

A Critical Review of Gardenian Disciplinary Thinking: Disciplinary in the International Baccalaureate's Theory of Knowledge Course

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Abstract Students and teachers often have differing – and sometimes conflicting- perceptions of the aims of the International Baccalaureate's Theory of Knowledge (ToK) course. In an attempt to demystify ToK, I explore the extent to which Gardenian Disciplinary Thinking (GDT) can be used as a lens through which to view and understand the intentions of the course. I suggest that, in general, ToK aims to encourage GDT. That aim is achieved by facilitating: 1) A domain-specific approach to critical thinking; and 2) A focus on second-order knowledge. Both of those practices are essential for performing GDT. Before looking at its applications in ToK, I critically review GDT via three themes: globalisation, domain-based critical thinking and meaningful learning. To position the principles that underly GDT, I compare GDT to trans-disciplinarity, a practice often placed in opposition to disciplinarity. Ultimately, I show that GDT can provide possibilities for achieving some of the aims of ToK despite the weaknesses of Gardenian Disciplinarity.

Keywords: IB, Theory of Knowledge, disciplinarity, critical thinking, 21st-century skills

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1. Introduction

In his elaboration of what a disciplined mind entails, Gardner [1] plays on two meanings of "discipline". In the first instance, Gardner characterizes a disciplined mind as one that is capable of thinking appropriately for a scholarly discipline. The second meaning of the "discipline" refers to the extent to which a learner "has acquired the habits that allow her to make steady and essentially unending progress in the mastery of a skill, craft, or body of knowledge" [1], p. 48]. Here, I will critique the disciplined mind only concerning the former definition of discipline. The disciplined mind will now be explained so to provide context for its critique.

Howard Gardner – a psychologist, educator, researcher, social scientist, among other things – is arguably most famous for his iconoclastic views on intelligence. In his theory of multiple intelligences (MI), Gardner posits that all learners possess a profile of autonomous cognitive abilities, each of which is called an "intelligence" [2]. An arguably lesser-known theory developed by Gardner is that of the Five Minds of the Future (FMF), published in his 2006 book of the same name.

Five Minds for the Future reads as Gardner's treatise on invaluable future competencies, as he elaborates what he perceives as "the kinds of minds that people will need if

they...are to thrive in the world during the eras to come". [1], p. 10]. Minds, as he calls them, is used synonymously with "uses of the mind" [1], p. 13] and "mental dispositions" [1], p. 29]. FMF, therefore, could be described as a taxonomy of mental dispositions that are and will continue to be at a premium for learners in the twenty-first century and beyond. The importance of Gardner's brand of future competencies can be seen in the International Baccalaureate's Theory of Knowledge course (TOK); a course that focuses on epistemology and critical thinking. In some respects, TOK can be seen as an outcropping of Gardner's perceptions of future competencies, particularly his notions of disciplinary thinking.

According to Gardner, the disciplined mind thinks in a manner apposite for the discipline under study; it focuses on how knowledge is created in the discipline. In mathematics, for instance, a disciplined mind may realize the role of the mathematician as one who may inductively arrive at general principles after observing the behaviour of a phenomenon that has a mathematical basis. A disciplined mind in history may realize the role of the historian as one who critically analyzes primary and secondary sources to construct a narrative consistent with an event being studied. The degree to which a learner can perform this type of disciplinary thinking with accuracy and efficiency may be an indicator of how advanced a learner is with this mind. In contrast to a focus on

memorizing subject matter [3,4], Gardner believes that the disciplined mind realizes that the twenty-first-century student must do more than merely memorize subject matter in order to be successful, learned, and employable. Criticisms of this view of learning will be discussed in this paper.

