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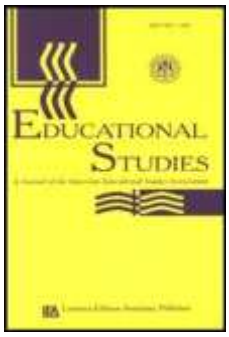

Deweyan Tools for inquiry and the Epistemological Context of Critical Pedagogy

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Resistance to social justice education has been attributed to a number of sources: the desire to uphold privilege, a willing ignorance to face social facts, an unawareness of history, or a psychological defense to shame and guilt (Willingham 2010; McFadden 1995; Pitt 1998; Weitz 2001; Lather 1992; Giroux 2001). Another possibility, taken up recently by Barbara Applebaum (2007), is that students resist the framing of problems in social justice terms, viewing them instead through other interpretive lenses. Rather than seeing resistance to social justice-focused classroom inquiry as mere interpretive disagreement, however, Applebaum considers it an epistemological problem, arguing that it entails a fundamental refusal to use the conceptual resources offered for examination. She characterizes it as a "premature disengagement" (p. 337) that exhibits both an individual refusal to confront the personal implications of evidence of privilege and oppression and a larger "culturally sponsored defensiveness" (p. 339). Social justice educators, she argues, should intervene because the refusal to engage is both "offensive to the systemically marginalized" (p. 339) and contributes to the reproduction of oppressive social systems. By Applebaum's analysis, resistance to social justice education consists of at least two mutually reinforcing dynamics: students' refusal to *think with* new conceptual resources and their *persistent use* of ones that support oppression. These are clear obstacles to social justice education, which, crucially, depends on the development of adequate conceptual tools for understanding and working against oppression.

There is danger in identifying and focusing upon student resistance to social justice education, however: it can be tempting to blame students because they do not "engage properly" with social justice inquiry (Lindquist 1994; Colby 2006). As Lindquist argues, discussions of resistance often imply "some kind of inadequacy in the person labeled resistant; for example, a

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failure to understand her/his motives and actions, a lack of knowledge, or a refusal to acknowledge information in a given situation" (Lindquist 1994, 3). Describing student rejection of social justice inquiry as "resistance," then, risks pathologizing student thinking, especially when it is characterized as deficit. So while Applebaum rightly captures an important epistemological dimension of social justice education, the specter of paternalism may be close at hand when casting students as 'resistant' to what educators are endeavoring to teach. Moreover, assigning the name 'resistance' psychologizes and personalizes what may equally be regarded as a structural problem in a social justice framework. One challenge facing critical educators, therefore, is to develop an epistemological position that helps reconcile the social and personal dimensions of so-called 'resistance,' while also pointing to practical ways forward.

In this article, we extend Applebaum's emphasis on epistemology by further developing the notion of resistance as both 'culturally sponsored' and cognitively manifested. We try and avoid paternalism and pathologizing by incorporating John Dewey's conception of *tools for inquiry* into the discussion of critical pedagogy. Dewey provides a way to conceptualize student resistance not as a form of willful disputation, but instead as a function of socialization into cultural models of thought that actively truncate inquiry. In other words, 'resistance' can be construed as the cognitive and emotive dimensions of the ongoing failure of institutions to provide ideas that help individuals both recognize social problems and imagine possible solutions. Focusing on Dewey's epistemological framework, specifically *tools for inquiry,* provides a way to grasp this problem. It also affords some innovative solutions; for instance, it helps conceive of possible links between the "regular" curriculum and the study of specific social justice issues, a relationship that is often under-examined. The aims of critical pedagogy depend upon students developing dexterity with the conceptual tools they use to make meaning of the evidence they confront; these are background skills that the regular curriculum can be made to

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serve even outside social justice-focused curricula. Furthermore, because such inquiry involves the exploration and potential revision of students' world-ordering beliefs, developing flexibility in how one thinks may be better achieved within academic subjects and topics that are not so intimately connected to students' current social lives, especially where students may be directly implicated.

