Teaching to the Test: A Pragmatic Approach to Teaching Logic

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Abstract

The proper goal of an introductory logic course, teaching critical thinking, is best achieved by maintaining the principle of continuity between student experiences and the curriculum. To demonstrate this I explain Dewey's naturalistic approach to logic and the process of inquiry, one which presents the elements of traditional logic in the context of student experiences. I offer an example of a logic textbook which models the maintenance of the principle of continuity I advocate. Last, I advocate a pluralistic and experimental approach to accomplish this, including methods that rely on the role of the body in learning and reasoning.

Introduction

Like many philosophy instructors throughout the academy, one of my primary services to the university is teaching 100-level logic, a required course for all undergraduate students. In many ways I relish the responsibility and consider teaching the course one of my more valuable roles at the university. Furthermore, that the university requires logic makes me hopeful that higher education still values the cultivation of critical thinking, which should be a primary function of a logic class. However, required courses at the university follow a mandated assessment process that involves the administration of entry and exit exams, and a comparison of the test results to track teaching effectiveness. Passing the exit exam is the only way to earn credit for the course. Again, in many ways I admire the high standards of the university in requiring an exit exam. But the question is inevitably raised, what should be *on* the exit exam? As our department is in the midst of rethinking the current twenty-five question multiple-choice test over the traditional square of opposition, direct inference, and categorical syllogism, the time is ripe for some reflection on the purpose of the logic course and the most effective way to teach it.

While the context of a required undergraduate logic course situates my inquiry to a certain extent, what drives my present investigation is the relationship between pragmatic education in the tradition of John Dewey and Dewey's own understanding of logic as the study of the process of inquiry. If critical thinking is

the skill most valued in a required logic class, and we as educators want our students to habituate the skill of thinking critically and being problem solvers, then our logic course must be situated in the context of the lived experiences, which, when indeterminate, give rise to inquiry. Dewey's logic, as we will see, allows the students to understand logic as an inquiry into inquiry, a study of the norms that guide our thinking in the process of problem solving. But the question remains, how should we *teach* Dewey's logic? If Dewey's naturalistic approach to logic is of value, then surely his naturalistic approach to education is as well. What classroom methods make manifest Dewey's insights on education and give life to the benefits of teaching logic in a Deweyan vein? Answering this question involves understanding Dewey's logic and his philosophy of education first, and then proposing some activities whereby students embody the skills we want them to habituate.

To that end, I will first present Dewey's understanding of logic and the process of inquiry and his understanding of the logical function of propositions. Second, I will illustrate some evidence supporting Dewey's hypothesis of the principle of continuity between lower human functions, such as physical navigation of the world, and higher human activities, such as abstract reasoning, by reference to the work of Mark Johnson on embodied mind and learning. Third, I will provide an example of a logic text, written by Scott Pratt, which explicitly and self-consciously maintains the principle of continuity in its presentation of various elements of logic. Further, this text, as I argue is appropriate, is uniquely sensitive to the dangers of teaching Aristotelian logic as if it were culturally neutral, reminding instructors that student experiences, and all of the cultural diversity therein, should provide the beginning and end of our instruction in logic. And last, I will provide some food for thought about classroom methods meant to maintain the principle of continuity. Maintaining this principle helps us close the gaps between the "child and the curriculum" and "the school and society" and better serves our students.

Logic and the Process of Inquiry

As Larry Hickman has written, John Dewey's magic number was three.[1] Dewey had an early philosophical affinity for Hegel, which he later abandoned in a self-conscious way. However, Dewey, in a way similar to Hegel before him, always seemed to be searching for an elusive third, a middle way, which had been excluded by opposing trends in philosophy of all sorts. His book titles came in twos—*Human Nature and Conduct*, *Democracy and Education*, *The School and Society*—but his thesis always involved the synthesis of the two previously opposed concepts. Dewey's logic is no exception to this norm. Dewey worked against several trends in the philosophy of logic that treated logic as either merely dependent upon subjective and mentalistic states and processes, as mere copies of antecedent empirical materials, or as originating outside experience from an a priori source.[2] Dewey identifies logic with methodology, the *theory* of inquiry, for which the guiding