Gardner also believes that thinking within a discipline has two components: an epistemologically first-order component and epistemologically second-order component. The first order component is concerned with disciplinary facts. The second-order component is concerned with the nature of the discipline itself and the discipline-specific processes by which disciplinary facts are manipulated to construct knowledge. He posits a focus on the second-order component as disciplinary thinking. This perception of disciplinary thinking is similar to Moore's [5] notion of disciplinary thinking. Gardner's "subject matter" seems to be coterminous with what Moore calls "objects of inquiry"; and Gardner's "discipline" is similar to what Moore calls "content of inquiry". Moore elaborates objects of inquiry as that which learners think about within the discipline, and the content of inquiry is the method by which the thinking is done. Like Gardner, Moore separates thinking within a discipline into two epistemological components. The distinction between a focus on first-order knowledge and a focus on second-order knowledge has necessary implications for learning and learners; this will be discussed at length in subsequent sections of this paper.

GDT, then, is the practice of viewing the world from the perspective of a thinker in a specific discipline. It has two key characteristics: 1) a domain-specific approach to critical thinking and 2) a focus on second-order knowledge within a discipline.

2. A Critical Review of Gardenian Disciplinary Thinking

2.1. Comparing and Contrasting GDT and Trans-disciplinarity

Disciplinarity in general – and GDT specifically – offers only one perspective of the role of academic disciplines in schooling. Trans-disciplinarity, as espoused by Osborne [6], Jessop and Sum [7], Becher [8] and others, is often characterized as the antithetic alternative to disciplinarity. It will be shown that disciplinarity and trans-disciplinarity offer different but somewhat complementary perspectives on how to address contemporary problems; and that the dilemma between disciplinarity and trans-disciplinarity is a false one.

In defense of disciplinary thinking as a valuable future competence, Gardner traces the origins of schooling, underscoring that, before the Renaissance, a student's competence would have been measured in terms of her ability to memorize prescribed texts. Says Gardner, "Instead of being asked to understand and apply, the apt student would repeat...the wisdom of the intellectual ancestors: Confucius or Mencius in the East; Aristotle or Aquinas in the West" [11], p. 34]. Gardner argues that, for the most part, extant schooling is a legacy of

pre-Renaissance ideas of learning. Trilling and Fadel [9] also notice that current schooling retains many traits of former ages; education systems retain an agrarian calendar, an industrial time clock, and curriculum subjects that originated in the Middle Ages. The Renaissance engendered a shift toward professional education insofar as, within the past century, schools tailored toward preparing students to work within specific fields – law schools, business schools, culinary schools, among other things – have flourished. Although value is still placed on the acquisition of some general skills and knowledge – à la the pre-Renaissance era – there appears to be an accretion in the value of schooling in preparation for a specific profession.

The last century has also seen the mushrooming of real-world problems that are "complex" [10], p. 249] in nature. Barnett uses 'complex' to describe phenomena where the components are difficult to distinguish because the interactions among those components are "unclear, uncertain and unpredictable". He illustrates the nature of many contemporary problems with the following description:

"It is not just that situations may be captured by an image of intertwined spaghetti strands such that their patterns are indeterminable; it is that the spaghetti strands are so interwoven that any attempt to engage with any one strand will have repercussive and unforeseeable impacts on many, if not all, of the other strands" (p. 249).

Therefore, on the one hand, there's an increase in professional education, and, on the other hand, there is a preponderance of complex problems that resist disciplinarity or other forms of compartmentalization.

If Gardner's ideas are to be pursued as a possible solution to the problems mentioned above, lines of demarcation between disciplines are needed in order to 'untangle' the interaction among disciplines. Such an approach is problematic, however, as it assumes that there exist clear boundaries that enclose and distinguish disciplines. Gardenian disciplinarity might, therefore, be in tension with the trans-disciplinary school of thought that maintains that knowledge should be organized in terms of its ability to solve particular problems [11] instead of by way of a collection of cultural and methodological norms used to form orthodox academic disciplines [8]. Hence, a trans-disciplinary solution to 'complex' problems may be found in an ad hoc amalgam of methodologies that best benefit those problems [7]. That approach contrasts with a disciplinary approach to problem-solving which invariably involves using a finite set of discipline-based methodologies that ultimately may not be suitable for addressing the problem; in that respect, the boundaries that delimit disciplines may also limit problem-solvers.

