

Education and Thinking:

Critical Thinking in General and in a Specific Subject **

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Liberal Education, General Education, and Critical Thinking

Liberal education is a widely accepted and extolled mode of education in the modern world. It aims to liberalize people from their natural inclination towards self-centeredness in cognition, and from their individual limitations as shaped by conditions such as the narrowness of their scope of learning, or prejudices inherited from particular socio-cultural contexts. The ideal result

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** This essay is largely based on my presentations at two events. The first was a General Education Lunch Seminar co-organized by the Research Centre for General Education and the Office of University General Education, the Chinese University of Hong Kong on May 5, 2009, entitled “How to Help Students Develop Critical Thinking?” (<http://www.cuhk.edu.hk/oge/rcge/luncheon.htm>). The other was the Fourth Cross-Straight Conference on Logic Teaching and Research (第四屆兩岸邏輯教學與研究學術會議) co-organized by Hong Kong Baptist University’s Department of Religion and Philosophy and the Hong Kong University of Science and Technology’s Division of Humanities on June 24 & 25, 2009. My presentation was entitled “Teaching and Learning Critical Thinking in General and in a Specific Subject.” I would like to express my gratitude to the participants of these two events who gave me helpful comments.

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is the creation of people who can think independently and reasonably, act confidently and responsibly, and interact with other people with consideration and flexibility. Harvard College, an educational institution of international repute that unreservedly promotes liberal education, states succinctly: “Education at Harvard should liberate students to explore, to create, to challenge, and to lead” (President & Fellows of Harvard College, 2009, para. 2). So conceived, liberal education requires students to master a wide range of skills and build up a broad base of knowledge to enable them to cope competently with the complex modern world.

General education, as a distinct component of liberal education, plays a major role in fulfilling these requirements. By studying a structured spectrum of non-major subjects, students are expected to have their horizons considerably broadened. Among other goals, educators aim to “[prepare] students for civic engagement”; “[teach] students to understand themselves as products of – and participants in – traditions of art, ideas, and values”; “[prepare] students to respond critically and constructively to change”; and “[develop] students’ understanding of the ethical dimensions of what they say and do” (President & Fellows of Harvard College, 2007, pp. 5–6).

Developing critical thinking (CT) skills has long been a central concern of university education. The general education goals mentioned above all presuppose an ability to formulate clear, rational thoughts and judgments. Thus, “how to think well?” or, more to the point, “how to think well in a critical manner?” is a central question in education. In addressing this question, a more general approach may be taken — such as through the study of logic — or a more specific approach — such as by studying particular

subjects like sociology. Both approaches have valuable things to teach us about thinking.

In the following sections, the two essential components in the development of CT — cognitive skills and affective dispositions — will first be explained. The author's own experiences with the process and some important resources for teaching and learning CT in general will then be discussed. Finally, some key issues in teaching and learning CT in a specific subject, and useful references, will be introduced.

What Is Critical Thinking?

CT has been defined in a number of ways by its prominent scholars and practitioners. At its core, CT can be defined as follows: *CT is a mode of thinking focused on judging right from wrong, distinguishing truth from falsity.* This definition is admittedly a very simple one, which only stresses two core objectives of CT while ignoring its other rich dimensions. However, it serves to delineate CT from other modes of thinking. For example, *creative thinking* is a mode of thinking focused on generating innovative ideas (e.g., the kind of thinking that takes place during a brainstorming session to come up with preliminary ideas for a new advertisement); *affective thinking* is a mode of thinking focused on effective communication or the sharing of feelings and emotions (e.g., the kind of thinking that takes place during a warm gathering of old friends); *kinetic thinking* is a mode of thinking focused on rapidly controlling and adjusting bodily movements (e.g., the thinking that occurs during a soccer match); and so on. Our daily mode of thinking (or our

mentality) can be understood as a complex mixture of these various modes in various degrees.

The following clearer and richer definition of CT is given in an outstanding textbook on the subject:

Critical thinking is the general term given to a wide range of cognitive skills and intellectual dispositions needed to effectively identify, analyze, and evaluate arguments and truth claims; to discover and overcome personal prejudices and biases; to formulate and present convincing reasons in support of conclusions; and to make reasonable, intelligent decisions about what to believe and what to do. It is disciplined thinking governed by clear intellectual standards that have proven their value over the course of human history. Among the most important of these intellectual standards are clarity, precision, accuracy, relevance, consistency, logical correctness, completeness, and fairness. (Bassham et al., 2005, p. 28)

One remarkable feature of this explanation that particularly interests us is its distinction between “skills” and “dispositions” for developing CT, which we will discuss in more detail in the next section.

