantive way as core learning. Throughout the past thirty years there have been numerous starts and stops in critical thinking, some successes, most of which have been partial, and many failures. Schools, colleges and universities get on the "critical thinking bandwagon" for a few years, usually because of reaccreditation. They will sometimes host one or a few two-day workshops on critical thinking, or send a team of faculty leaders to a critical thinking conference. But educational institutions characteristically lack a long-term vision of critical thinking because they lack, again, a substantive conception of it. In Linda Elder's article on the importance of long term staff development in critical thinking (Elder, 2010), she lists the following components of an effective program:

1. Choose a substantive conception of critical thinking.
2. Choose a conception that is explicit, systematic, integrated, transdisciplinary and based in intellectual but non-technical language.
3. Choose a conception that fosters traits of mind

4. Commit to the long run
5. Reach for deep administrative commitment
6. Establish a leadership team that can move the process forward
7. Provide ongoing faculty and staff workshops
8. Fund the program
9. Be inclusive
10. Tie assessment to critical thinking

Thus far only a handful of institutions have integrated more than a few of these components. Only a select few schools, colleges, and universities have sustained critical thinking over more than a few years.

## VI. CONCLUSION

My fundamental goal in part one of this two-part paper is to alert my readers to some important realities in the “big picture” intrinsic to the problem of integrating critical thinking principles across the disciplines and into everyday life. This goal defines a messy multi-layered problem. What is more, the layers interact and, in doing so, make the problem highly complex. Each of the questions (immediately below) has been addressed in part one, though not all at the same level of depth and finality. What is more, many of my answers to these questions are being presented as at the level of “perception” and “interpretation,” rather than at the level of rigorous “proof.” Nevertheless, an important set of “answers” that I offer remain, are verifiable, and suggest important needs in the field of Critical Thinking Studies:

- What do the last 35 years of critical thinking look like from my personal point of view?
- What has happened in the field of critical thinking studies historically, politically, and theoretically?
- To what extent has the field developed; and what problems have plagued the effort to establish a three-fold tradition covering: theory of the concept of critical thinking, theory of the pedagogy of critical thinking, and theory of the application of critical thinking into the problems of everyday life?
- What are the problems, issues and realities that have made developments in the field difficult?
- What have been and are the most formidable barriers to the cultivation of critical thinking?
- What insights about the nature of critical thinking can we glean from its history from Socrates to the present?
- To what extent has the history of critical thinking been a struggle between force and reason?
- What does the history tell us, in general, about the role of money and politics in education?
- Is there evidence of bad faith in the process by which philosophy departments in the United States have gained control (to the extent that they have) of university-wide critical thinking courses?

- Is the argument by some philosophers that philosophy has a proprietary right to critical thinking an exercise in bad faith?
- Is it true that philosophy faculty are not expected by their departments to do any research on critical thinking? Is it true that they are not expected to study research into critical thinking pedagogy? Is it true that philosophy chairs do not expect philosophers to attend critical thinking conferences?
- Is it true that the policies followed by philosophy departments (that have gained them control of university critical thinking requirements) are undermining critical thinking (university wide)?
- Is it true that administrators rarely ask academic departments to explain how they are fostering critical thinking in their various courses?
- Is it true that administrators nevertheless include in mission statements the claim that critical thinking is a primary university goal (and expected outcome) of the institution. Is it true that university administrators allow those involved in teaching critical thinking to make of critical thinking what they will?
- Is it true that some theoreticians (mostly philosophers) assume that reasoning and argumentation are the only constructions in which critical thinking is manifested?
- Is it true that research indicates that most university faculty lack explicit understanding of critical thinking?
- Is it true that few faculty and administrators take a long-term approach to critical thinking? These questions, and others related to them, suggest important needs and problems in the field of Critical Thinking Studies. The future will tell us the extent to which those in critical thinking studies have taken them seriously.

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## Appendix

The following reviews were prefatory in my 1990 anthology, *Critical Thinking: What Every Person Needs to Survive in a Rapidly Changing World*. They document the fact that my work on critical thinking in the 1980's

was taken to be of such quality and scope that the present failure (on the part of a core of largely informal logicians) to give critical notice to my subsequent work requires some explanation. See Robert Ennis's (2011a, 2011b) summary of the field in the previous *INQUIRY* issues as clear-cut evidence for this point. If my later work suddenly fell in quality, that work should be refuted, not marginalized.

I have included with some misgivings these largely laudatory remarks to establish a specific and important point: To document beyond question that something other than academic reasons motivated and still motivates some who would marginalize or systematically ignore my middle and later work as well as the work of the other fellows at the Foundation for Critical Thinking. The risk I take is the likelihood that some may see these quotations as attempts at self-aggrandizement. I take that risk because there is an important point to be made — that academic politics can powerfully influence what does and does not get analyzed and given serious critical consideration in the field of critical thinking studies.

Finally, I am not suggesting that everyone quoted here has systematically ignored my work.

**John Chaffee.** Paul's book, *Critical Thinking*, is a milestone in the emergence of the field of critical thinking. As a pioneer and leader in this movement, Dr. Paul has, more than anyone, sought to place its central concepts and insights within an integrated theoretical framework, and this volume reveals both the extraordinary breadth and depth of his thinking in this area. The text will serve as an invaluable resource for educators at every level, and constitutes a significant contribution to the literature and intellectual advancement of the critical thinking field.

