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The transferability of higher order cognitive skills

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Abstract

An assumption of this paper is that successful adaptation to the complex and rapidly changing world of the future requires an education that places great emphasis on the development of higher order cognitive skills, especially critical and creative thinking skills. This approach to education makes sense only if such skills are transferable, both from one discipline to another, and to work and life situations. This paper claims that such skills will be transferable if certain conditions about curriculum design and reinforcement are met, and goes on to outline the nature of these conditions.

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1. Introduction

It is widely recognized today that advances in technology have created rapid changes not only in society and in our personal lives, but perhaps most noticeably in the workplace. In America, for example, low skill manufacturing jobs are rapidly disappearing and being replaced by a demand for workers who have developed high levels of cognitive skills. As important as they are in the workplace, such skills are also important for countries to remain competitive with others and for citizens to participate effectively in democratic societies. Perhaps most importantly, being able to think critically and creatively is necessary in this rapidly changing, complex, information overloaded world, for individuals to live happy and successful lives as rational human beings.

Most American colleges and universities have acknowledged that they need to do a better job in developing these skills in their graduates, especially when en masse college education is the norm. Many have required that students take a course in Critical Thinking, for example, a course that usually focuses on general reasoning skills that are assumed to be transferable across disciplines and in everyday life and work. But are they? There seems to

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be some evidence that thinking skills can be developed only in domain specific areas and that such thinking is not transferable to other disciples, let alone to everyday and workplace life. If this is true, then educating students to be critical and creative thinkers in general seems to be misguided. If we cannot carry over the thinking skills developed in one course to another, let alone transfer these skills to everyday life, then the entire liberal educational enterprise of educating people to be rational human beings in general seems to be misguided.

1.1. What Are Higher Order Thinking Skills?

Before addressing the question of transferability there is some preliminary work to be accomplished. Let us begin to attempt to solve this problem by deciding on what we mean by higher order cognitive skills. First, “higher order” should be distinguished from “lower” or “middle level” thinking skills. These latter are skills presupposed by higher order ones, such as reading and writing, being able to organize and the like. Next, because of time constraints, this paper will focus on the higher order cognitive skills usually called critical thinking skills and discuss creative thinking only briefly, even though a case may be made that creative thinking may perhaps our highest cognitive ability. One of the problems encountered in discussing critical thinking skills is that there are many different ideas of what they are.

The most detailed and accurate lists of critical thinking skills are usually developed from an academic perspective. The American Philosophical Association has developed one of the most important and influential lists of critical thinking skills. A consensus of 46 experts in critical thinking from various fields developed the following list of six core critical thinking skills (Facione, *The Delphi Report*, 1990). It is worth examining briefly how each item is described in the report.

- **Inference:** “to identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to educate the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation.”

- **Explanation:** “being able to present in a cogent and coherent way the results of one’s reasoning. This means to be able to give someone a full look at the big picture: both “to state and to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological, and contextual considerations upon which one’s results were based; and to present one’s reasoning in the form of cogent arguments.”

- **Evaluation:** “to assess the credibility of statements or other representations which are accounts or descriptions of a person’s perception, experience, situation, judgment, belief, or opinion; and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions or other forms of representation.”

- **Self-Regulation:** “self-consciously to monitor one’s cognitive activities, the elements used in those activities, and the results educed, particularly by applying skills in analysis, and evaluation to one’s own inferential judgments with a view toward questioning, confirming, validating, or correcting either one’s reasoning or one’s results.

- **Interpretation:** “to comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria.”

- **Analysis:** “to identify the intended and actual inferential relationships among statements, questions, concepts, descriptions, or other forms of representation intended to express belief, judgment, experiences, reasons, information, or opinions.”