Developing Critical Thinking — Two Essential Components

A reasonable question we should ask when considering the development of CT is: Are students *able* and *willing* to think critically? If a student is able to think critically but unwilling to do so, then she may not be properly

educated to make good use of a valuable ability; if a student is willing to think critically but unable to do so, then she may also not be properly educated in CT because of the lack of suitable skills. Only when a student is both able and willing to think critically could she be said to be a properly educated critical thinker. Roughly speaking, that part of the question relating to ability corresponds to *cognitive skills* training, while the part relating to willingness involves the cultivation of *affective dispositions*.

What are the cognitive skills that should be trained? What are the affective dispositions that should be cultivated? A representative and authoritative study known as the “APA Delphi Report” (Facione, 1990b) offers some answers. “APA” stands for the American Philosophical Association, which is the main professional organization for philosophers in the United States. “Delphi” refers to the Delphi Method, which is a well-established qualitative research methodology for generating a consensus resolution of matters of opinion. The title of the report itself is “Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction.” For this study, the APA collected the opinions of 46 CT experts in the U.S. and Canada concerning their conceptions of CT, and analyzed them by the Delphi Method, in order to arrive at a consensus on the nature of CT. The resulting Report is intended to provide useful references and guidelines for the purpose of educational assessment and instruction in CT. The Report is rather long, but there is an “Executive Summary” (ES) of it, which can be downloaded from the Internet (Facione, 1990a).

According to the ES (Facione, 1990a, p. 6), the experts arrived at the following consensus list of CT cognitive skills and sub-skills:

Table 1
The Consensus List of CT Cognitive Skills and Sub-skills

SKILLS	SUB-SKILLS
1. Interpretation	Categorization Decoding Significance Clarifying Meaning
2. Analysis	Examining Ideas Identifying Arguments Analyzing Arguments
3. Evaluation	Assessing Claims Assessing Arguments
4. Inference	Querying Evidence Conjecturing Alternatives Drawing Conclusions
5. Explanation	Stating Results Justifying Procedures Presenting Arguments
6. Self-regulation	Self-examination Self-correction

The Report and the ES have elaborated on these skills and sub-skills, which we will therefore not discuss here except to make two observations. The first is that it is easier to see how the first five skills and groups of sub-skills are connected to the conception of CT sketched in the foregoing section. The second is that the last skill (self-regulation) and group of sub-skills (self-examination and self-correction) are regarded as “meta-skills” of a sort, meaning that they act as skills for acquiring the other five groups of skills. The idea is that acquiring and improving these five groups of skills is a difficult long-term (even life-long) process, and if the learner expects to make progress in this endeavor she needs to observe and control her own thinking

and behavior from time to time. Hence, the necessity of developing the skill of self-regulation and the sub-skills of self-examination and self-correction.

The ES pointed out that “[t]he **education** of good critical thinkers is more than **training** students to execute a set of cognitive skills” (p. 14). This raises the issue of the significance of cultivating suitable affective dispositions for a genuine CT education. Decades ago, John Dewey, one of America’s greatest popular philosophers and educators, made a similar observation on the importance of the affective dispositions:

If we were compelled to make a choice between these personal attributes and knowledge about the principles of logical reasoning together with some degree of technical skill in manipulating special logical processes, we should decide for the former. (Dewey, 1910; quoted in Facione, 2009, p. 11)¹

By “personal attributes,” Dewey meant something similar to what we mean by affective dispositions. In a sense, he even placed dispositions above skills. It seems that what Dewey was really saying was this: A learner with good dispositions is a well-motivated well-prepared learner, so that she can learn the skills very independently; while a person trained with the skills but without good dispositions probably would not be willing to apply the skills or would not apply them for correct purposes.

Is there any consensus among CT experts about the dispositions? According to the ES (p. 13), the following is a consensus (83%) list of CT affective dispositions:

¹ Facione (2009) is a clear and popular introduction to CT based on the findings of the APA Delphi Report.