Professor/Author  
Department of Philosophy  
La Guardia Community College  
Long Island City, NY

**Perry Weddle.** Paul's contributions, though highly and seminally influential, have been scattered in sources only a few of which are indexed. Now we have the opportunity to examine the whole. Paul poses a challenge not just to critical thinking instruction and education, he poses a challenge to the whole educational enterprise as presently conceived. The challenge deserves our most serious attention. Paul is a direct promulgator and furtherer of ideas pursued by Paine, Jefferson, James, Dewey, and many others. His polemic against rote learning, against unthinking facts-cram, is a fresh breath, a healthy antidote to the Alan Bloom/E. D.

Hirsch mentalities which would elevate erudition (valuable as that might be) over the Socratic arts of questioning and especially self-questioning.

Professor/Author/Editor  
C. T. News  
Center for the Reasoning Arts  
California State University  
Sacramento

**Michael Scriven.** Paul, one of the most influential evangelists of the Critical Thinking movement has always realized that the merely academic discussion of critical thinking will not produce much social impact. His mighty efforts in the field of education have led to a position of unmatched importance in the educational working out of the real meaning of Critical Thinking. This large collection of essays covers the logic and teaching of Critical Thinking as well as its curriculum applications, and no one with the slightest interest in improving the thinking skills of students — or themselves — can fail to learn a great deal from it. It is fair to say that it represents the first really massive effort to deal with the huge range of pedagogical and logical issues that emerge when we really turn our critical thinking skills towards the subject of teaching Critical Thinking.

University of Western Australia

**David Perkins.** Richard Paul has contributed to the current interest in cultivating critical and creative thinking one of the simplest and most powerful notions around: the concept of “strong sense” critical thinking, that sort of critical thinking that confronts deep and genuine conflicts of values and perspectives. In doing so, Paul has given us not just a philosophical distinction but an ideal to strive for. Quite rightly pointing out that it is all too easy to settle for modest technical improvements in the practice of thinking, Paul presses the point that this is not enough — indeed, if this is all the enterprise amounts to, it is hardly worth undertaking. He has taken some pains to spell out what constitutes strong sense critical thinking and where it applies in everyday life and in subject matter instruction. Not content just to articulate distinctions and standards, through his work, Paul has also sought to carry the message and a perspective on methods to practitioners. He has conceived an approach to making instruction in the subject

matters a more thoughtful enterprise - in a strong sense! He has clarified our notions of Socratic interaction, produced videotapes demonstrating effective patterns of thought-provoking interaction, and more. Certainly this compendium of essays by Paul is a valuable resource for anyone who aspires to broaden and deepen the quality of their students’ thinking — or their own.

Co-director, Project Zero  
Graduate School of Education  
Harvard University

**Ralph H. Johnson & J. Anthony Blair.** This timely volume is a necessity for anyone who is interested in the critical thinking movement as an instrument of educational reform. It is also mandatory reading for anyone who wishes to understand the concept or theory of critical thinking of Richard Paul, who is certainly one of the leading lights of the Critical Thinking Movement North America — and beyond. Certain common themes emerge and reappear in these papers: the importance of the rational life, the difficulty of attaining it in a society in which irrationality and illogic flourish; the ways of building rationality; specific advice for teaching critical thinking appropriate to various levels — all of this and more. There are the familiar themes: the distinction between strong sense and weak sense critical thinking, the papers providing much needed perspective on the movement. There are some surprises in this volume — a paper on prejudice, for example, which shows how the concern for critical thinking intersects with an important phenomenon in American life. There is a glossary of terms which are connected with critical thinking, in which Paul presents his conception of crucial terms. We suspect many will find this glossary useful. This volume constitutes an important addition to the growing literature on critical thinking. Paul writes from a coherent center and from many years of experience with the theoretical problems, the practical and administrative concerns, and also pedagogical experience.

Professors, Authors,  
Editors, *Informal Logic*  
University of Windsor  
Windsor, Ontario, Canada

**Harvey Siegel.** *Critical Thinking* is a welcome addition to the literature on critical thinking. Paul is the acknowledged leader of

the “Critical Thinking Movement, and has for years been critical thinking’s most impassioned and persuasive advocate. Paul’s work ranges from the theoretical and philosophical to the very practical aspects of education for critical thinking; whatever dimension of critical thinking Paul addresses, we benefit from his attention. Critical Thinking is a collection of Paul’s writings on critical thinking. The extraordinary range of his work is clearly in evidence here. The philosopher/theoretician concerned with critical thinking will find much to ponder inside these covers. So will the teacher practitioner who is seeking ways to incorporate critical thinking into the curriculum and daily classroom experience. Many of these papers are published in places which make access to them difficult; it is an important step to bring them together in one place, and to provide the opportunity for a systematic appreciation of Paul’s writings and contributions to both the theory and the practice of critical thinking. I am delighted that this collection of Paul’s work is available. I am sure that the book’s presence will enhance Paul’s efforts to make critical thinking not only an educational ideal, but an educational reality as well.