The article proceeds as follows. In the first section, we discuss Dewey's epistemology, focusing on conceptual "tools for inquiry" and articulate their relationship to resistance. In the second, we argue that the context surrounding social justice education has important implications for student resistance. We ground the argument within two general school practices, high stakes testing and academic tracking. In the third section, we argue that analyzing how conceptual tools influence the ways meaning is made within the general curriculum can support the more specific aims of social justice education by developing a kind of "epistemological dexterity." This helps reframe 'resistance' to social justice education. We conclude by proposing a next step, integrating discipline-specific engagement with Deweyan inquiry tools and social justice topics.

Tools for inquiry

In *How We Think* (1933), Dewey recounts a young Charles Darwin's encounter with the power of conceptual thought after finding a tropical shell in a gravel pit. Excited by the discovery of a geologic anomaly, Darwin brings the shell to his Cambridge teacher, the geologist Adam Sedgwick. Sedgwick is not impressed. If the shell had been deposited naturally, his teacher asserts, "it would be the greatest misfortune to geology, because it would overthrow all that we know about the superficial deposits of the Midland Counties" (Darwin, quoted in Dewey 1933, 153). Dewey uses the story to illustrate that scientific inquiry depends upon the use of a relatively stable set of conceptual tools to guide its investigation. If the shell were revealed to be anything other than a haphazard transplant, Sedgwick would have to alter his fundamental

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understandings of geology. He would now have to doubt what had been previously useful and relatively stable geologic concepts. Doing so could render him unable to pursue scientific inquiry with any confidence. His resistance, his distinct lack of enthusiasm for Charles' find, is understandable.

We propose that social justice education places students in Sedgwick-like positions. Engaging with the substance of social justice education, through examining the metaphorical tropical shells offered by teachers, may require students to doubt and even revise the beliefs and concepts they use to make sense of their social worlds. Like the geologist who depends upon relatively stable sets of scientific concepts in order to guide ongoing investigation, they are similarly invested in the continued use of concepts that have successfully guided their personal meaning making in previous instances.[1] Within the context of critical pedagogy, these include the ways race, ethnicity, gender, sexuality or social class do or do not impact their lives. Many students, for example, come to the classroom with solidified concepts of what sexism means and whether or not it has an influence on their social experiences. Through their experiences, they have developed relatively stable conceptual tools that help them effortlessly to 'do' gender and make meaning of it according to prevailing cultural models (see West and Zimmerman 1987). When teachers offer evidence for the influence of sexism in their lives, students may resist by rejecting it, like Sedgwick's reaction to the tropical shell, because acceptance would require that they doubt the conceptual resources that have previously helped them explain their interactions as devoid of gender implications. Here we see one of the key aims of critical pedagogy is foregrounded: to help students question the beliefs they already successfully use to make meaning of social justice issues. Or, in terms of our argument, such education aims to help

[1] By "meaning making" we do not mean to imply that we "make up" meanings. Instead, we use the language to emphasize the active nature of personal inquiry.

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students transform the way they hold such beliefs – from being relatively stable and unquestioned to more tentatively held and subject to revision.

The shell example also points to the utility of Dewey's naturalistic epistemology for thinking about and working with conceptual tools related to social justice issues as well as resistance to their study. Tracing the Hegelian influences on Dewey's epistemology, Jim Garrison argues that Dewey's action-oriented epistemology involves *labor* as we attempt to answer questions or to restore harmony in situations of doubt. All inquiry begins in doubt, and that "doubt is a living, embodied, and impassioned condition, a state of need and active seeking" (Garrison 1997, 94). Dewey is helpful here: "living may be regarded as a continual rhythm of disequlibrations and recoveries of equilibrium… The state of disturbed equilibrium constitutes *need*. The movement towards its restoration is search and exploration. The recovery is fulfillment or satisfaction" (Dewey quoted in Garrison 1997, 92). Inquiry involves action – labor – and as such, we require resources – or tools – to do our mental work. Moreover, inquiry-related actions (which necessarily involve tools) are focused upon the resolution of doubt or confusion, what Dewey and Garrison describe as the restoration of harmony. Tools, then, are an important part of the inquiry process because they help perform the task of restoring harmony; they are essential to doing the labor of inquiry. "Work, labor and tools, justify themselves by satisfying our needs and bringing about the desired object and its enjoyment" (Garrison 1995, 96). This is linked to Dewey's rejection of a correspondence or "spectator" theory of truth. He instead argues for "warranted assertions," moving away from a static conception of knowledge and onto the ongoing and active nature of "knowing" which is irreducible to something outside the process of inquiry. Knowing, then, is grounded and contextualized in our social lives and daily experiences and is indissoluble from the very tools we use to inquire.