While this list is quite comprehensive it is more helpful to focus on its central elements and to arrange them into a problem solving format. After all, very few of us think at all unless there is some problem to solve, something to figure out. We seem to be creatures of habit more than thought, and for most of us it is only when habits break down and our usual routines no longer work, that we have to think up new answers to questions or new ways of acting. One such format is loosely based on the approach of the National Council for Excellence in Critical Thinking. It contains the following elements:

- Identify the problem
• Clarify basic concepts
• Formulate the problem
• Formulate possible solutions
• Gather information
• Recognize assumptions
• Defend possible solutions
• Form a reasoned judgment
• Examine consequences

Most of the core critical thinking skills described in the Delphi report are listed here. Many of these skills are also those that the widely used Watson/Glazer critical thinking test has singled out as representing essential critical thinking skills, such as inference, recognizing assumptions, deduction, interpretation and evaluation of arguments. It should be noted that creative thinking finds its home in this schema especially under “propose possible solutions”. It should further be noted that this type of thinking is not exclusively “philosophical” thinking, but is quite closely related to the type of thinking that goes on in science, the law and in everyday life. There will be more on that later.

1.2. Can Higher Order Thinking Skills Be Taught?

There are some who believe that people who exhibit high levels of problem solving skills in more than one area simply have a higher level of intelligence than others, which enables them to figure out quickly how to solve problems in various areas. According to this view, thinking skills are like athletic skills, they can be nurtured but teaching cannot create them. Others believe that thinking skills can be taught, but only by an apprenticeship method. You learn to think like a philosopher, for example, by reading lots of philosophy, taking lots of philosophy courses, writing lots of philosophy papers, getting an advanced degree in philosophy, and so on. It takes a long time, but eventually spending lots of time with philosophy and philosophers produces a philosophical mind. Unfortunately, such cognitive skills apply only to philosophy and not other domains, just as a carpenter’s skills do not make a good plumber.

While some believe that traditional classroom teaching methods cannot produce critical thinkers, others believe that such skills may be acquired by teaching, but are quickly lost when not used consistently. The reason for this is that much of our decision making is intuitive and not logical. Cognitive scientists have discovered a number of what they refer to as “cognitive heuristics” which are employed on this level of thinking. Cognitive heuristics may be understood as a type of mental shortcut. While these served our hunter-gatherer ancestors well, and continue to serve us well in some especially familiar areas that require quick decisions, they can also be obstacles to rational thought. They can be cognitive biases.

Cognitive biases can be especially troublesome because we are usually not aware of them. They guide our problem solving and decision making along the paths of least resistance if we allow them to do so. Some examples include the following (Novella, 2012). Anchoring is a tendency to focus disproportionately on one feature of a situation and base our judgment only on that. Marketers often use this tendency to convince us to buy their product, otherwise indistinguishable from others, by pointing out some one feature. Buy our toothpaste because it whitens your teeth,” is an example. Anecdotal reasoning counts personal experiences as more important than scientific studies. For example, someone refusing to believe that smoking causes lung cancer because they know someone who smoked for years and did not develop lung cancer would be guilty of using this heuristic inappropriately. Availability heuristics consider an event to be more likely if it is accompanied by a personal story or an emotional experience. If a rouge wave swamps my sailboat on an otherwise clear day, I may come to believe that this event is likely to occur each time I sail—even in fair weather. Various confirmation biases lead us to rate evidence or beliefs as more likely to be true the more we are familiar with them or the more they confirm our previous beliefs, or the more we have invested in them being true. We think of scientific studies, for example, as more likely to be true the more we agree with their conclusions.

There are many other examples of powerful cognitive heuristics that may serve us well some times, but lead us astray at others. While they may seem like common sense, and while they work much of time in our daily lives, they are often not sufficient guides for solving new problems in this complex, changing world. If thinking skills are to be taught we must be aware of our cognitive heuristics and be able to evaluate when they do and when they do not lead
to correct conclusions. Part of learning to think critically is learning when our natural habits of thinking, wired in by evolution, are serving us well or not. The point for now is that they can serve as obstacles to teaching and retaining critical thinking skills. Because critical thinking is hard work, and because our heuristics bypass this work, most would rather follow their cognitive biases than engage in critical thinking. As Bertrand Russell famously pointed out: “Most people would rather die than think; in fact they do.”