Fidelity to specific methodologies – as is done in traditional academic disciplines – puts the learner at risk of promoting what [7] call "methodological imperialism" (p.5), where disciplinarians tend to interpret all phenomena via the go-to methodologies of disciplines indiscriminately. Nobel-prize-winning economist Richard Thaler acknowledges and disavows an instance of methodological imperialism in economics where it was common to erroneously attribute all human behaviour to

human rationality [12]. Trans-disciplinarity may guard against such practices.

Despite the forces arrayed against their union, GDT and trans-disciplinary thinking can coexist as valid problem-solving methodologies: Whilst there are some contemporary problems that are best addressed by ignoring disciplinary boundaries [6], conceptual innovation at the disciplinary level is often the wellspring of trans-disciplinary progress [13]. Shinn [11] argues that many of the trans-disciplinary breakthroughs that are alleged to be divergent to the discipline of science, for example, may be inspired by disciplinary developments or even built into science's framework. Thus, the relationship between disciplinarity and trans-disciplinarity is best seen as complementary rather than dichotomous.

Both trans-disciplinarity and disciplinarity are needed to provide the type of differentiation that is needed for social progress. Trans-disciplinarity with its focus on instrumental knowledge is frequently associated with skill-based curricula, whereas disciplinarity is often associated with more academically oriented curricula. Within trans-disciplinary curricula, the learner's "know-how" is prioritized, and disciplinary curricula privileges the learner's "know what" [14]. Muller [13] contends that conflating skill-based curricula with knowledge-based curricula or supplanting one with the other is tantamount to equating vocational and more academically-oriented training, a process he calls de-differentiation. Both the vocational training associated with trans-disciplinarity and the academically oriented training associated with disciplinarity are needed in varying degrees in any society. It could even be argued that there are instances in which vocational and academic training are inexorably linked and other instances in which one supplements the other. Therefore, disciplinarity does not necessarily exist at the expense of trans-disciplinarity or vice versa.

2.2. Gardenian Disciplinary Thinking and Globalization

Gardenian disciplinary thinking has attracted criticism aimed at Gardner's rationale for suggesting FMF. Gardner rationalizes disciplinary thinking – and the four other Minds for the Future – as a means of meeting the demands of an increasingly globalized world. While providing the anthropological background for FMF, Gardner says, "it is virtually inconceivable" (p. 27) that the four major trends in globalization – the movement of capital across the globe, the movement of human beings across borders, the movement of information through cyberspace, and the movement of popular culture – will be permanently stemmed. It could be argued that this is a rather fatalist view of globalization and suggests that Gardner is discounting the power of schooling to arrest some aspects of globalization. Indeed, Pava [15] wonders whether "education itself [might] serve a necessary and critical function in opposition to the excesses of globalization" (p. 288). Thus, despite the anthropological antecedents that seem to necessitate GDT, learners need not respond by yielding to the forces at work. The aim of learning is not to assuage the uncertainty that inheres in a practically unknowable future; instead, learning equips students to live comfortably with that uncertainty.

In using globalization as the motivation for disciplinary thinking, Gardner seems to suggest that schooling supply the demands of the knowledge economy or the knowledge-based economy [16,17]. At the heart of the knowledge, the economy is the notion that "knowledge is the primary resource for individuals and the economy overall" [[16], p. 95]. Knowledge, therefore, can be seen as a commodity supplied by educational institutions; and, as a commodity, demand is driven by the consumers of the commodity. The IBO [18] accedes to that demand, explaining its focus on 21st-century skills by citing Trilling and Fadel's [9] research on the needs of contemporary employers. Thus, the IBO, like Drucker [16] believe that employers create the demand for specific types of knowledge, and consequently influence what is taught and learned. Gardner, then, is suggesting that the knowledge economy – and, indirectly, contemporary employers – necessitates disciplinarity. That perspective contends with that [13], [11] and [19] – to name a few – who argue that it is the intrinsic value of knowledge lends legitimacy to disciplinarity, as opposed to its instrumental value as goods in the knowledge economy. That is, while Gardner suggests that disciplinarity is necessitated by its ability to support globalization, other disciplinarians posit that disciplinarity is predicated on the value of knowledge for its own sake as opposed to its practicality. Moreover, a need-based approach to scholarship is "inimical to basic, conceptual, traditional scholarship" [[19], p. 128]. That practice also restricts the academic freedom afforded by disciplinarity to pursue so-called 'blue skies research' wherein the real-world relevance is not immediately apparent.