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Varieties of tools. In *How We Think* (1933), Dewey divides tools for inquiry into three types: beliefs, meanings and concepts. It is helpful for our purposes to read the list as a progression from relatively *unfixed* to *more fixed*. A belief is a tentatively used tool, one that we might use to *guide* inquiry, but with less confidence in its ability to help resolve doubt. Because a belief is an untested and an unreliable resource, Dewey asserts that, "we hold it in suspense as a possibility rather than accept it as an actuality" (Dewey 1933, 132). Seen in this way, ideas become "tools with which to search for material to solve a problem" (Dewey 1933, 133). It is important to note Dewey's insistence that even when held tentatively, using ideas is itself a transactional process. Through use, the tool, the person, and the object of inquiry are all altered. Like a hand conforming to the grip of a hammer in order to drive a nail, user, tool, and problem merge into a singular act whereby "meaning is *extended* as well as defined" (Dewey 1933, 157). And, like material tools, ideas gain use value by accumulating successes at problem solving. When meanings are further refined through their successful use during inquiry, they become relatively solidified as concepts.

In this way, concepts are ideas that have performed reliably in prior inquiry (Dewey 1933, 149). Dewey wrote:

> An idea, after it has been used as a guide to observation and action, may be confirmed and so acquire an accepted status on its own behalf. Afterwards it is employed, not tentatively and conditionally, but with assurance as an instrumentality of understanding and explaining things that are still uncertain and perplexing. These established meanings, taken to be secure and warranted, are *conceptions*. (Dewey 1933, 149)

To exemplify his point, Dewey points to common nouns like "table, stone, sunset, grass, animal, moon, and on through the list of common nouns that are solid and dependable" (Dewey 1933, 150). In keeping with the linguist's maxim that language is arbitrary, he argues that these nouns have *become* concepts—their significance in our world is virtually settled. The key here is that we base further inquiry upon these concepts; *we use them* to make meaning in the face of

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perplexing new situations. Just as it would be absurd to puzzle over the mass of a hammer each time one picks it up—gripping happens effortlessly after only a few uses—concepts "introduce solidity into what would otherwise be formless, and *permanence* into what would otherwise be shifting" (Dewey 1933, 150 emphasis in original). Furthermore, the "concept signifies that a meaning has been stabilized and remains the same in different contexts" (Dewey 1933, 151). As such, concepts are essential for continued inquiry: "The moment a meaning is gained, it is a working tool of further apprehensions, an instrument of understanding other things" (Dewey 1933, 157). In this way, as tools for inquiry, concepts help make meaning in a variety of contexts, especially in novel ones that require dependable resources with which to build new understandings.

How tools function. Specific tools—like our trusty hammer—enable us to make certain moves and not others. In other words, they foreclose as well as enable active processes of inquiry in our everyday situations, but when we bring tried-and-true resources into new situations, they may not *work* well to resolve doubt. For example, within the context of critical pedagogy, our accumulated conceptual tools that have helped us make meaning in a sexist world may not be able to account for new evidence that sexism exists in ways that we previously failed to recognize. Perhaps a belief in the meritocratic nature of schooling may help middle class, white males arrive at meanings they find satisfying: *Work hard and you shall be rewarded. Those who fail are lazy*. Such beliefs may be tentatively held at first, but continued experiences in school tend to confirm these beliefs credibly explain differences in academic performance. They thus move from tentatively held guiding tools to trusted ones. Again, it is useful to recall the bi-directional nature of tools, making the user conform to their features. Dewey elaborates:

> We cannot explain why we believe the things which we most firmly hold to because those things are a part of ourselves. We can no more completely escape them when we try to examine into them than we can get outside our physical skins so as to view them from without. Call these regulative traditions

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> apperceptive organs or mental habits or whatever you will, there is no thinking without them. (Dewey 1985, 13)

Like Sedgwick's reaction to Darwin's shell, accepting the evidence that one's academic success may be partially a result of gender privilege may require male students not only to question the nature of their gendered social experiences, but also the stable conceptual tools they have used to make sense of their social worlds. Such beliefs may fail to account for evidence that social positions provide some with privileges that help them succeed in ways that may be unjust. Tools for thinking are implicated in both the problems concerning critical educators and their possible solutions.

Context and the Tools for inquiry

Context matters. Individual classroom explorations – attempts to create spaces where students are encouraged to upend stable concepts in favor of less sturdy ones – exist within an expansive architecture to which children have been socialized, which exists before, during and after the particular situation at hand. While old ways of resolving problems may be disrupted in situ, students are also continuously re-engaging with the same topics in other contexts that may support their continued use and cultivation in ways we may wish to question and problematize. As such, change is particularly difficult, tied as it is to an on-going series of highly personal, everyday acts of inquiring, of which the social justice classroom is but one type and location. Dewey's conception of *tools for inquiry* suggests the need for an "epistemological dexterity" – the ability to hold even one's most dependable concepts tentatively, as if they were beliefs.[2] Such work is, of course, both complex and difficult. We are not implying that epistemological

[2] By focusing on what he describes as "world views" Richard Paul uses a much broader categorization than we are describing here, but his arguments about both the incredible difficulty and the importance of subjecting one's most fundamental and solidly held (unquestioned) concepts are right on target. See Paul's (1984) *Critical Thinking: Fundamental to Education for a Free Society*.

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dexterity itself will lead to a necessary acceptance of social justice aims or arguments; it may, however, increase the likelihood that concepts that underwrite social oppression will become questioned.[3]

Focusing on the context of the emergence and use of tools for inquiry – especially with regard to social justice focused education – is important because conceptual tools are learned and *used* in multiple contexts, providing them with varied transactional venues for solidification. Understanding the larger context is important because it may offer additional resources for helping students to engage with these multiple social contexts in critical ways, thereby more directly exploring how they utilize their meaning-making resources in multiple spaces. Again, it is important to emphasize that a tool of inquiry gains usefulness when it helps solve problems, but it does so within an important epistemological background of other, corroborating conceptual resources. This entails considering a concept in its relation to other things: "to note how it operates or functions, what consequences follow from it, what causes it, what uses it can be put to" (Dewey 1933, 137-138). What Dewey means here is perhaps clearest within his discussion of language use and context: To converse successfully with others, we must rely upon a background filled with inquiry related tools like grammar, syntax and vocabulary:

> a vast network of relations surrounds the individual: indeed, 'surrounds' is too external a word, since every individual lives *in* the network and as a part of it. The material of personal reflection and of choice comes to each of us from the customs, traditions, institutions, policies, and plans of these large collective wholes. (Dewey and Tufts 1909, 370)

Dewey also argues: "we are not explicitly aware of the role of context just because our every utterance is so saturated with it that it forms the significance of what we say and hear" (Dewey

[3] We agree with one anonymous reviewer of this paper who stated the point well: "While a greater epistemological awareness by itself is not a simple logical guarantee that one will overturn previous conceptions, it greatly increases the chances for cognitive and emotional confrontations that call for a better resolution."

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1985, 4). He goes on to state that "what is true of the meaning of words and sentences is true of all meaning" (Dewey 1985, 4).[4] Many tools for inquiry may be so stable and implicit in the background of our thinking that we may fail to recognize them while we continue to use them in current projects that simultaneously solidify their use values. In this way, users 'collude' with the tools they use in ordinary interactions, and in so doing, become certain types of people (see Wortham 2005). Dewey argues that such background thinking resources only become apparent when "responsible for some of the confusion and perplexity we are trying to clear up" (Dewey 1985, 11-12). We notice their existence when they fail to resolve doubts or solve the problems that motivate inquiry.