principles and criteria emerge empirically but have rational standing as affairs of relations of means to consequences.[3] Consider several characteristics of Dewey's description of logic. Logic is progressive: logical forms read off from the sciences and no longer respected by the community of inquiry do not provide coherent accounts of existing scientific methods, and as such, demand revision.[4] Logic's subject-matter is determined operationally. Logic inquires into both the materials of experimental observation and the symbols that direct reflection on those materials. Furthermore, the latter element in the operation of logic is delineated by reference to the existential conditions and consequences of the former.[5] Logic is naturalistic: Dewey postulates that the biological and cultural existential matrices of inquiry are continuous with the matrix in which inquiry is formal, rational, and takes its own symbols and language as its subject matter. Dewey does not dichotomize realms of inquiry; instead, they lie on a spectrum from the problematic situations of the live creature, to common sense, to controlled scientific investigation, to inquiry directed at its own methodology. Although logic is naturalistic, it is a social discipline, conditioned by the natural, communal, and linguistic interactions of those in community with each other.[6] The logical forms are postulates of inquiry made of and for inquiry as formulations of conditions to be tested by further inquiries until they yield "warranted assertions." These logical postulates are not the ultimate *a priori* grounds or transcendental conditions for possible inquiry yielded by intuition or pure reason.[7] Yet logic is autonomous. It is a circular process because, as inquiry into inquiry, it only depends on that which is connected to inquiry and thereby rules out the importation of "bad" metaphysical or epistemological presuppositions (such as the power of intuition) "shoved under inquiry as its foundation."[8]

Inquiry follows a pattern, and understanding this pattern is an important step in determining what a logic course must teach, and the types of problems we want our students to solve. The antecedent condition of inquiry is an indeterminate situation, which is permeated and defined by its particular doubts, questions, uncertainties, and discomforts.[9] Once this precarious situation is subjected to inquiry, it is constituted as a problematic situation. The inferential movement from the indeterminacy which gives rise to the need for inquiry and the establishment of a problem is abductive in nature. While often the initial uncertainty in an indeterminate situation is momentary, fleeting, and followed quickly by the recognition of a problem, as when I miss a step walking down my staircase, at other times I have to hypothesize a possible problem.

Consider having a conversation with a friend who you pass in the hall. You chat briefly, but it is a short, choppy conversation, and the feeling that pervades the entire situation is one of unease, yet this is surprising because your interactions with your friend are ordinarily comfortable and habitually easy. In a situation such as this, you have a feeling of doubt or confusion, but you do not know why. You must figure out what the problem is. You reflect on it and imagine possible causes. You think, "Did I forget to call her back?" "Did I forget her birthday?" "Did I fail to ask

her about her interview or test?" Once you establish the problem, you have begun your inquiry and entered a problematic situation.

Once you have established a problem—say, you realized you missed a breakfast date with your friend that morning—the next step is to hypothesize a solution to the problem. Again this moment involves abductive inference. The situation suggests to you possible solutions. She was not overtly angry with you, so perhaps you could text her an apology, as opposed to writing a hand-written letter, calling her, or waiting until you could express your regret face-to-face.

The next step, once you have hypothesized a solution, is to test it out. You send her a text and wait. Nothing happens. You wait until her class ends and give her a call. Nothing happens. You intercept her before her next class, call out her name, and express a sincere apology. Her demeanor returns to its habitual state, and the situation transforms itself back to its habitual state. You have resolved the situation from indeterminate and problematic to determinate and habitual.

Dewey suggests that all inquiry follows these stages. Consider seeing a math problem on a test. Upon first sight, it appears as a bunch of incoherent symbols. You get an uneasy feeling. You must determine what the problem is. You must hypothesize a means to solve it. You must test it out. If you are successful, you transform your indeterminate situation into a determinate one. Logic is the theory of this process of inquiry.

The Logical Function of Propositions

If critical thinking and problem solving are legitimate aims of a required course in logic, then Dewey's attempt to situate logic in the lived process of inquiry has merit. Part of Dewey's attempt to situate logic within ongoing situations and their transformation from indeterminacy to determinacy involves distinguishing judgments from propositions. Dewey characterizes judgment as the "continuous process of resolving an indeterminate, unsettled situation into a determinately unified one."[10] Dewey tells us that judgment is *individual*, as it is concerned with unique, qualitative situations.[11] Students as problem solvers find themselves in unique, qualitative, and affectively thick situations that produce the need for inquiry. If they have successfully habituated the operations common to all inquiries and determined the relations of instrumental operations and the situations and conditions which call for their existential enactment, then they will be better problem solvers. The students' ability to habituate these skills, however, depends upon the extent to which their education in logic is thoroughly and consistently contextualized in situations demanding inquiry. As we will see below, contextualizing logic means closing the gaps between the "school and society" and the "child and the curriculum."

One mistaken direction in the study of logic, according to Dewey, is the identification of propositions with sentences and of terms with words. Such a mistake narrows the scope of the symbols that can function as means in an inquiry, poten-

tially eliminating a wide host of utilities, including gestures and maps. Further, if the study of subject-predicate logic is read off of grammatical structure, then, Dewey argues, the material of the logical subject will be treated as something entirely given independent of inquiry, and this reduces the study of logic to the study of predication. Dewey postulates that the movement from grammatical to logical structure was an Aristotelian movement that brought with it the theory that the "ultimate subject was always ontological substance," a theory which forestalls inquiry.[12] Such a theory—taken in conjunction with a formalism derived from the analysis of mathematics—ended in an overly sharp distinction between the material meaning of words and the formal syntactical relations among them. But Dewey sees no way to determine the formal relation of words without taking account of their meaning, which is a matter of material content and contextual, communal use.[13] W. V. O. Quine famously asked that the web of meaning be cast wider to include this latter content.