The consensus list of CT affective dispositions*Approaches to life and living in general:*

- inquisitiveness with regard to a wide range of issues,
- concern to become and remain generally well-informed,
- alertness to opportunities to use CT,
- trust in the processes of reasoned inquiry,
- self-confidence in one's own ability to reason,
- open-mindedness regarding divergent world views,
- flexibility in considering alternatives and opinions,
- understanding of the opinions of other people,
- fair-mindedness in appraising reasoning,
- honesty in facing one's own biases, prejudices, stereotypes, egocentric, or sociocentric tendencies,
- prudence in suspending, making, or altering judgments,
- willingness to reconsider and revise views where honest reflection suggests that change is warranted.

Approaches to specific issues, questions or problems:

- clarity in stating the question or concern,
- orderliness in working with complexity,
- diligence in seeking relevant information,
- reasonableness in selecting and applying criteria,
- care in focusing attention on the concern at hand,
- persistence though difficulties are encountered,
- precision to the degree permitted by the subject and the circumstance.

From the experience of an experienced critical thinker, it should not be difficult to see that the above are valuable attributes that can promote the good practice of CT.

There are mutual interactions between cognitive skills and affective dispositions, so that both components must not be ignored. They can work hand in hand in a virtuous circle — competency in skills can strengthen favorable dispositions, and strengthened favorable dispositions can in turn enhance further competency in skills, and so on. By contrast, deficiency in either component would instead result in a vicious circle.

After briefly reviewing aspects of the rich content of CT, one should then begin to understand why the consensus statement regarding CT and the ideal critical thinker arrived at in the Delphi Report would be elaborated upon in such a detailed manner:

We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life. While not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon. The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information,

reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. Thus, educating good critical thinkers means working toward this ideal. It combines developing CT skills with nurturing those dispositions which consistently yield useful insights and which are the basis of a rational and democratic society. (Facione, 1990a, p. 2)

Teaching General Critical Thinking Courses

By “general CT courses,” I mean courses aimed at enhancing CT ability generally, under any circumstances, not specifically within a certain subject or discipline. In this type of course CT is taught without a specific subject as a background; rather, diverse materials are used to illustrate the general principles of CT. I have been teaching this type of course for some years and would like to briefly discuss my own experiences in this section. The discussion will be divided into two parts — the first on cognitive skills, the second on affective dispositions.

When teaching cognitive skills, I generally cover the following four areas:²

- A. Meaning analysis
- B. Logical skills
- C. Scientific reasoning
- D. Fallacy analysis

2 I first learned about this framework as a student of Dr. Tien-ming Lee’s courses, as well as a reader of his books. But my presentation of it below is my own understanding and involves my own synthesis of his framework with other CT materials. He would not necessarily endorse the result. Apart from these four areas, I will sometimes also touch on a topic such as “cognitive biases,” which is related to fallacy analysis but is more akin to psychology than to logic.

Although the categorization of these four areas does not exactly correspond to that of the skills as put forth by the Delphi Report (interpretation, analysis, evaluation, and so on) as discussed in the previous section, it is not difficult to see that their actual contents have much in common. In fact, notwithstanding their differences in labeling, categorization, or format of presentation, different frameworks proposed by different CT textbooks or scholars are generally very similar in content.

When teaching meaning analysis, my central message to students is the importance of using language skillfully and appropriately for correct ways of thinking. Examples of topics that I would cover are “the clarification of meaning,” “using and evaluating definitions,” “linguistic pitfalls,” and so on. The treatment of linguistic pitfalls concerns analyzing defects in language that are harmful to correct ways of thinking. One type of linguistic pitfall is “conceptual distortion,” in which the distortion of existing meanings of terms results in mistaken or misleading ways of thinking. Below, let us briefly examine an example of conceptual distortion.

Thich Nhat Hanh, a famous expatriate Vietnamese Zen Buddhist monk, commenting on the state of existence of Buddha, made the following analogy:

... farmers have already planted thousands of seeds [of sunflowers] ... The sunflowers are *there*. They lack only the conditions of sun, heat, rain, and July. Just because you cannot see them does not mean that they do not exist.
(Nhat Hanh, 2007, p. 42)