Professor/Author  
Department of Philosophy  
University of Miami

**Vincent Ryan Ruggiero**

This collection of articles is a most welcome addition to the literature on critical thinking. For many years, Paul has been a leader of the thinking movement in education. His efforts not only to advance knowledge of this vital subject, but also to make the thoughts of other contributors accessible to educators around the world reflect a dedication seldom paralleled in modern education. Readers of this volume will find here the qualities that mark all of Paul’s work — a breadth of vision and analytic skill, a capacity for insight, and a most favorable balance of theory and application.

Professor/Author  
Department of Humanities  
SUNY at Delphi College

**John Barell.** “The problems of real-world practice do not present themselves to practitioners as well-formed structures. Indeed, they tend not to present themselves as problems at all but as messy, indeterminate

situations.” (Schon, 1987, *Educating the Reflective Practitioner*.) This suggests that if we wish to prepare students for such ill-structured situations, we must enrich their academic lives with opportunities to view life from a wide variety of perspectives; we must encourage a kind of viewing of the world through multiple lenses and not the monocle of one dimension; it further suggests that we provide learning experiences wherein students can practice applying open-mindedness to the rich diversity of life’s conflicting pressures, trends, conceptions, and interpretations while exemplifying such criteria as accuracy, precision of language, and a high regard for evidence. Paul’s new book on critical thinking, therefore, comes as a welcome addition to the literature that will enable all of us, teachers, administrators, teacher educators, and parents to work toward empowering ourselves as well as our students to identify and think through life’s complex and problematic situations. “If human life is by its nature multilogical, then the problem of learning to think critically includes the very difficult task of learning to think clearly, accurately, and insightfully within a variety of conflicting points of view.” (p. xx “Bloom’s Taxonomy and Critical Thinking Instruction”). Paul’s emphasis upon the “multilogical,” multidimensional nature of life’s experiences is one of the most potentially powerful and illuminating models to help those of us who work for change within schools, because this focus upon multiple perspectives comes at a time when so many schools are narrowly reducing their emphases to that which can be gleaned from standardized tests, single-minded lesson designs (e.g., Hunter’s), and one dimensional ways of viewing life. Of special interest to practitioners will be the modeled lessons wherein Paul and his colleagues have re-cast textbook approaches to help our students achieve “the universal ideals of thought” such as clarity, accuracy, breadth, fairness, and, above all, an openness to our various ways of understanding life’s complex and ill-structured situations.

Professor  
Department of Curriculum and  
Teaching  
Montclair State College

**Nicholas M. Michelli.** Critical thinking as a movement in American education is troubled by a variety of definitions and conceptions of

what critical thinking means and by a split between its application in the K-12 schools and higher education, not to mention the differences between those approaching the subject from the perspectives of philosophy, cognitive psychology, or the various sub-disciplines of education. This publication shows the extent to which Richard Paul's work bridges those differences. For that reason alone, it makes an enormous contribution to the emerging literature on critical thinking. For the first time, the variety of audiences with an interest in critical thinking — philosophers, psychologists, staff development experts for colleges and K-12 schools, and teacher educators — have one useful source they can all turn to. This work, in combination with the previously published handbooks on remodeling lessons, meets the full variety of needs of these constituents. It is an especially important contribution for teacher educators because of the growing interest within the teacher education community in critical thinking. As colleges and universities re-conceptualize their teacher education programs to include critical thinking, the work provides a unified conception that draws on the work in philosophy, psychology, and education as well as a connection with the real world of classroom teachers.

Dean of Education  
Montclair State College

**Mark Weinstein.** From his earliest published efforts in critical thinking, Richard Paul has offered challenging and well supported positions that have had a significant effect on the ongoing discussion in the field. A compendium of his published and unpublished papers is thus an invaluable resource for all of those who see critical thinking as a deeply vital force in the reform of education and society. Paul's theoretic work is both available and profound. His call for strong sense critical thinking and the analysis of irrational language games points to psychological, social, and cultural aspects of critical thinking that are essential for meaningful reform. His practical and pedagogical work includes the most ambitious attempt to date to coordinate the work of teachers, students, and college faculty around an image of the infusion of critical thinking throughout the curriculum. Most essential, however, is Paul's identification of the social and personal ethic that underlies critical thinking.

By highlighting the relation between critical thinking and social and moral critique, Paul moves critical thinking beyond a temporary expedient riding the swinging pendulum of educational reform to its rightful place at the heart of education.

Associate Director  
Institute for Critical Thinking  
Montclair State College  
President, Association for  
Informal Logic and Critical  
Thinking

**Alec Fisher.** The critical thinking movement has articulated its objectives more clearly as it has developed. Though many working in the field initially thought in terms of what Paul calls micro-skills — how to spot the conclusion of an argument, how to identify a parallel argument, how to challenge a critical term, etc. Paul has long maintained that these (“weak” critical thinking) skills are of limited worth unless associated with certain values, notably the values of open-mindedness and fair-mindedness. It is a commitment to these values which characterizes what Paul calls the “strong” critical thinker: they amount to being open to criticism and taking seriously your opponent's point of view. In some ways, Paul's position has an instructive parallel with views concerning the nature and value of science. There are those who argue that science should be value-free, value-neutral, and objective. Others argue that this is impossible and that it is a mistake to separate science and values. Whatever the merits of the theoretical arguments, it is clear that science can be used for good or ill, that it can do as much harm as good. In the same way, on Paul's view, weak critical thinking can do as much harm as good. The parallel is instructive, and Paul is surely right to stress the moral element in critical thinking and to advocate his conception of “strong” critical thinking.