A traditional view of logic takes propositions to be coextensive with sentences with truth value, that is, linguistic expressions of logical judgments which are capable of being true or false. But this view conflates the individual character of a judgment and the propositional means to resolve problematic situations. Divorcing propositions from their context and equating them with sentences treats propositional sentences as closed systems, while the position that Dewey offers, that propositions are intermediate and functional as means to directing a final judgment, treats propositions as proposals and suggestions in the direction an inquiry might go. Further, it falls easily into the mistake of treating logic as only a mental affair in one of two ways: "[Either] judgment alone is logical and propositions are but linguistic expressions of them—a position which is consonant with the idea that logic is the theory of thought as mental. [Or] . . . since judgment is a mental attitude taken towards propositions, the latter alone are logical in nature."[14] Rather than treating logic as a purely mental affair, Dewey shows that inquiry concerned with "objective transformations of objective subject-matter" defines the only sense in which "thought" is relevant to logic.[15] In the midst of such an inquiry, "propositions are products of provisional appraisals, evaluations, of existences and of conceptions as means of institution of final judgment which is objective resolution of a problematic situation."[16] Propositions are useful logical instrumentalities for reaching warranted judgments. Propositions are at once existential and procedural, material and ideational. But the functions of propositions in these two characteristics are correlative and functionally correspondent.[17] As means, propositions are neither true nor false; they are (as means) "either effective or ineffective, pertinent or irrelevant; wasteful or economical, the criterion for the difference being found in the consequences with which they are connected as means."[18] Propositions institute facts that help identify the problem; propositions can institute facts providing evidence to help test out possible solutions. But propositions can also represent solutions to problems and prescribe operations with an end-in-view of reaching a

determinate situation. The effectiveness and strength of propositions is determined operationally and functionally: some propositions serve as material means that can be used to actualize a determinate situation through interaction and experimentation. The relations between the interacting conditions and the actualized consequences resulting from experimentation are general and functionally formal, freed from reference to the particular situation at hand.

In each of Dewey's critiques of traditional theories of logic we find the postulation of continuity, characteristic of his entire philosophical corpus and, as we will see, especially present in his philosophy of education. Dewey's project, whether in logic or education, is to undermine strict dichotomies between mind and body, theory and practice, thought and action, reason and affect. Logic is not the purview of the mental only; the theory of logic must be read off from the practice of inquiry, although the formulation of logical relations has an autonomous and "functionally formal" standing; and our thinking, when propositional, is always a means, an instrument culminating in a judgment that unifies a previously indeterminate situation into a determinately unified one, which allows us to return to our habitual activities.

The "Child and the Curriculum": Closing the Gap

Dewey's critique of the separation of the formal and the material elements in logic, as well as the isolation of propositions from their context and function in determining a final judgment, is really the product of his applying the naturalistic postulate of continuity to the study of logic. I am proposing that we understand the same postulate applied to the philosophy of education. After Dewey's philosophy of education is in clear view, I will offer some classroom methods which put teaching to the test, hopefully closing the gap between student experiences and the curriculum in logic.

What registered for Dewey as the separation of the formal and the material elements in logic, and the isolation of propositions from their context and function in determining a final judgment, had already been made manifest in his many inquiries into educational theory and experimentation in teaching. In educational theory, the same division registered as the separation of the psychological component in education, the development of the mental powers of the student, from the sociological component in education, the goal of adjusting the student to social needs and roles. My contention is that the dominant tendency of an undergraduate logic course is to focus only on the psychological component in education at the expense of the sociological component. Such a tendency carries with it the potential of alienating the student from the curriculum and widening a gap between child and curriculum, where the goal should be to dissolve that gap.

Consider an analogy to coaching. If I am coaching a sport, strength and speed training may be of great value and import regarding the athletes' success. But ideally, all of my "conditioning" activities would be situated in the context of the sport I coach. Removing the athlete from her context, a volleyball court for instance, in order to

work on strength training, takes time away from the habituation of the skills needed to compete in volleyball. This is not to say that time not be spent in the weight room, but the more strength, power, and speed could be trained in the context of a volleyball court with five teammates interacting in a game-like mode, with ball skills interacting alongside the focus of power and speed, the better. We may remind ourselves of the age appropriateness of the specialization of sports training. The less experience an athlete has, the more her physical education need be contextualized in ball skills relating directly to game-like situations, and the less she should be removed from that context to lift weights or train jumping on an unstable mat. Logic class has been analogized to doing mental push-ups, useful in cultivating mental powers, but removed from the context of application, the qualitatively unique situations which give rise to the need for inquiry. The more removed from context, especially in a 100-level course, the less effective and more onerous the mental push-ups will be.