Are sunflowers something transparent that cannot be seen by human eyes? Definitely not. In our normal use of language, what would we say about

the situation described by Nhat Hanh? We would say something like “The sunflowers do not yet exist although their seeds have already been planted.” Would we say that some cooked dishes already exist when actually only some raw materials for cooking have been prepared? Definitely not. So why did Nhat Hanh say such a strange thing? Would there be some deep hidden meanings in his words, concealing some deep hidden truths? Would there be some deep hidden meanings in my words if I said that the cooked dishes already exist? Under our existing use of words, my statement would either be clearly false or still need to be assigned some meanings that would make it true or even profound.³ Nhat Hanh’s statement should be treated in a like manner. Suppose, reasonably, that Nhat Hanh did not intend to say something so obviously false. What, then, did he actually mean (if anything)? I do not know and the context reveals nothing to me. Even if Nhat Hanh had really meant something special (which is doubtful), his way of expressing his meaning — by using common words while intending an uncommon meaning, yet without any indication that this was the case — can be taken as a case of conceptual distortion. Words should be construed under their usual meanings, unless otherwise indicated. For readers, Nhat Hanh’s statement could have been a way of distorting the usual meaning of the word “exist” with regard to non-transparent objects.

When teaching logical skills, my central message to students is that such skills are useful and applicable to daily reasoning and argumentation. Examples of topics that I cover are “argument analysis,” “deduction and

3 For the sake of simplicity, I ignore the problem of the possible case that the new meanings assigned to the words are totally unrelated to the original meanings. There might be a problem of the illegitimate assignment of meaning in certain linguistic contexts.

induction,” “propositional logic,” and others. Let us briefly examine an example of argument analysis, but of a somewhat special type of argument — a “visual argument.”⁴

Information conveyed by visual images is very common, so that students should be taught to analyze their argumentative content in addition to the usual arguments constructed by words. The figure in Groarke (2007, section 10) shows a poster promoting a certain brand of wine. Students may be asked to discuss common questions of argument analysis such as:

- A. What is the conclusion?
- B. What are the premises?
- C. Is it a good argument?

A suggested solution for the first two questions could be:

Premise #1: If you add vodka to your life, your sleepy life will be transformed into a life of cosmopolitan excitement.

(Implicit) Premise #2: A life of cosmopolitan excitement is desirable.

Conclusion: You should add vodka to your life (i.e., purchase vodka).

Although there may be room for disagreement on interpretation, it is still instructive to motivate students to clearly state the content that they perceive from the image. The last question can be discussed by introducing the students to some elementary conceptions for evaluating arguments, such as the plausibility of premises or the logical support of premises to a conclusion.

When teaching scientific reasoning, my central message to students is the usefulness and importance of applying scientific methods for solving empirical factual problems. Examples of the topics taught are “common

4 This example is adopted from Groarke (2007, section 10).

marks of pseudoscience,” “the hypothetico-deductive method,” “hypothesis and evidence,” and so on. Below, I discuss an example, drawn from daily life, which shows marks of pseudoscience.

That the demarcation between science and pseudoscience is a crucial topic in CT for the modern scientific world is quite obvious. Because of the great success and huge impact of science (and technology), labels such as “science” or “scientific” stand for reliability and quality to the general public. Because of this, many pseudoscientific products or inventions or ideas — i.e., something that is said to be scientific but that is in fact not scientific — would be labeled “science” or “scientific” so as to attract people’s attention. The abuse of such labels is indeed serious nowadays. Critical thinkers must be equipped with useful conceptual weapons to defend themselves against such pseudoscientific enemies.

易經與金股預測

易經助你預測有法，投資決定更有把握

每個人在投資股票、外匯、金融產品或其他生意時都有下列問題：
 這隻股票的市場價格走勢如何？
 何時入市，何時出市最有利？
 買入這股票或參與這個生意能否賺錢？

市況波動，反應熱烈
 詢單要求，優惠加碼！

而每天我們看報章、電台、手機信息中都有很多財經專家為我們分析股市、預測走勢、提供投資點子。然而如曹仁超在信報專欄「股壇老道」中所說：「所謂投資專家，大部分時間都在看錯市。我老曹覺得連自己亦不相信，……面對世上太多的資訊，我們必須獨立思考，提出自己的意見。」究其原因這些專家的意見都是根據過去與現在的資訊來推斷未來的發展而將至深奧取未來信息。然而我們的未來充滿變數，若一般邏輯理性思考何處預料。

講座內容：易經預測的智慧
 易經預測的科學性
 如何預測股票短期
 中期的走勢
 分析戊子年股市大勢
 現場驚喜預測試範

名額先到先得，請從速點擊報名！

Figure 1. An Advertisement for an I Ching Class

(Email promotion, Jan 24, 2008)