2.3. Linking Critical Thinking and Disciplinary Thinking

A panoply of research addresses the importance of critical thinking [20,21,22]. Albeit there is general agreement that this skill is essential, there are differing opinions about how critical thinking should be characterized. Some researchers believe in the generalizability of critical thinking [20]. Proponents of that type of critical thinking posit that "critical thinking" subsumes a finite set of transdisciplinary thinking skills that are deployed equivalently to all disciplines. This view contrasts that of McPeck [23], who contends that to speak of critical thinking generally is to ignore the domain-specific types of thinking that may be required of a learner. Further to Gardner's ideas about disciplinary thinking, McPeck believes that the type of critical thinking that is required in the arts is different from that required in, say, mathematics.

Moore [5] agrees, suggesting that "the development of students' critical abilities is always best pursued within the context of their study within the disciplines" (p.263). In a study of educators in the disciplines of philosophy, history, and literary studies, Moore found that educators describe in markedly different ways the type of critical thinking required of learners in their discipline of expertise. While all the informants in the study identified being "critical" as an essential part of critical thinking – arguably a truism – they differ in how they believe critical thinking can and should be instantiated. A history

professor in the sample believed that learners must be able to evaluate and synthesize the arguments of secondary and primary sources in order to form a compelling narrative. This approach contrasts with the philosophy professor's belief that learners should be able to "judge" arguments, focusing on the degree to which they are fallacious. It can be appreciated that the putative mode of critical thinking done by the historian may include elements of the philosopher's typical mode of critical thinking, indicating areas of overlap. However, the student of philosophy is not usually overly concerned with constructing narratives, indicating areas of divergence concerning what is classified as critical thinking among disciplines. The argument for generalizability of critical thinking, then, albeit accounting for some areas of overlap, will neglect the nuances that distinguish critical thinking among disciplines. A disciplinary approach to critical thinking may give a better representation of how learners in a discipline think critically. Put more succinctly, answers to questions such as "how does the artist think critically?" or "how does the social scientist think critically?" may lead to a more real-world-relevant definition of critical thinking. This may be owing to the idiosyncrasies of disciplinary cultures and the nature of the knowledge that academic disciplines usually handle.

2.4. Meaningful Learning within Disciplinary Thinking

From a cognitive perspective, Gardner's explication of "discipline" to comprise more than "subject matter" is promoting meaningful learning processes as opposed to rote learning processes. Gardner argues that many learners "conceive their task as committing to memory a large number of facts, formulas, and figures" [1], p. 36; he defines this process as "studying subject matter". Albeit "rote learning" is not mentioned explicitly, Gardner's characterization of studying subject matter appears similar to Ausubel's [24] description of rote learning processes. During rote learning processes, the learner links new information to her existing cognitive structure in an arbitrary and verbatim manner. Shorn of context, rote learning processes "[do] not result in the acquisition of meanings" [24], p. 4]. Memorizing formulas in science, or dates of specific historical events are examples of rote learning processes.

The ill-effects of a singular focus on rote learning processes are exacerbated when viewed in light of the fact that the human brain is more meaning-driven than information-driven. Correctly, the human brain handles arbitrary information inefficiently compared to how it handles new information that is relatable to existing cognitive structures in a non-arbitrary fashion. Further, despite its expedience, information acquired by rote learning tasks is "highly vulnerable to interference from previously learned and concurrently or retroactively encountered similar materials" [24], p. 4]. Even if a learner manages to acquire and retain some information during rote learning processes, that the information is not linked meaningfully to the learner's cognitive structure increases the likelihood that the learner will unwittingly conflate this information with other similar but confusable information.