Professor/Author  
School of Economic &  
Social Studies  
University of East Anglia



# An Assessment of Undergraduate Engineering Students' Critical Thinking Skills Guided by the Paul-Elder Critical Thinking Framework

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University of Louisville, Delphi Center for Teaching and Learning

## Abstract

Faculty in a large, urban school of engineering designed a longitudinal study to assess the critical thinking skills of undergraduate students as they progressed through the engineering program. The Paul-Elder critical thinking framework was used to design course assignments and develop a holistic assessment rubric. This paper presents the analysis of the freshman course artifacts (baseline and course critical thinking assignments) and associated faculty scoring sessions for all three cohorts. A total of 649 first semester freshman students at least 18 years old agreed to participate in the study. The majority were white males with a mean high school grade point average of 3.73, ACT composite score of 28.33, and final freshman engineering course grade of 3.57. There was a statistically significant positive relationship between the freshman course artifacts and the faculty scores. Data from the study are being used to enhance the critical thinking experiences for undergraduate engineering students.

**Key words:** Assessment, Paul-Elder Critical Thinking Framework, Engineering Students

## Introduction

This paper describes an ongoing project by the school of engineering at a large urban university to enhance the critical thinking skills of their undergraduate students. Presented are: the steps followed to develop a holistic rubric aligned with the Paul-Elder critical thinking framework for use with undergraduate engineering students, the faculty training required for both teaching the framework and rating the written artifacts, and initial results from the assessment of students' critical thinking skills that is part of a longitudinal study to assess the critical thinking skills throughout the educational experience of undergraduate engineering students.

In 2007, the university began implementing a multi-year plan to enhance undergraduate students' critical thinking skills in all undergraduate programs across the entire undergraduate experience as part of the regional reaccreditation process. For the reaccreditation plan, the university selected Scriven and Paul's (1987) definition that critical thinking "*is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.*" A primary goal early in the initiative was to identify a critical thinking framework that could be used across the undergraduate programs for consistency in terminology and assessment. Frameworks and mod-

els reviewed for the initiative included Bloom (1956), Bogo and Vayda (1998), Brookfield (1987), Facione and Facione (1998), and Paul and Elder (2001). The models were reviewed for their comprehensiveness, applicability to all undergraduate programs, inclusion of specific cognitive skills (e.g., metacognition), and availability of high quality resources by the critical thinking specialist for the initiative. Faculty, administrators and staff responsible for leading the initiative reviewed the assessment and unanimously agreed to select the Paul-Elder critical thinking framework to provide intentional and consistent language across undergraduate programs because of the Paul-Elder framework's comprehensiveness, discipline neutral terminology and extensive high quality resources.

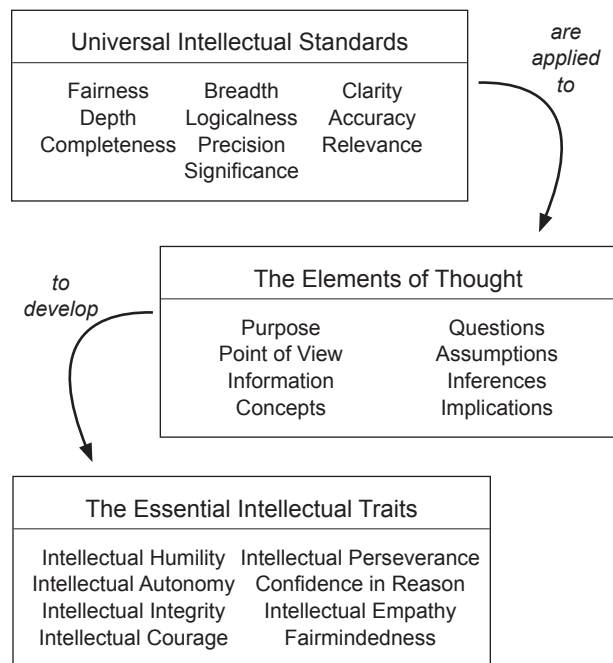
## Paul-Elder Critical Thinking Framework

The Paul-Elder (2009) critical thinking framework has a formal structure and is a discipline-neutral schema. Figure 1 depicts the Paul-Elder critical thinking framework. The framework depicts critical thinking by applying Universal Intellectual Standards to the evaluation of typical Elements of Thought, with the goal of developing certain Essential Intellectual Traits in the thinker.

The eight Elements of Thought are the parts or fundamental structures of thought, which are the essential dimensions when all reasoning occurs in all persons at any time. The Elements of Thought work together in a nonlinear interrelationship to shape reasoning and provide

a general logic to the use of thought. There is an *intimate overlap among all of the elements by virtue of their interrelationship*. Fundamental to critical thinking is the ability to assess the quality of the reasoning. Assessing critical thinking involves consistently taking apart and examining thinking with respect to the Universal Intellectual Standards of quality. Unlike the eight Elements of Thought that are universal — present in all reasoning on all subjects in all cultures for all time — the ten Universal Intellectual Standards presented in Figure 1 are simply some of the most fundamental selected from a wide variety of standards. (Paul & Elder 2006, p. 44) The Universal Intellectual Standards are criteria for assessing the quality of reasoning that serve as guides to better reasoning. The Essential Intellectual Traits are developed by consistently applying the Universal Intellectual Standards to the Elements of Thought. The Essential Intellectual Traits are tendencies or commitments towards the trait and not skills or abilities. (Paul and Elder, 2001; Paul and Elder, 2009). The framework allows for the analysis and evaluation of thought, but more importantly, it provides a common vocabulary for those who want to discuss, evaluate, or teach critical thinking.