Figure 1 above shows an advertisement for a course intended to teach people how to use an ancient Chinese classic, the *I Ching*, to help them predict trends in the financial markets. Two items should be noted in the message when assessing whether or not the course is pseudoscientific in character. The first is the claim that the method followed in the course is scientific, which is suggested in the title of one of its topics, “The Scientific Nature of the Predictions of the I Ching.”⁵ This is important, because for something to be pseudoscientific, it is necessary that the claim first be made that it is scientific. “Pseudoscience” should not be confused with “nonscience.” A pseudoscience is a nonscience, but a nonscience may not be a pseudoscience. Art is usually not claimed to be a science, so although it is a nonscience, it is not a pseudoscience.

The second item of note relates to a common mark of pseudoscience, namely, the violation of well-established scientific beliefs. In the advertisement, the smallest Chinese characters in the text first state that even experts of financial markets mostly make wrong predictions about market trends. An explanation is then provided for this situation: even experts can only make predictions about the future based on past or current information, but not directly extract information from the future.⁶ This leaves the impression that its method is superior in that it can *directly extract information from the future!* Nevertheless, proclamations like this one can only reveal the writer’s ignorance of science or, to us, the pseudoscientific character of the course. Anybody who is knowledgeable about the rudiments of scientific

5 The Chinese original: 易經預測的科學性。

6 The Chinese original: 究其原因這些專家的意見都是根據過去與現在的資信來推斷未來的發展而非直接攝取未來信息。

methodology should know that even science can “only make predictions about the future based on past or current information.” The result is simply weird: the method is both scientific as well as “super-scientific”!

When teaching fallacy analysis, my central message to students is how common fallacious thinking is in daily life and the significance of avoiding it. Most of the common specific fallacies (e.g., hasty generalizations) are readily classifiable into a four-division general framework, constituted of the components of the “fallacy of inconsistency,” “fallacy of irrelevance,” “fallacy of insufficiency,” and the “fallacy of inappropriate presumption.”⁷ The four general concepts of inconsistency, irrelevance, insufficiency, and inappropriate presumption are themselves useful critical concepts for identifying and analyzing fallacy in a general preliminary manner. Below is a brief examination of a real-life example in which the specific fallacy of strained analogy is committed (or, at least, is seriously suspected of having been committed).⁸

In 1998, the Master Settlement Agreement saw the major U.S. tobacco companies agree to pay \$246 billion over 25 years to settle lawsuits filed by U.S. state governments accusing them of damaging public health. Later, some people raised the accusation that U.S. fast-food manufacturers should be the next target, since they also make products that are harmful to public health. The argument may be presented in this standard form:

7 I learned this framework from Dr. Tien-ming Lee’s works. Again, he would not necessarily endorse my interpretation.

8 This example is adopted from Baggini (2008, p. 260). The fallacies associated with analogical arguments have more than one dimension. The one I will discuss here is most suitably classified under the fallacy of inconsistency. The reason for this is that the argument to be criticized below is based on a requirement for consistency (as expressed by *Premise #1* below), which will be shown to be one that cannot be fulfilled. Also, it should be noted that another common dimension is concerned with irrelevance — irrelevance between the analogy made and the conclusion drawn.

Premise #1: Both U.S. tobacco companies and fast-food manufacturers have made products that are harmful to public health.

Premise #2: U.S. tobacco companies are punished for that.

Conclusion: Fast-food manufacturers should also be punished for that.

This is an analogical argument based on the analogy expressed by *Premise #1*. Is this argument convincing or not? No, it is not, because the analogy is a strained one, which can be disclosed by a closer inspection.

The two cases of making products harmful to health are essentially different. This can be argued from at least two perspectives. First, there is the distinction between “intrinsically damaging to health” and “damaging only when misused.” Tobacco contains substances that are intrinsically damaging to health, meaning that no matter how small the amount taken, they are still harmful to health, although in a smaller degree or probability. But the substances in fast food that are commonly claimed to be harmful to health — e.g., fat, sugar, and salt — are damaging only when misused, meaning that only when they are taken in excessive amounts would they be harmful to health. After all, our bodies need them. Therefore, are the customers themselves responsible for eating too much fast food by their own choice? After all, even foods commonly regarded as healthful, such as vegetables or milk, would be harmful if too much were eaten.