Thinking with Dewey, the sociological and psychological components are organically related, and once separated can only be articulated in an ill-formed manner with disastrous consequences.[19] The unnecessary separation of these components tacitly implies that our arenas of learning are discrete and not continuous. The social situations in which students find themselves (from a traditional classroom environment to an athletic field to a an online chat room), stimulate their powers, and the ensuing activities result in adjusted habits, based largely on the success and failure of their functioning in their natural and social environments.[20]

The model of education Dewey criticized suggested that students learn external material as it is impressed on them as a ring into malleable clay or poured into their container-minds. But can students reach into their minds as a storage cabinet and retrieve the distribution rules, the figure and mood of syllogisms in order to apply these when a situation calls for their application? Further, do situations call for their application? This model suggests that when it is time to do social work, we can open up our brain-cabinets and get some sociology; when it is time be engineers, we can open up our brain-fridges and get some math or physics; when it is time to conduct our businesses ethically, we can reach into our heads and retrieve some moral philosophy. This model is as inane as suggesting that, just before the kick-off of the football game, we retrieve from our memories the rules of the game given in a lecture or assigned to be read in a rule book.

We do not learn passively in order to do actively; rather, our doing is learning. As Dewey wrote, the active side precedes the passive in the development of the student. As I mentioned above, the extent to which logic is about thought is defined by inquiry concerned with transformation of originally given subject-matter. Such thinking is just the habit of directing our actions effectively. Reason, surely under the purview of logic, is just a law of orderly and effective action. Symbols, highly abstract, are tools of effective and economized action.[21] One can ignore this educational insight only if one treats the mind and the body as distinct entities and treats

theory as antecedent to practice.[22]But my contention is that if we drill students on theory, conceived as distribution rules in valid categorical syllogisms and as tools to be applied later in practice, we have already run the risk of alienating them from those relevant tools. The knowledge we acquire in learning should end in habits of activity. The more effective the activity, the more relevant the learning.

The relevant question concerns what we are doing. What should be practiced? Turning to practice in the classroom does not necessarily mean that we turn away from contemplation, reflection, symbolization, or abstraction. This is only the case if one begins with a concession that thought and action are discontinuous. If we think with Dewey that generalizing, symbolizing, and theorizing are types of activities governed by norms and conducted with ends-in-view, then a turn toward practice is not a turn away from theory. A turn toward the embodied activities and metaphors we use to bridge the gap between the student and the curriculum is not a turn toward a self-interested and spontaneous student and away from the norms governing inquiry. Rather, attempts to bridge this gap with activity, embodied learning, and metaphor are the operations of habituating the activity of thinking in ways that help solve problems.

The Body and Metaphor in Learning

The hypothesis of the principle of continuity I have been relying on undermines several dualisms. First, the principle maintains that there is no radical fact/value distinction. We reason for various purposes and goals, influenced by interests and values. We elevate the rules of inference in deductive logic as valid because we measure them according to various values, including predictability, consistency, testability, and relevance.[23] Second, the principle undermines a strict emotion/reason dichotomy. Recall that the situations which give rise to our inquiries register as indeterminate affectively and qualitatively. We *feel* unease, doubt, and uncertainty. If our inquiries are successful in settling our doubts, we *feel* a sense of repose and satisfaction. Last, and most important to our reflections here, the higher and more complex human activities of conceptualization and reasoning recruit cognitive resources from both our lower and less complex human functions and from our monitoring of our emotions.[24] This means that there is no radical mind/body separation, although the principle precludes any reduction of one set of activities to the other. Thinking under the norms of the principle of continuity, we do not represent external, concrete, physical objects using internal, abstract, mental concepts.

How do logic and critical thinking rely on our body and not just on our mind? Answering this question means thinking with Dewey that our words "body" and "mind" are convenient ways of "identifying aspects of ongoing organism-environment interactions."[25] Thinking with Dewey, cognition is a certain kind of action, which is both continuous with the lower functions and emergent from our interactions with our problematic environments. Bodily processes extend sensorimotor concepts for use in abstract reasoning, and our capacity for abstract reasoning is

learned during our development. Recent research in cognitive science has shown how various neural maps develop and preserve topological structures which significantly define the world we navigate. That is, these maps are our structures of experience; we experience a structured world through them. The habit of referring to the relationship between subjective mental structure and object experienced through that structure, as internal concepts representing external objects, is the product of taking a third party, scientist's view of the situation and attributing that view to a special, ontological status. William James called this the psychologist's fallacy.[26]