1.3. Can Higher Order Cognitive Skills Be Transferred?

For now we will simply assume that we can be taught to overcome our cognitive biases and turn to the main question of this paper, whether or not critical thinking skills can be transferred from one domain to another. The fact that when we think we have to think about something has led some to the conclusion that higher order thinking skills are specific to a particular subject matter. According to this view, there are no general critical thinking skills, only critical thinking within a domain specific area. Thinking like a philosopher is not the same as thinking like a lawyer; thinking like a lawyer is different from thinking like a scientist; this in turn is different from solving problems in everyday life. The difference is not just in what it is that is thought about, but also in the types of thinking skills required. The skills required to gather evidence in a biology lab, for example, are not at all like those required by a lawyer or a philosopher when they search for evidence to support their conclusions. According to this view there are no domain independent critical thinking skills that get applied to various disciples and to daily life. Just as “expert systems”—computer programs created to do specific jobs such as scheduling airlines or making medical diagnoses—are domain specific, so are our critical thinking skills. No more than a medical diagnosis program could be used successfully to schedule airline travel, can our thinking skills developed in a history course be used successfully to solve philosophical problems, let alone problems in daily life.

According to an extreme view of this type even reading comprehension skills are domain specific. Being able to understand what you read in one area does not mean you will understand what you read in another area. The key to reading comprehension and interpretation seems to be familiarity with the subject matter. If you can read and you are familiar with sports you will understand written material about sports. If you are not familiar with philosophy, you will fail to understand Descartes’ Meditations. In general, the subject matter you are thinking about determines the type of thinking skills employed. If these vary from subject to subject then it makes no sense to talk about general critical thinking skills that can be taught independently of a particular subject. Moreover, if there are no domain independent thinking skills, then talking about transferring thinking skills from one discipline to another and to daily life makes no sense either. But is this not the point of a liberal education, to teach us how to think critically and to use these skills in our work, our society and in our everyday lives?

The case that higher order thinking skills are not transferable rests especially on the belief that thinking skills vary from one domain to another. While there seems to be a great deal in common between playing chess, for example, and military strategy, there is no indication that even an expert chess player’s thinking skills will make him or her a good military strategist (Perkins, 1989). The same problem of transferability is true between any domains. This is not just because, for example, philosophy and biology have different content. This is important, to be sure. Solving problems in any field requires a great deal of knowledge about the domain. You have to know a lot about a cells’ structure and function, as well as many other biological phenomena, to solve problems about how DNA molecules replicate. But it is about more than just content; it is also, and especially, about the epistemological standards employed in the domain. It is about, that is, the very model of acquiring knowledge employed in the domain, and the particular model of thinking that is used to solve its problems.

The domain specific view of critical thinking, the view that denies the transferability of thinking skills from one domain to another, believes that epistemological relativism is true. It holds the view that each domain has its own ways of solving problems that vary from discipline to discipline. It denies that there are any universal laws of thought that are employed, with appropriate content variations, to all thinking. To think like a historian, for example, you have to know a lot about history, but you also have to know a lot about how historians gather information, draw inferences, consider implications and so on. Knowing how philosophers do this will not help a bit in your study of history, just as knowing how to play chess will not help you to win military battles.

I believe that there is something to this view that thinking requires a subject matter and that solving problems in a domain requires a rich knowledge base, a great deal of specific knowledge about a field. There is also something to the claim that many thinking skills vary from one domain to another. Forming hypotheses in astrophysics, for example, seems to be quite a different process from proposing possible solutions to philosophical problems or
getting a hunch in our everyday lives, for example, about the best way to lose weight. However, it is a mighty inferential leap from this to the claim that thinking critically in one domain has nothing in common with the sort of thinking that goes on in another. While critical thinking skills may be best honed in a specific context, either by intentional instruction or by the apprentice method, the most important ones—the ones listed earlier in our general definition of critical thinking skills—are not relative to specific domains.