The second perspective is concerned with the existence of the intention of engaging in a cover-up. There is well-supported evidence showing that the tobacco companies knew all along that tobacco contains substances that are intrinsically damaging to health, but intentionally covered up this fact. However, in the case of fast food, that taking too much fat, sugar, or salt is harmful to health is just common sense. Therefore, no intention of engaging in a cover up seems to have been involved. Therefore, are the customers

themselves responsible for controlling their fast food diet to within healthful limits when the necessary information they need is either commonly known or readily obtainable? After all, we should be doing the same even for so-called healthful foods.⁹

After a short illustration, using some examples, of my method of teaching cognitive skills, I make some remarks on the cultivation of affective dispositions. In general, it is more difficult to reap a harvest from cultivating the dispositions of others than from teaching others some skills. This is especially so in the usual context of teaching within one course, which lasts only about several months. The main reason for this is that cultivating dispositions involves changing deep-rooted attitudes and habits of students, which generally takes quite a long time. Despite the difficulties, such cultivation is nonetheless very important, as was explained in the previous section. I find myself still struggling hard to explore more effective ways to achieve that purpose. After reflecting on what I have done in my own classes, I find that there are three general methods that one could use.

The first method may be called the “method of direct explanation.” By this I mean the straightforward strategy of explaining conceptions of affective dispositions directly to students. For instance, we may directly tell students what a disposition like “inquisitiveness with regard to a wide range of issues” means and its significance. The aim behind this method is to provide students with a knowledge of such basic conceptions so that they may themselves further reflect on their significance or build a solid conceptual groundwork for

9 There are arguably other subtle points that may be further explored, but have not been here. That is why I admitted, at the beginning of the discussion, the possibility that one might find my discussion merely to be making the case that the fallacy of strained analogy is seriously suspected of having been committed. But the treatment should be sufficient for my purpose here — namely, to give a brief illustration of how to analyze a *real-life* (suspected) fallacy.

other methods of cultivation. This method is both fundamental and crucial; however, merely conveying conceptions is very far from the establishment of firm attitudes and habits.

The second method may be called the “method of inducement.” By this I am referring to the following two components: (1) demonstrating the usefulness and importance of cognitive skills so as to induce a strong desire in students to acquire those skills; (2) explaining to students the necessity of developing suitable dispositions for enhancing the mastering of the skills, in order to make them see that developing those dispositions is something they must do if they want to acquire and use the skills satisfactorily. For instance, suppose that an instructor has shown her students how she can readily use logical skills to analyze and solve problems that the students are interested in but originally seemed very difficult to them. The students might then feel a strong desire to acquire these skills. The instructor may then point out that, among other things, a prerequisite for truly mastering the relevant logical skills is to develop a disposition like “alertness to opportunities to use CT.” Only if a student is alert to the chance to practice the skills, and grasps this opportunity, can she hope to truly master them. The hope is that, driven by the desire to master the skills, students would gradually feel inclined to develop suitable dispositions. To be driven by desire is then the key element of this method. This method works best with students who have a strong desire to learn useful skills and are self-disciplined.¹⁰

The third method may be called the “method of sowing seeds.” By this I mean that the seeds of proper affective dispositions are sown into the field of a student’s mind by engaging the student in active thinking or discussions

¹⁰ The skills of self-discipline are those discussed in section III. Please refer to that section for an explanation of their significance.

in lectures, tutorials, and assignments. Although a seed cannot be compared with a full-grown tree, there would be no tree if no seed were sown. Why could seeds be sown in that way? Because suitable dispositions are naturally embedded in these kinds of active thinking or discussion, if one is to do them well. It is not difficult to see this point if one reflects on the expert consensus list of dispositions shown in section III. For example, “understanding the opinions of other people” is a good practice that generally facilitates discussion with others, and “clarity in stating the question or concern” is a quality that generally facilitates thinking or discussion. In the tutorials of my own classes on CT, during which students are required to debate controversial issues, apart from simply instructing the students to prepare some materials for the debate topic, I often also remind them to think about and observe dispositions that can facilitate the discussion, such as the two dispositions mentioned above. During the tutorials, comments are also made that relate to proper or improper dispositions. It is to be hoped that some seeds sown in ways such as these will finally grow into a big tree.