Our bodily experience of navigating our environment, an environment shot-through with gravitational force, temperature scale, and constantly changing bodily states, contributes to the development of all sorts of schemas. One such schema Mark Johnson explains is the container image schema. We learn to interact with containers of all shapes and sizes, and we learn from this the logic of containment structures of boundaries, interiors, and exteriors.[27] Such an image schema, thinking with Dewey, should be thought of as a contour of our "body-mind." These schemas have "internal structures that give rise to constrained inferences."[28] These inferences apply to all sorts of abstract reasoning, including our use of sets, categories, and predicates. So much of the logic we teach is predicate logic, and the Greek for predicate is κατηγόρημα.Such predicate logic is a container logic. Aristotle gave us this propositional logic, in which we find subjects connected to predicates by *copulae*. The subject is the particular of our experience and we put it under a category, a predicate. The phrase *Socrates is mortal*, in this way of thinking, just means that the particular man, Socrates, belongs to the category of all things mortal. Socrates is the same as those others in that category and different from others not in it. But the development of our logic of classification emerges from our container image schema, whose internal structure gives rise to an inferential logic. Similarly, the language we use to describe the understanding of abstract concepts builds on the metaphors of seeing and grasping, both of which have their origin in the lower functions. We see and grasp ideas, not just physical objects.

If the hypothesis of the principle of continuity appears convincing, and the story of our capacity to reason which Johnson weaves is more attractive than the pervasive dualisms it undermines, then I propose this has implications for the way we teach logic. Our conscious selection of educational methods should reflect what we know about the bodily origin of logic and meaning. What does this mean for a pragmatic approach to teaching logic?

A Text to the Task: Situating Logical Fallacies in the Process of Inquiry

The fundamental insight guiding our reflections on a pragmatic approach to teaching logic is the principle of continuity. That is, logic is continuous with other ev-

eryday modes of solving problems and navigating our natural and social worlds. Establishing a real, living continuity between all of the subjects taught in school and the off-campus world is in many ways every educator's ideal. We think what we teach matters, and we want our students to understand why and how it matters. In order for this sentiment to be more than occasionally emphasized in the classroom, we must find a text that consistently situates the study of logic in a broader theory of inquiry. In Scott Pratt's *Logic: Inquiry, Argument, and Order*, we find a text up to the task of establishing the continuity we want, although I am not implying that it is the only one or even the best one. What Pratt's text is, however, is an exemplar of situating instruction in formal and informal logic in a wider cultural context and within Dewey's process of inquiry.

Pratt's text considers arguments as a form of inquiry. He writes, "Arguments are a presentation of a response to an indeterminate situation where the premises mark the stages of inquiry and the resources used."[29] These arguments are meant to be used as resources in the larger community of inquiry. We want our students to be able to make valid and sound arguments in the process of communal inquiry of all sorts, from discussions of the greatest basketball players of all time to debates about the best way to allocate public resources. We also want our students to be able to measure the argumentation used in the discourses they encounter. We want them to be able to detect deception and logical fallacies.

Part of this second goal is the evaluation of the modes of discourse they encounter. Toward this end, Pratt situates the study of logical fallacies within a broader discussion of Jürgen Habermas's distinction between strategic and communicative action.[30] Strategic action, according to Habermas, is a mode of discourse in which language is aimed at causing the audience to do or not do something. The gold standard examples of strategic action are the salesperson looking to close a deal or the politician who wants your vote or campaign contribution. The goals are determined independently of the means of achieving them and prior to the use of language. Habermas contrasts this with communicative action. Here, the use of language is aimed at seeking agreement, which is arrived at by each listener. Agreement is occasioned, not caused. The goal of the speech act cannot be separated from the means of achieving the goal, and the often the ends of the communicative action emerge from the occasion of the communal inquiry. The gold standard example of communicative action is the neighborhood association meeting in its most democratic form.

The upshot of this approach is to habituate students in the process of determining what type of speech act they are encountering. The well-trained student will ask herself, "Am I being sold something here?," "Does the speaker genuinely care about my opinions and ideas?," and "Does the speaker have a pre-determined goal when she addresses me?" Further, Pratt speculates that when a person engages in strategic action, while attempting to appear that she is engaging in communi-

cative action, the situation is ripe for fallacy. After all, our word for fallacy has its etymological roots in the Latin *fallere*, meaning to deceive.

The way Pratt organizes the customary list of informal fallacies helps maintain the principle of continuity. Some fallacies relate to the way indeterminate situations are framed, such as the false dilemma. Others, such as fallacies of ambiguity and fallacies of source, like appeals to pity and authority, concern the premises used in the argument proffered. Last, some fallacies concern both the connection between premises and conclusions, such as fallacies of relevance, and the character of the conclusion of the argument, such as the *post hoc ergo propter hoc* fallacy.