**Figure 1**  
**The Paul-Elder Critical Thinking Framework**



### Critical Thinking and Engineering

The university's School of Engineering faculty members embraced and supported the emphasis on critical thinking, since critical thinking is fundamental to problem solving which is the essence of engineering. The term "critical thinking" is familiar to most engineering

educators, but it is difficult to define easily. Paul, Elder and Bartell (1997) found that 89% of teachers interviewed claimed critical thinking to be an important education objective, but only 19% were able to give a clear explanation of critical thinking. Considering Ennis (1993) and Scriven and Paul's (1987) definitions of critical thinking in Table 1, the three key elements of critical thinking thus are reason, reflection, and decision making.

Fundamentally, critical thinking is thinking about thinking, a meta-cognitive process. The combination of reflection and reason leads to the final element, belief in the validity of a premise, process or solution to a problem, which also can lead to action. Critical thinking develops conclusions by deducing or inferring answers to questions and then reflecting on the quality of the reasoning; the end result is conviction, and in most cases a decision is made or action taken, based on those conclusions.

**Table 1**  
**Critical Thinking Definitions**

Ennis (1993): *Critical thinking is reasonable, reflective thinking focused on deciding what to believe or do (p. 180).*

Scriven & Paul (1987): *Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.*

The ability to think critically is an important skill for practicing engineers, although in 2000, employers perceived engineering graduates to be particularly poor at critical and independent thinking (Nielsen, 2000). The development of critical thinking, collaborative learning, communication, and leadership skills have been recognized to be as important for an engineering faculty member to initiate as delivery of content (Koehn, 2001). One could argue that critical thinking is the foundation for all eleven program outcomes that must be assessed for accreditation by the Accreditation Board for Engineering and Technology, now since 2005 simply known as ABET. Table 2 summarizes the ABET outcomes.

Although the term critical thinking is not specifically used in any of the ABET outcomes, the outcomes all require "the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief or action," i.e., critical thinking as defined by Scriven and Paul (1987). Shuman, Besterfield-Sacre and McGourty (2005) proposed that attributes of life-long learning include the ability to demonstrate reading, writing, listening, and speaking skills; demonstrate an awareness of what needs to be learned; follow a learning plan; identify, retrieve, and organize information; demonstrate critical thinking skills; and reflect on one's own understanding. Jiusto and DiBiasio

(2006) analyzed the effectiveness of an experiential academic program in preparing students for life-long learning through the acquisition of critical thinking, research, and communication skills which support self-directed learning. These two recent studies demonstrate that the engineering community accepts that critical thinking is foundational to life-long learning. The assessment of critical thinking complements the assessment of ABET outcomes for engineering programs. The more effective thinkers students are, the better equipped they are to achieve the ABET outcomes. The assessment of program outcomes for engineering schools will be enhanced by strong, well-assessed critical thinking elements of a program curriculum.

**Table 2**  
**ABET Outcomes Table**

Engineering programs must demonstrate that their students attain the following outcomes:

- (a) an ability to apply knowledge of mathematics, science, and engineering,
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data,
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability,
- (d) an ability to function on multidisciplinary teams,
- (e) an ability to identify, formulate, and solve engineering problems,
- (f) an understanding of professional and ethical responsibility,
- (g) an ability to communicate effectively,
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context,
- (i) a recognition of the need for, and an ability to engage in life-long learning,
- (j) a knowledge of contemporary issues,
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## Critical Thinking Longitudinal Study

### Design

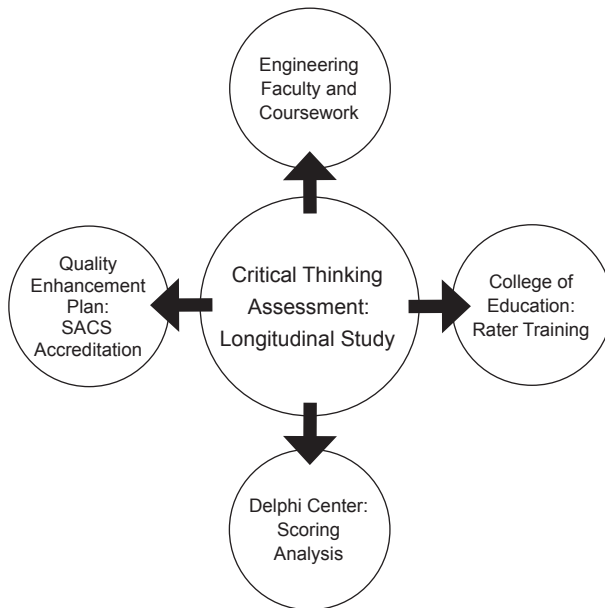
Engineering faculty at the institution are intentionally and transparently incorporating critical thinking skill development into the undergraduate engineering experience in support of the regional reaccreditation initiative and ABET outcomes. One specific effort is a four-year longitudinal research study for assessment of the impact of critical thinking in the undergraduate engineering program after incorporating the Paul-Elder critical thinking framework into every year of the curriculum. Approved by the university's Institutional Review Board and funded by a competitive university-wide internal program, the purpose of this multi-year study is to assess the critical thinking skill development of undergraduate engineering students