Critical Thinking in a Specific Subject

Many teachers say that they would like their students to think more critically in their own subjects. Can having students take general CT courses assist them in achieving this purpose? The answer is not a simple yes or no. General CT courses can, if conducted successfully, at least make students more aware of CT and give them some general training in it so that, to a certain extent, their ability to think critically in a specific subject may improve. However, the extent of the assistance that is required may vary enormously

from course to course, from student to student, and from subject to subject. Because of this, CT educators would like to develop more effective ways to better achieve that purpose. Here, I introduce some relevant issues and studies on the subject, with the hope of arousing awareness and interest among teachers in promoting CT education in their own subjects.

How subject-specific is CT?¹¹ Is CT in psychology similar to CT in physiology? What about physics and phonetics? In view of the very diverse nature of different subjects, one may be or should be skeptical about any general attempts to analyze the notion “CT in X” for any subject X. At the same time, fruitful attempts of this kind can give us valuable insights on the teaching of CT in a specific subject. There are works of this kind. Here, I examine the work of Nosich (2005), *Learning to think things through: A guide to critical thinking across the curriculum*. The titles of several exemplary chapters or sections hint at the book’s character: “The Parts of Critical Thinking within a Field,” “Thinking Biologically, Thinking Sociologically, Thinking Philosophically, Thinking Musically . . .,” “The Logic of the Field or Discipline,” “Impediments to Thinking Critically within a Discipline,” and so on.

In brief, the book uses the following framework. It identifies a “core process of CT in a discipline,” which may be characterized by this sentence: *To think through a question, using the elements, with the standards in mind, and in terms of the discipline*. “Elements” here means “elements of reasoning.” The idea is that “[u]ltimately, we can display the *logic of a field* by analyzing it in terms of the *elements of reasoning*” (Nosich, 2005, p. 98; former italics

11 See Ennis (1989) and McPeck (1990) for some clarification and discussion on the notion of subject specificity in the context of CT.

mine) and that “[t]hinking critically in a field is getting hold of the logic of that field” (p. 96). Elements of reasoning include, for instance, identifying assumptions, the question at issue, the implications and consequences, the point of view, and the purpose. When examining a theory in a discipline, one may ask, *critically*, “What *assumptions* is this theory making?” On the other hand, “standards” means some commonly recognized standards of CT, like those expressed by these adjectives: clear, accurate, important, relevant, sufficient, deep, broad, and precise. With these standards in mind, a follow-up CT question can be “Are the assumptions that have been made *accurate*?” Lastly, “in terms of the discipline” means, of course, that one is engaged in CT within that discipline — the discipline is a lens through which one looks at (reasons about) the world. Nosich has raised three common related ways through which a discipline can take effect: by asking central questions of the discipline, by doing an analysis through its points of view, and by applying its fundamental and powerful concepts for analysis. If the discipline is, say, sociology, the foregoing question may be modified as, “Has the theory made accurate assumptions, *in terms of what we know about social patterns*?”¹²

Effective testing or measuring of the results of learning is an essential component of curriculum design. How should CT learning results be tested or measured, whether in general or within a discipline? Among the available specially designed tests or measures for CT, some have been designed with close reference to the APA Delphi Report and can be accessed through the Internet.¹³ Some exemplary titles are: “The California Critical Thinking

12 In addition to the core process of CT in a discipline, Nosich has also discussed additional CT processes that make use of the results of the core process, including evaluation, application, action, comparison and contrast, decision making, living mindfully, and others.

13 <http://www.insightassessment.com/home.html>.

Skills Test,” “California Critical Thinking Disposition Inventory,” “Business Reasoning Test,” “Business Attitude Inventory,” “Health Sciences Reasoning Test,” “Legal Studies Reasoning Profile,” and so on.¹⁴ These tests are not only limited to skill testing but also disposition testing, in response to the emphasis on both skill training and disposition cultivation in the APA Delphi Report.¹⁵

After briefly introducing two central issues, we turn to two works that deal with CT for a specific subject. The first subject is law and the work in question is Waller (2005), *Critical thinking: Consider the verdict*. Two exemplary chapters or sections are “The Burden of Proof in the Courtroom” and “Consider Your Verdict: Comprehensive Critical Thinking in the Jury Room.” There are also many exercises called “Consider the Verdict” or “How Do You Rule?”, which make use of real court cases to test a person’s understanding of CT concepts. A prominent feature of the work is simply the teaching of CT in law with reference to real court cases or law-related concepts. If we are to use Nosich’s framework sketched above to interpret this book, we may think of it as applying the core process of CT to make further judgments or decisions about real court cases. An example of a case is given below, involving some law-related or CT concepts such as “the burden of proof,” “the presumption of innocence,” and “the fallacy of the appeal to ignorance.”