Classroom Methods: Experimentalism and Pluralism

Consider a retail application of the principle of continuity in a logic class. In teaching the theory of the syllogism, we first discuss several direct inferences, including conversion, obversion, and contraposition. If we begin with a true standard form assertion, such as *no humans are immortal*, we can directly infer by obversion the true claim that *all humans are mortal.* A traditional method of teaching these direct inferences—a method that "teaches to the test" in the pejorative sense—is to encourage students to memorize the procedure of the obversion: same subject, opposite quality, complementary predicate. But if we situate the warranted assertion within a proximate environment, especially one whose terms are ordinarily conceived of as physical and external, then we can make use of the principle of continuity. The testing stone for any direct inference is that it must describe the exact same state of affairs as the original assertion. If our state of affairs is a cup of candy in front of a group of students and they make standard-form universal, particular, affirmative, and negative assertions about it which are true, the direct inference from the original assertion must describe and hold true of the same cup of candy. The conversion of *all of the candy in the cup is sweet* must be that *some sweet things are candy in the cup*. The physical state of affairs tests the logical operation in a proximate, tangible manner.

A similar tool to teach symbolic logic is Tarski's World. In Tarski's World, a computer program developed for instruction in symbolic logic, the sentences written in symbolic logic describe states of affairs of virtual objects on a checkerboard. Various objects of three sizes can be arranged on the checkerboard confirming or denying the propositions written below them. The visual arrangement of the objects serves as a testing stone for the truth value of the propositions that describe the states of affairs on the checkerboard.

However, these are only retail reforms toward a pragmatic approach to teaching logic. What would wholesale reforms look like? As I mentioned earlier, Dewey's logic provides students with an understanding of logic as an inquiry into the norms that guide our thinking in characteristic problem solving. Deductive logic and syllogistic reasoning in Dewey's understanding are only modes of logic, tools

we might use while in the midst of inquiry. But if we are to close the gap between school and society by situating logic within the process of inquiry, then we need our students to engage in problems whose solutions are not certain. Where syllogistic logic yields necessarily true conclusions from true premises, the problems we encounter outside the classroom are much messier and more indeterminate. A traditional method of the categorical syllogism, a significant portion of the exit exam our university offers—but one which "teaches to the test"—is to have the students memorize the quality and quantity of the propositions used in the premises and conclusions, the distribution values of the subject and predicate terms therein, and then apply the axioms of quantity and quality to the syllogism. This method, however, is the most mechanical and merely mental approach, failing to maintain the principle of continuity. It equates propositions with sentences, terms with words, and divorces both propositions and arguments from the context of an inquiry meaningful to students' experiences. And while the use of Venn diagrams to determine the validity of categorical syllogisms applies a modicum of continuity between the physical and the mental, I suggest that what many of the students need are problem solving scenarios with multiple solutions.

Consider the example of breaking a three-way tie in sports. We present the students with the situation:

> In a division of college football, three teams are tied for first place. Each team has one loss only. The Shorthorns beat the Laters 45–35 in mid-October on a neutral site. On a last second play, The Blue Bombers beat the Shorthorns 39–33 on the Blue Bombers' home field in early November. The Laters creamed the Blue Bombers 62–28 on the Laters' home field in late November. Since it is an obvious 3-way tie, with each team winning one and losing one, how should the tie be broken? Only one team can advance to play the Cats, the winner of the other division, for the conference title. No games can be replayed. You decide the criteria for breaking the tie. Defend your criterion.

The students are charged with establishing the problem, identifying constituents within the situation that they can use to hypothesize a solution. They then test out their hypotheses using various criteria and defend their solution. They enact the stages of inquiry as outlined by Dewey. One of the inferential moves the students must develop is the process of abduction or hypothesis formation. To do this the students must see in the situation the material which suggests itself as possible data serving as criteria for breaking the tie. The students cannot go outside the situation (much like in real life) in order to determine the solution. In the above scenario, the students have many options to use and each provides a different solution. They could appeal to points scored, points scored in games lost, place of victory and place of loss, total point differential. Potentially, the students could detect meaningful data that are missing and ask for them in their response. But

in the process, they become the problem solvers, and they abduce their own rules. This method is similar to the problems they encounter outside the classroom, but unlike the problem of selecting a valid conclusion from two premises because they do not apply antecedently given rules to a particular case. Ideally, they habituate the skill of being autonomous problem solvers.

Again, these situations and problem-solving tasks can overlap with ethical issues. We present the students with an exercise whereby they become the professor and must determine the appropriate action to take in three different cases of academic dishonesty: *One student hands in a paper purchased from an online retailer. A second properly footnotes a source from which she copied an entire paragraph verbatim without the use of quotations. A third takes two consecutive sentences verbatim from an online source in three different areas of her paper but does not footnote the source at all.* Again, we provide the students with enough information for them to use some of the information from within their situation as criteria to help resolve the problem. They follow the process of inquiry, hypothesize criteria to be applied and defend their solution. The situations are meant to close the gap between school and society and between logic and ethics.