as they progress through the engineering program. The study follows three different cohorts of students for four years, those that entered in fall 2008 (cohort 1), fall 2009 (cohort 2), and fall 2010 (cohort 3). Thus, the study will actually continue for a total of six years, from 2008-2014; it is a four year study for each cohort.

Both formal and informal assessment and evaluation data will be used to enhance the intentional and transparent incorporation of critical thinking into the undergraduate engineering experience. Faculty will rate authentic student artifacts that are collected during each year of the students' undergraduate experience. For the freshman course, "Introduction to Engineering," one case-study artifact will be collected and one quiz given that requires critical analysis. The case study introduces various aspects of engineering before critical thinking is intentionally discussed in the course. The case study serves as the baseline assessment and will be the artifact independently scored by trained engineering faculty raters. The quiz, given after the Paul-Elder critical thinking framework has been introduced and discussed, evaluates each student's ability to read and analyze a newspaper article about an accident that involved texting. The quiz serves as an additional freshman course critical thinking artifact. The sophomore differential equations course's artifact is a one-page description that answers the question "If you had time to teach only one method to solve differential equations, which method would you pick and why?" The artifact collected from third year students is their cooperative internship report summary which asks students to critically reflect on their primary responsibilities. Artifacts from fourth year courses from the seven degree-granting departments will be written summaries from either capstone design or seminar courses.

Figure 2 illustrates the interconnected aspects of the longitudinal study within the university. Regardless of whether students consented to participate in the research study, they will receive explicit critical thinking instruction and real-world practical application exercises in every year of their undergraduate engineering education. Thus, this effort will enhance student learning and metacognition as students "think more about thinking" and "know more about knowing" (Metcalfe and Shimamura, 1994) in the context of their engineering program of study.

**Figure 2**  
**Critical Thinking Assessment**  
**Collaboration Relationships and Interaction**



### Rubric Development

Rubrics are one tool for assessing students' critical thinking. A key aspect of the research study was to develop a critical thinking rubric that could be used to assess student artifacts at each phase of the project. Since no existing critical thinking rubric was found that incorporated the Paul-Elder critical thinking framework for engineering, the engineering faculty leading this study decided to construct a critical thinking rubric based on the Paul-Elder critical thinking framework for use within the research project.

In collaboration with the university's accreditation assessment specialist, engineering faculty with disciplinary and critical thinking expertise discussed the goals and desirable aspects of a critical thinking rubric. For a rubric to be acceptable to the engineering faculty as a whole, it must be clear, straightforward, easy to use, and discipline specific. Additionally, to support and align with the university reaccreditation plan, the rubric must incorporate the Paul-Elder critical thinking framework. The rubric will be used throughout the longitudinal study to assess students' critical thinking performance in written artifacts from first year through senior engineering courses.

The rubric, designed by faculty and used in the scoring of engineering students' written assessments, was holistic rather than analytic. Holistic scoring goes beyond mechanical correctness to focus on the overall effect of the writing. It measures the effectiveness of the communication according to a set of criteria on a scoring rubric. Trained readers evaluate the student writing as a whole using the criteria of the rubric and knowledge from training with benchmark or sample papers. Readers are trained not to focus on any one prioritized aspect of the writing

but to look at the entire essay or work product according to the criteria provided in the assignment and levels of performance on the scoring rubric. It was decided to have a four-level scale for the rubric, which is consistent with other university-wide holistic rubrics and minimizes the tendency to rate in the middle of odd number level scales (Alfrey & Cooney, 2009; Newell, Dahm & Newell, 2002). The holistic critical thinking rubric developed for this project is presented in Figure 3 (Ralston and Bays, 2010).

### Faculty Rater Training

The first cohort was consented in Fall 2008 and the first set of artifacts was produced from the Introduction to Engineering course. For first-semester engineering students who consented to participate in the study, one course assignment (artifact) was selected to serve as the baseline for blind review by the engineering faculty. The process for preparing the student artifacts for assessment was as follows:

1. An ungraded copy of each student's work was given to the Center for Teaching and Learning assessment specialist to prepare for blind review.
2. Each student artifact was given a unique identifying number; then all identifying information (e.g., student name and section number) was removed.
3. Folders were created that contained six to seven blinded student artifacts, the assignment instructions, and the critical thinking rubric.
4. Clipped to the outside of the folder were two identical scoring sheets for recording the name of the faculty evaluator, the number for each artifact, and the assessment score.