The case happened in 2002 in Pennsylvania, and is described as follows in Waller (2005, p. 60):

14 These tests have been translated into various languages, and two of the tests have been translated into Chinese.

15 Sample CT skills questions can be accessed through: <http://www.insightassessment.com/9SampleTest1.html>; sample questions on CT dispositions: <http://www.insightassessment.com/9Sample%20Test2.html>.

Jennie Collins was charged with driving under the influence of a controlled substance, and a jury found her guilty. In her defense, Jennie had agreed that she was driving under the influence, but argued that her intoxication was involuntary. The judge instructed the jury that the burden of proving *involuntary* intoxication rested on the defendant, and that she had to prove by a preponderance of the evidence that her intoxication was involuntary. (She was *not* required to prove *beyond a reasonable doubt* that her intoxication was involuntary; but the judge ruled that she still had the burden of proof of establishing involuntary intoxication by a *preponderance* of the evidence. That is, she must convince the jury that it is *more likely than not* that her intoxication was involuntary; the prosecution must prove that she operated a vehicle while intoxicated, but does *not* have to prove that her intoxication was voluntary.)

The jury returned a verdict of guilty. Jennie Collins appealed her conviction, arguing that the trial judge erred in his instructions, that her presumption of innocence was violated, and that the burden of proving *voluntary* intoxication should rest on the prosecution.

Finally, the question is put forth: “As an Appeals Court Judge, the case now comes to you. How would you rule?”

Sternberg, Roediger III and Halpern (2007), *Critical thinking in psychology*, is a psychologically oriented “introductory text on critical thinking for upper-level undergraduates and graduate students” (p. i). Sample chapters include, “The Nature and Nurture of Critical Thinking,” “Critical Thinking in Quasi-Experimentation,” “Critical Thinking in Designing and

Analyzing Research,” and “Critical Thinking in Clinical Inference.” As revealed in this list, one of its prominent features is the teaching of CT in psychology with respect to a wide range of psychological topics.

It also illustrates a “psychological approach” of teaching CT *in general*. Very roughly speaking, under the usual “logical approach,” logical principles are taught; while under a psychological approach, topics like “cognitive biases” are taught. An example of cognitive biases discussed in the book is “Thinking with Numbers” (p. 3), which is concerned with the notorious “anchoring effect.” These two approaches may also be distinguished by appealing to the reason/cause distinction. The logical approach is concerned with reason — the principles of logical reasoning; while a psychological approach is concerned with cause — the psychological causes of judgment. For instance, when a fallacy like hasty generalization is taught, the logical approach will explain that the principles of reasoning — namely, some principles of inductive logic — were violated in hasty generalization, hence identifying a fallacy. However, even though someone might know very well the reasoning behind a hasty generalization, that person might find it difficult to resist committing the fallacy in daily life. As a matter of fact, it is not difficult to observe people committing trivial fallacies again and again as a daily routine. But why would they do so? The key point to note is that the (perhaps simple) logical reason behind a fallacy is one thing, while the (perhaps irresistible) psychological cause of it is another. A psychological approach aims at studying the psychological cause behind the committing of a fallacy so that psychological remedy may be suggested. Moreover, since there may be causes other than psychological ones (e.g., cultural or sociological),

there may be still other approaches to teaching CT. But it should be noted that the logical approach is the core and necessary part, which provides the reason guiding the direction of other causal approaches.

Concluding Remarks

The main title of this essay indicates that the intention was to forge some linkages between education and thinking. We started with a very rough sketch of how liberal education is built upon general education and how general education in turn rests upon CT. The main body of the essay was an attempt to conduct an elementary examination of this cornerstone of CT, through the exposition and clarification of basic concepts, a report and discussion of personal experiences, an introduction and analysis of reference works on the subject, and so on.

Let us emphasize these linkages once again: For CT scholars or experts, I hope that this essay will arouse their interest in joining the discussion for the purpose of improving education; for teachers of any subject, it is to be hoped that this essay will give them some ideas or stimulate their own ideas on promoting CT education in their own discipline; for general readers, the hope is that it will help them to appreciate the relevance of the development of CT to education in general or their self-education in particular.

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