The methods I propose have limitations and downsides, and I suggest using a very experimental approach to seeing what works, using a variety of examples from different cultural institutions. We need a plurality of approaches to help habituate the students in the process of inquiry and critical thinking. One of the downsides is the choice of the subject matter of the first problem. A student less familiar with sports might not know some of the conventional methods of breaking ties. Other cultural limitations can occur. References to golf—in a classroom where no one has ever played golf—fall flat, as I have learned. Gendered references can be particularly problematic as well. But these limitations provide us with opportunities to give the students more autonomy in generating the problems they ordinarily encounter, describing them according to the stages of inquiry, proposing solutions, and testing them out. As Jim Garrison points out, "Dewey emphasized the philosophical importance of the plurality of human purposes and selective interests, driven by needs and desires, in arresting the flux of cultural events and in fixing identities and establishing values."[31] Thus, since student interests and needs are plural, and limitations pervade teacher-centered examples, we need to turn to student interests and experiences to cultivate the material of the curriculum.

We can borrow insights from research in mathematics education, which asks that we use students' cultural capital as material to build an interest in the discipline we are teaching. Such research reminds us that, "One of the strengths that children bring to the classroom is their cultural capital. Theoretically, teachers can use children's cultural capital to stimulate mathematics learning or ignore it and actively deplete motivation to learn, thus adding another barrier to achievement."[32] This insight is entirely relevant to education in logic, as the first line of the

first chapter of Pratt's text shows us. Pratt's logic text boldly begins with a reference to Franz Fanon's critique of traditional logic: it follows the logic of "reciprocal exclusivity."[33] Aristotelian logic—that which we teach on the exit exam—uses a logic of separation to divide the colonizer from the colonized and categorize the groups into superior and inferior, oppressor and oppressed.[34] A white male teaching logic as if logic were "a culture-free or mono-cultural activity" does not honestly address the dangers latent in our current approach.[35] Pratt, by beginning his text with an honest admission of these hazards, and by situating logic within a Deweyan theory of inquiry, avoids the pretense of cultural neutrality and opens up the curriculum to the call that we use student cultural capital to provide the touchstones of our curriculum. Again, thinking with Dewey, we begin and end in students' experiences with all of their cultural uniqueness and qualitative affectiveness.

Returning to the way we teach fallacies, we can maintain the principle of continuity by providing students with occasions to detect and describe the fallacious arguments they encounter in a holistic way. Instead of assigning students the task of finding fallacies in print journalism or news media in a piecemeal way, we can assign them the task in a way that asks them first to describe the indeterminacy which gave rise to the inquiry, how the problem is framed, and whether that framing is deceptive, and then to identify specific fallacies occurring in the process of inquiry.

We can also maintain continuity on another level. Just as one of my examples of the process of inquiry was a problematic interpersonal situation, we can occasion students to reflect on their problematic interpersonal encounters, considering them as manifesting stages of inquiry and giving rise to deceptions and fallacies. This move establishes continuity between logic and ethics. Logic, in this sense, is what C. S. Peirce calls a "normative science." Logic is the study of how we *ought* to think. The successful student can think more successfully about the modes of discourse they encounter in their various interpersonal relationships. She can inquire, "How is it that my friend always manipulates me into serving her needs?" And "What went wrong in my discussion with my employer about compensation?" The ideal goal here is an improvement in the way students think and inquire into the modes of discourses encountered in their interpersonal relationships, and by proxy, the improvement of those relationships themselves. As Dewey reminds us, one of criteria for good aims in education is that they end in the freeing of student activities.[36] Freeing the student from the previous ignorance pervading their problematic interpersonal relationships is a noble end in a logic class, one that will not always be achieved, but one that deserves to be among our goals.

Conclusion

My hypothesis is that a twenty-five question multiple-choice exam on the traditional square of opposition, direct inferences, and categorical syllogisms violates the principle of continuity in a variety of ways. I doubt that the skills needed to

pass the exam translate very well into the inquiries students encounter. Knowing that *if some professional athletes take performance enhancing drugs* is true, then it is undetermined that *some do not* is not worthless, but I propose that such a skill is not as valuable as habituating the students in Dewey's logic. I doubt that, outside the classroom, students regularly employ the skill of identifying middle terms and checking distribution rules, let alone memorizing figures and moods of a finite number of valid syllogisms. These push-ups are mental push-ups, but the students need to develop their mental muscles, especially at the 100-level, within the context of problematic situations they already encounter. Therefore, I propose that the standard we use to put teaching to the test is the maintenance of the principle of continuity. The more we close the gap between the child and the curriculum and between the school and society, the better we serve our students.