This can be seen when experts face unfamiliar problems, when their routine cognitive heuristics break down. In these situations people who are true critical thinkers routinely employ problem solving skills learned in other contexts to solve their problems about why their routine, domain specific problems solving schemata have broken down. The key to being able to perform this type of transfer of thinking skills seems to be how higher order skills were acquired in the first place. If I learn to think like a philosopher by studying lots of philosophy and acquiring the habits and methods of philosophical thinking—the apprentice method—then I am less likely to be able to transfer this thinking to other domains. If, on the other hand, I learn to think critically in an intentional way, being conscious of the thinking skills being employed, then I am more likely to understand and utilize these skills in other areas as well—to transfer them to other domains. In other words, if I not only think critically but also think about thinking critically, then I have a better chance of decontextualizing thinking skills learned in specific domains and transferring them to others. The term for this is metacognition.

The well know American baseball player, Yogi Berra, once famously said, “When you come to a fork in the road, take it!” If we agree that teaching higher order thinking skills ought to be an educational priority, then our fork in the pedagogical road is to teach critical thinking in domain specific ways, as in history, math, biology and so on, or in domain independent ways, such as in critical thinking courses usually offered by philosophy departments. It seems clear that we need to do both. It is difficult to see how we could avoid teaching critical thinking skills on the K-12 level in any but domain specific ways. The real task is to promote teaching for the development of thinking skills in the first place, making thinking and not memorizing facts the main educational goal. Teaching students to think in domain specific ways will tap into the concrete learning styles of younger students as well, making it a more effective way for them to learn how to think.

In higher education as well, thinking skills need to be taught in domain specific ways. If we are intentionally going to teach our students how to think critically, to be effective problem solvers and good decision makers, it should start within courses that have a specific subject matter. We should not teach history as a collection of facts, but rather we should teach students how to think like historians when historians are thinking well. The same should be the goal for all disciplines. A truly liberal arts education will teach us how to think like scientists, like philosophers, like mathematicians and humanists. In addition, however, it will teach us to think in general, so that we may apply our reason to a whole range of problems that have yet to arise within various domains and in daily life. Achieving this goal is possible, but it will take dramatic changes in curriculum design.

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Here are some suggestions to guide such a curriculum design. First, as a pilot program, develop a cluster of courses in various domains that would be taught less as lecture courses and more as problem solving courses. Start, for example, with courses in history, social science, biology, psychology, math and literature. Each will be designed to promote critical thinking in its own specific domain. Next, a course in critical thinking offered by the philosophy department should be added to the mix. This course will have two goals. First it will teach students general critical thinking skills, utilizing everyday contexts for practicing these skills. Next, it will develop a common metacognitive language to be utilized in all related courses. Students who take this course and other courses in the interdisciplinary cluster will refer to this language as they practice various skills. So information gathering in the various courses, for example, will be labeled as such, as will conceptual clarification, forming and testing hypotheses, and so on through the list of critical thinking skills. In this way students will become conscious of their thinking skills and how they work to think through the content of various domains. Throughout there will be a need for instructors to work together to demonstrate to students how thinking in one course relates to thinking in others and to the everyday world. It will take this type of instruction for students to be able to transfer thinking skills from one domain to another and to daily life.

It is quite clear to me that the patterns of problem solving are quite closely related in science, philosophy, the law and everyday life. Generalized, this problem solving pattern is the one we identified earlier with critical thinking. If students are taught a metacognitive language and taught to reflect upon various thinking skills as they are used in
different domains, they will develop an awareness of this pattern of thinking, and develop the habit of using it in various domains. This is important, because it is not so much the particular skills, but the habit of using them that will transfer. If students use them over and over again, in a self-conscious manner and in various contexts, the disposition to use them when confronted with a problem in any area will take hold. If there is a regular, conscious employment of higher order thinking skills, cognitive biases will be seen for what they are and more often than not avoided and replaced with habits of critical thinking, habits that students will carry with them throughout their lives. As a result, liberal education will get closer to what it should be--less about memorizing facts and more about educating the mind.

References


National Council For Excellence in Critical Thinking (www.criticalthinking.org/national)