Initially, 15 faculty volunteered to score the student artifacts throughout the research project. These engineering faculty had obtained various types of exposure to the Paul-Elder framework offered by the university's Center for Teaching and Learning, from intensive semester-long faculty learning community participation to shorter workshops or presentations. Faculty received a stipend to spend on any academic expense as a compensation for the time the scoring session would take over the six-year length of the research project. Engineering faculty participated in a four-hour week day afternoon training and scoring session facilitated by four faculty with expertise in rater training and rubric scoring from the university's College of Education and Human Development. To enhance reliability the faculty training included a practice session using the rubric to score student artifacts that were identical to those for the actual scoring session but would not be included in the final analysis. Faculty were debriefed after the practice scoring session in preparation for the actual scoring. The debriefing included discussions about reasons for and resolution to differing scores in addition to a review of the way to properly use a holistic rubric for scoring, not grading, student artifacts. To reduce bias all artifacts were blinded to the faculty and randomly assigned to faculty for



scoring. As additional faculty volunteered to participate in the study and take part in subsequent rating sessions, they were trained by the study Principle Investigator using the materials from the initial training session.

**Figure 3**  
**Holistic Critical Thinking Rubric**

**University of X**  
**X School of Engineering**  
**Holistic Critical Thinking Rubric\***

*Consistently does all or most of the following:*

|          |  |
|----------|--|
| <b>4</b> | <p>Clearly identifies the purpose including all complexities of relevant questions.<br/>                 Accurate, complete information that is supported by relevant evidence.<br/>                 Complete, fair presentation of all relevant assumptions and points of view.<br/>                 Clearly articulates significant, logical implications and consequences based on relevant evidence.</p>   |
| <b>3</b> | <p>Clearly identifies the purpose including some complexities of relevant questions.<br/>                 Accurate, mostly complete information that is supported by evidence.<br/>                 Complete, fair presentation of some relevant assumptions and points of view.<br/>                 Clearly articulates some implications and consequences based on evidence.</p>                            |
| <b>2</b> | <p>Identifies the purpose including irrelevant and/or insufficient questions.<br/>                 Accurate but incomplete information that is not supported by evidence.<br/>                 Simplistic presentation that ignores relevant assumptions and points of view.<br/>                 Articulates insignificant or illogical implications and consequences that are not supported by evidence.</p> |
| <b>1</b> | <p>Unclear purpose that does not includes questions.<br/>                 Inaccurate, incomplete information that is not supported by evidence.<br/>                 Incomplete presentation that ignores relevant assumptions and points of view.<br/>                 Fails to recognize or generates invalid implications and consequences based on irrelevant evidence.</p>                                |

\* Based on the Paul-Elder critical thinking framework

**Data Analysis**

All three freshman cohorts have been consented and are in the process of completing the critical thinking activities throughout their undergraduate experience. A complete set of freshman baseline and course critical thinking data for each of the three cohorts has been collected and analyzed. This section presents the analysis of the freshman course artifacts (baseline and course critical thinking assignment) and associated faculty scoring sessions for all 3

cohorts. Data collection and analysis is continuing for each cohort in the remaining engineering courses, with the first cohort scheduled to graduate and complete the longitudinal study in May 2012. Engineering faculty have presented preliminary findings associated with the longitudinal study at engineering and critical thinking conferences (Evans & Chen, 2010; Lewis, Hieb & Wheatley, 2009; Lewis, Hieb & Wheatley, 2010; Lewis & Wheatley, 2011, Lewis & Bays, 2011; Ralston & Bays, 2010).

**Demographic Data and Critical Thinking Scores for Three Student Cohorts**

**Demographic Data.** A total of 649 first semester freshman students at least 18 years old agreed to participate in the study (57% consent rate combined for all 3 cohorts). Table 3 presents the descriptive data for the three freshman cohorts. The majority were white males with a mean high school grade point average of 3.73, ACT composite score of 28.33, and final freshman engineering course grade of 3.57. For the first and third cohorts, the students who consented had statistically significant ( $p < 0.05$ ) higher high school GPAs and composite ACT scores than those who did not consent. Additionally, the third cohort had a statistically significant ( $p = .035$ ) higher high school GPA than the second cohort and approached a statistically significant ( $p = .060$ ) higher high school GPA than the first cohort. There was no statistically significant difference ( $p > .05$ ) in high school GPA between the first and second cohorts. Lastly, the second cohort had a statistically significant lower final course grade than the first ( $p = .019$ ) and third ( $p = .012$ ) cohorts. There was no statistically significant difference ( $p > .05$ ) in final course grade between the first and third cohorts.

**Table 3**  
**Freshman Student Demographic Means**  
**(Standard Deviations)**

|                                     | <b>Cohort 1</b> | <b>Cohort 2</b> | <b>Cohort 3</b> |
|-------------------------------------|-----------------|-----------------|-----------------|
| <b>High School GPA</b>              | 3.708 (.306)    | 3.705 (.332)    | 3.782 (.295)    |
| <b>ACT Composite</b>                | 28.11 (2.914)   | 28.27 (3.049)   | 28.58 (2.857)   |
| <b>Final Course Grade</b>           | 3.64 (.646)     | 3.46 (.731)     | 3.65 (.635)     |
| <b>Baseline CT Case Study</b>       | 90.136 (5.900)  | 83.170 (18.969) | 81.263 (19.500) |
| <b>CT Quiz</b>                      | 84.172 (17.562) | 75.720 (21.765) | 73.864 (21.216) |
| <b>Faculty Rating of Case Study</b> | 2.602 (.743)    | 2.332 (.658)    | 2.291 (.707)    |