Many months have passed between the submission of this article and its publication. In that time, our philosophy department's logic committee has completed one stage of an ongoing inquiry into rewriting our assessment tool, which is to be universal across all twenty sections of introductory logic. While such an inquiry is communal and compromise is a necessary means toward resolution, we have made significant progress. Each of our questions will be situated in a textual context of paragraph-length arguments. Students will respond to questions about the structure of the argument, the main conclusion, key premises, and about assumptions the author makes and propositions (as proposed means) which might strengthen or weaken the argument. A student's success in responding to the question will not hinge on an understanding of technical vocabulary, such as the meaning of obversion or the Latin name of a fallacy. Other questions will be about causal reasoning, including the necessary and sufficient conditions of an outcome presented in the text given. Contextualizing the situations is a significant step in closing the various discontinuities we found problematic in our exit exam. Further, we proposed that proper space be given for each logic instructor to experiment and both self-assess and peer-assess the utility of experiments in each course's curricular material and methodology.

To demonstrate that the maintenance of the principle of continuity is a service to our students, I have attempted to explain Dewey's naturalistic understanding of logic and the process of inquiry. The abstract reasoning we have developed and all of the rules of inference therein are the product of the human race's attempts to navigate our problematic environments. Our bodily learning, with its neural maps and image schemas, gives rise to the metaphors we employ to reason logically. The traditional elements of logic, including the teaching of logical fallacies, need to be situated in the process of our inquiries and presented in the context of our actual problems in a holistic way. Last, our pluralistic and experimental classroom methods need to fall back on the role of the body in learning and reasoning by giving students proximate, physical material to use in their instruction in various skills

in logic, including standard form propositions, direct inferences, and syllogistic logic. Those methods need to provide the students with the opportunity to become autonomous problem solvers in a way that maintains continuity between the fields of logic and those areas ordinarily thought of as value fields, ethics, aesthetics, and politics. Maintaining the principle of continuity treats logic as a value field, a normative science in the spirit of Peirce. Treating the study of logic as only the science of necessary inference, where all answers are clearly demarcated, (A, B, C, or D), widens the gap between the school and society. Presenting logic as the study of the process of inquiry, with all of its indeterminacy, messiness, affective dimensions, and multiple solutions, closes the gap, providing students with the skills they need to become autonomous problem solvers. If we can do that, we will stop teaching to the test. Instead, our teaching will have come closer to passing Dewey's test.

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Notes

1. Larry A. Hickman, "What Was Dewey's 'Magic Number?'" in *The Proceedings of the Twentieth World Congress of Philosophy, Vol. 8: Contemporary Philosophy*, ed. Daniel Dahlstrom (Charlottesville, VA: Philosophy Documentation Center, 2000).
2. LW 12:106.
3. LW 12:12, 17.
4. LW 12:21.
5. LW 12:22–23.
6. LW 12:26.
7. LW 12:24.
8. LW 12:28.
9. LW 12:109.
10. LW 12:283.
11. Ibid.
12. LW 12:285. See also *The Basic Works of Aristotle*, edited by Richard McKeon (New York: The Modern Library, 2001), 9. Such a primary substance is neither predicable of nor present in a grammatical subject.
13. LW 12:285.
14. LW 12:286–287.
15. LW 12:287.
16. Ibid.
17. LW 12:284.
18. LW 12:287.
19. EW 5:85.
20. EW 5:84–85.
21. EW 5:92.
22. See also Seth Vannatta, "The Logic of Relevance in Independent School Education," *Contemporary Pragmatism* 10, no. 1 (2013): 113–30.
23. Mark Johnson, *The Meaning of the Body: Aesthetics of Human Understanding*(Chicago: University of Chicago Press, 2007), 108.
24. Ibid., 10.
25. Ibid., 117.
26. William James, *The Principles of Psychology, Vol. I* (New York: Dover, 1950), 196.
27. Johnson, *The Meaning of the Body*, 138.

28. Ibid., 144.

29. Scott Pratt, *Logic: Inquiry, Argument, and Order* (Hoboken, NJ: Wiley, 2010), 61.

30. Jürgen Habermas, *Theory of Communicative Action*, translated by Thomas McCarthy (Boston: Beacon Press, 1984).

31. Jim Garrison, "Deweyan Prophetic Pragmatism, Poetry, and the Education of Eros," *American Journal of Education* 103, no. 4 (1995), 411.

32. Robin Averill et al., "Culturally Responsive Teaching of Mathematics: Three Models from Linked Studies," *Journal for Research in Mathematics Education* 40, no. 2 (2009), 159.

33. Franz Fanon, *The Wretched of the Earth*, Trans. Constance Farrington (New York: Grove Press, 1968), 38–39.

34. Pratt, *Logic*, 1.

35. F. Walls, "The New Zealand Numeracy Projects: Redefining Mathematics for the 21st Century?," *The New Zealand Mathematics Magazine* 41, no. 2 (2004): 21–43; Julian Weissglass, "Inequity in Mathematics Education: Questions for Educators," *The Mathematics Educator* 12, no. 2 (2000): 34–39.

36. MW 9:112.

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