The arbitrary nature of the link between new information and the learner's cognitive structure during rote learning processes contrasts with what takes place during meaningful learning processes. During meaningful learning processes, learners focus on relating new information to other relevant ideas in the learner's cognitive structure. When operationalized via GDT, meaningful learning processes may include tasks aimed at linking new information to the learner's extant cognitive structures about the nature of the discipline being studied. For instance, an appropriate sketch of the role of the natural scientist may be as one who observes natural phenomena, hypothesizes about the relationship between the observed entities, and adjusts her hypotheses based on experimentation. Therefore, instead of merely trying to memorize a formula that links force, acceleration and mass, for example, the learner should approach learning the formula in the manner that a scientist would – observe, hypothesize, experiment and adjust [25]. As such, the learner would be acquiring knowledge as a scientist would, while making non-arbitrary links between new information and her cognitive structure.

That said, Tan [26] attempts to dispel the notion that memorization of subject matter is always the antithesis of – or inimical to – learning. He identifies at least two variations of memorization: "mechanical memorization (rote learning with no understanding) and memorization in order to achieve understanding" (p. 130), and Tang [4] observed that the latter could be strongly correlated to deep approaches to learning. Tan [26], like Watkins & Biggs [27], argues that the common practice of posing memorization as uncondusive to meaningful learning is primarily a Western view of memorization. That is, some Eastern learners –especially those of Confucian descent (Chinese, for example)–are more accepting of rote learning and, in many cases, prefer it. Moreover, memorization can buttress deep approaches to learning, contrary to what Gardner posits. Thus, Gardner's equating memorization to lower-order learning may betoken a cultural bias in his notions of learning.

3. Gardenian Disciplinary Thinking in TOK

Despite its fatalist view of globalization and its apparent cultural skew, GDT provides possibilities for fulfilling some of the documented aims of the IBDP's Theory of Knowledge course. Disciplinary thinking has been treated in a relatively abstract manner so far. I will now discuss the extent to which practicing GDT supports the aims of TOK. It will be shown that TOK encourages students to practice Gardenian Disciplinary Thinking insofar as the course:

- 1) encourages a domain-specific approach to critical thinking; and
- 2) focuses on second-order knowledge.

TOK allows students to reflect on the nature of knowledge. This reflection may take the form of identifying and interrogating his or her own personal and ideological assumptions, as well as those made while acquiring and producing knowledge in his or her academic courses. This type of analysis requires a critical approach

to epistemology such that the learner invariably asks, “How do I know this?” when presented with knowledge. It is reasonable to infer, therefore, that critical thinking is the lifeblood of TOK. The IBO [3] maintains that the critical thinking skills acquired in TOK can be transferred to the learner’s subjects in the Diploma Programme. But, as was discussed in a previous section of this paper, a generic approach to critical thinking does little to illuminate the nuances of critical thinking in individual disciplines. Consequently, TOK encourages a discipline-based approach to critical thinking, a hallmark of GDT.

The Theory of Knowledge Guide delineates eight areas of knowledge (AOK). AOK are often used synonymously with “disciplines” and include mathematics, the natural sciences, the human sciences, the arts, history, ethics, religious knowledge systems, and indigenous knowledge systems. In its most recent revision to the TOK Guide, the IB added the use of a “knowledge framework” to compare and contrast knowledge production in AOK. TOK’s knowledge framework is a five-part tool for comparing and contrasting disciplines. The knowledge framework unpacks AOK with respect to their:

1. Scope, motivation and applications;
2. Specific terminology and concepts;
3. Methodology;
4. Key historical developments within the AOK; and
5. Interaction with personal knowledge.

An examination of the knowledge framework as explicated in IB documentation reveals the IB’s – and TOK’s – perspective on knowledge creation within each discipline. It illustrates that there are standard practices within methodologies and that there are also unique practices that distinguish each AOK. Table 1 below shows how TOK applies its knowledge framework to the methodology of three disciplines. The table illustrates that IB documentation emphasizes the disciplinary nature of critical thinking, a key component of Gardenerian disciplinary thinking.

Consequent upon the differences in methodology, there are differences in how critical thinking is done. As can be inferred from the table below, thinking critically about, say, works of art may involve an interrogation of how well they evoke the emotion they intend to evoke. This is radically different to mathematical critical thinking that focuses on the extent to which a mathematical statement can be proven using mathematical methods. The comparison of methodologies and its implications for critical thinking within disciplines exemplifies GDT. As discussed before, GDT requires learners to think in a manner consistent with how knowledge is produced within a particular discipline – thinking as a scientist, artist, or mathematician would. TOK and its use of the knowledge framework facilitates this type of thinking. Thus, the aims of TOK (and the IBO) can be supported by Gardner’s variety of disciplinary thinking as they both share the aims of honing domain-specific critical thinking.