**Critical Thinking Scores.** Three critical thinking scores were collected for the cohorts, a percentage score on the first critical thinking course case study assignment

graded by course faculty before instruction on critical thinking (baseline), a percentage score on a second critical thinking course quiz graded by course faculty after instruction on the Paul-Elder critical thinking framework (course), and a rubric score on the first critical thinking course case study assignment by trained engineering faculty raters (longitudinal). There was a statistically significant difference ( $p = .000$ ) in all three critical thinking scores between cohort 1 and the other two cohorts. There was not a statistically significant difference in critical thinking scores between cohort 2 and 3 ( $p > .05$ ). The faculty rater CT score had a significant moderate positive correlation with the baseline CT assessment ( $r = .300$ ,  $p = .000$ ) and a significant weak relationship with the course CT assignment ( $r = .102$ ,  $p = .017$ ). The stronger relationship between the faculty rater and baseline CT scores is expected because they were generated from the same assignment. The baseline CT assessment had a significant weak relationship with the course CT assignment ( $r = .090$ ,  $p = .033$ ). Preliminary analysis of longitudinal data shows an encouraging upward trend in faculty rater CT scores for each year.

### Inter-rater Reliability

A total of 618 (95% of students consented) baseline written artifacts from the "Introduction to Engineering" course were available for faculty scoring because some consented students transferred out of the course prior to submission of the artifact. Trained engineering faculty in 66 pairs have independently scored the artifacts. The scores of the two faculty were deemed acceptable if they were either identical or within one point of each other. If there was a two or three point disagreement in the scorings a 3rd faculty scored the artifact. The majority of artifacts (492, 80%) were scored by two faculty within one point. The percentage of faculty who were within one point of agreement in scores increased from 80% with the first cohort to 89% with the third cohort. The scores ranged from 1-4 with mean of 2.40 ( $SD = .71$ ). The consistency of faculty rater scores was assessed using the intraclass correlation coefficient (ICC). The majority of ICCs were greater than 0.4 (56%) and 18 (27%) significant at the 0.05 level.

### Discussion

After the first cohort, the scoring of some assignments was changed to remove options for bonus points and to give less weight to some relatively minor assignments. This could account for the variation in average course grade. The third cohort was a statistically significant better class in terms of high school GPA and ACT score than the first and second cohorts.

Predictably, the third cohort's overall course grade was higher than that of the second cohort. Additionally, the third cohort's overall course grade was slightly higher than that of the first cohort even though the course scoring was the same in cohort 2 and cohort 3. The decrease from cohort

1 to cohort 2 in course grade is understandable in light of changes made in the course assignments even though the students were statistically similar.

The results show that the faculty rater critical thinking score is consistent with the baseline critical thinking score given by the lead course instructor for all three cohorts. This consistency gives some confidence in the process of faculty training. The decrease from cohort 1 to cohorts 2 and 3 in both the faculty rater average CT score and the baseline CT score given by the class instructor is most likely the result of faculty gaining experience in scoring against a holistic rubric. It took faculty a while to learn to avoid norm referencing. As faculty gained practice and experience scoring with the rubric, they became much more aware of the need for students to support their statements rather than accepting reasonable statements without proper justification. As faculty began to internalize the components of the framework, especially the use of the standards to assess the quality of the reasoning, they tended to give more low scores and fewer high scores.

As a result of this longitudinal study, faculty in the engineering school have anecdotally reported placing more time and intentional emphasis on the teaching of critical thinking. Faculty had always demonstrated critical thinking, but with the introduction of the Paul-Elder critical thinking framework and collection of written artifacts that require an explanation of the thinking involved in problem solving, the undergraduates are getting a more focused, explicit, intentional emphasis on critical thinking that will be invaluable in their engineering practice. Continuation of the longitudinal study will provide results that show how students in each cohorts critical thinking skills change as they proceed to graduation. A study is underway to assess the impact of this study on faculty, specifically the faculty participants will be surveyed to assess the impact of the rating sessions and training on their teaching of critical thinking.

### Conclusions

The longitudinal study is enhancing engineering faculty's intentional and explicit inclusion of critical thinking activities, which will impact the development of students' critical thinking abilities. First, we believe that undergraduate engineering students' critical thinking abilities will be enhanced as results from the longitudinal trend analysis continue to be used by engineering faculty members for refinement and enhancement of course critical thinking experiences. Secondly, we expect that the continual faculty involvement with the rating sessions and use of the holistic critical thinking rubric will enhance the faculty's abilities to foster critical thinking skills in undergraduate engineering students. This type of assessment strengthens and augments ongoing work to assess ABET outcomes.

The longitudinal study has provided an opportunity to encourage and support faculty in the intentional and transparent teaching of critical thinking. Faculty embraced

the Paul-Elder framework and worked to produce a holistic rubric for engineering based on the framework. The ongoing analysis of the cohorts as they move through their undergraduate education will provide evidence of the impact of the faculty's overt attempts at teaching critical thinking. There are dedicated and sustained efforts in the school of engineering to embed in an intentional and systematic manner critical thinking assignments in core courses that align with the Paul-Elder critical thinking framework.

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