In addition to how knowledge is analyzed within disciplines, TOK also prescribes what knowledge should be analyzed. In TOK, students are required to use “knowledge claims” as they unpack how disciplines go about producing knowledge. Knowledge claims in TOK are statements about knowledge that usually take the form

of a knower saying “I know X”. The IB [28] distinguishes between two types of knowledge claims:

“Claims that are made within particular areas of knowledge or by individual knowers about the world. It is the job of TOK to examine the basis for these first-order claims.

Claims that are made about knowledge. These are the second-order claims made in TOK that are justified using the tools of TOK, which usually involve an examination of the nature of knowledge” (p. 20).

“Mathematical models are used to represent the relationship between variables” is an example of a first-order knowledge claim, and “inductive reasoning is the primary way of knowing in mathematics” is an example of a second-order knowledge claim. The IB further points out which of the two types of knowledge claims is given primacy in TOK: “the second type will constitute the core of any piece of TOK analysis” (p. 20). Specifically, while first-order knowledge claims are used to illustrate instances of knowledge production, second-order knowledge claims are used to analyze knowledge production. Use of second-order knowledge in this manner is characteristic of GDT.

Table 1. Knowledge framework comparison of the methodologies of three areas of knowledge (IBO, 2015)

Discipline/Area of Knowledge	Methodology
Natural Sciences	<ul style="list-style-type: none"> • measurement involves interaction with the world, but this interaction can sometimes change the aspect of the world we are trying to measure • models are important in most areas of the natural sciences • classification is a central idea in many of the natural sciences • among the methods employed by the natural sciences are: hypothesis-deduction and induction—use of reason and sense perception
Human Sciences	<ul style="list-style-type: none"> • uses pure reason from axioms to produce proofs of mathematical theorems • a statement in mathematics is true if and only if it is proved • mathematics does not seem to rely on sense perception of the world • mathematicians require intuition and imagination in order to prove theorems
The arts	<ul style="list-style-type: none"> • artistic creation is often a result of personal knowledge requiring imagination and creativity • creativity requires imagination taking place within a framework, often using reason • art often requires a (possibly emotional) interaction with an audience • relationship between art and technology—new technologies spawn new art forms, for example, film, computer art, computer music

4. Conclusion

Howard Gardner believes that the extent to which a student can think in a disciplined manner is a prized skill in the 21st century. And he theorizes his notions of disciplinary thinking on this basis. He further suggests that the demands of globalization necessitate disciplinarity. This is in sync with what the IBO believes as, they too, suggest that disciplinarity is an invaluable skill for the 21st

century student, necessitated by globalization. When this view of what necessitates disciplinarity is combined with the IB's focus on second-order epistemology and discipline-based critical thinking in TOK, it can be seen that the IB's view of disciplinarity is Gardenian.

That said, Gardener's notions of disciplinarity are not flawless. It would seem that Gardner tries to make disciplinarity superior to trans-disciplinarity but, as was shown, such an enterprise is illusory. Disciplinary thinking and trans-disciplinary thinking are so closely linked that attempts to tease them apart seem destined to fail. What's more is that there is an apparent cultural skew in Gardner's characterization of memorization, as he neglects to account for the extent to which some variants of memorization can lead to meaningful learning, especially for some students of Confucian descent. These criticisms do not significantly diminish the value of GDT as a 21st-century competence; the IBO's arguably unwitting adoption of a Gardenian strand of disciplinarity in TOK lends to the value of GDT. That they have adopted one of Gardner's minds opens the possibility for the IB to adopt the other four minds to complement the disciplined one. Further research is needed to see whether traces of Gardner's other minds can be seen in IB documentation. Such research may lead to more harmonious and deliberate integration of Gardner's Five Minds for the Future in the IBDP.

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