Furthermore, meaning-making tools function in specific locations to solve specific sorts of problems and not others. They help us resolve confusion and doubts, to make meaning in response to particular configurations of social relations and practices that structure our interactions in specific ways. Schools are one such location, requiring unique inquiry tools to resolve the types of problems that emerge within them (see Cazden 2001; Minick 1993). As a result, students may develop school-related tools for inquiry that work within one context – the school – but (similar to category mistakes) we can misapply them to other social contexts. Likewise, schools may contribute to flawed or partial concepts based upon inadequate understandings of the social and political dynamics that shape them. In the following section, we use two school examples—high stakes testing and tracking—to show how contextual background affects the ways tools for inquiry arise and are used.

Mandatory curricular goals and high stakes tests designed to insure that those goals are met in specific ways form the background in which teachers and students develop and then use tools

[4] Dewey describes language as the "tool of tools" because it instrumentally enables us to craft any other sort of tool. Garrison elaborates in his (1995) *Dewey's Philosophy and Theory of Working*. See also Dewey's *Experience and Nature (1925/2000)*.

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for inquiry, often with implications for understanding student intelligence and motivation (Crocco and Costigan 2007). The tools students develop may seemingly resolve questions about ability and interest, but lead to mistaken conclusions. Teachers and students then incorrectly use such judgments as new tools to form general beliefs about students' aptitudes and motivations elsewhere in their lives. Such incorrect judgments emerge from a much broader context where schools have responded to accountability measures and testing pressures to narrow the curriculum while increasing the prescription of both content and pedagogy (Crocco and Costigan 2007). For instance, while many elementary school teachers are spending more time on literacy instruction, they may be required to follow prescriptive "pacing guides" that mandate content and instructional strategies therefore limiting the ranges of literacy experiences students receive to textual decoding and test preparation (Crocco and Costigan 2007, 516). High school teachers fare no better, for while they may not use the same formulaic curricular materials (although text-books can certainly be used in that way), their subject-area mandates are so packed with content-specifics that many teachers limit their primary instructional strategies to lectures, drills and tests, with no space for innovation or student engagement, let alone critical analysis (Crocco and Costigan 2007). As teachers across the country know too well, it results in a narrowed curriculum that focuses on testing to claim legitimacy by aligning itself at least rhetorically "to scientific and positivistic forms of knowing" (Barnett 1993, 35). Boldt, Salvio and Taubman (2009) argue that this "has impoverished the intellectual, aesthetic, and affective dimensions of life in classrooms. Students' interests, curiosity, and play, as well as teachers' passions and questions fall by the wayside as they work together to follow directives and meet production quotas" (p. 3).

While such prescriptiveness is troubling in general, it constitutes the context in which specific inquiry tools help understand students as learners. For example, Diane Reay's (2001)

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research into "high stakes" tests in British elementary schools illustrates that the scores used to assess students may also provide them with tools that they can use for thinking about themselves in ways we fail to understand. Tracey, a year six student Reay describes, expresses nervousness at her prospects for doing well on the Stage 2 Standard Achievement Test (SAT) despite the constant drilling her teachers and peers have done in preparation for the test. She states: "I'm frightened I'll do the SATs and I'll be a nothing" (Reay 2001, 342). When pressed by the interviewer about her statement, Tracey replied that she meant what she said. "You have to get a level like a level 4 or a level 5 and if you're no good at spellings and times tables you don't get those levels and so you're a nothing" (Reay 2001, 342).[5] Another student equated the scores with moral virtue and future life chances. Imagining the prospect of a low score, she remarked, "I might not have a good life in front of me and I might grow up and do something naughty or something like that" (Reay 2001, 342). Reay reports that

> When later in the year I interviewed Tracey, now in year 7 of an inner city predominantly working class comprehensive she told me, unsolicited, that she was a 3, 3, 3. When I asked her how she felt about that, she replied that it was better than being a nothing, but still "rubbish." (Reay 2001, 343)

Reay's transcripts speak powerfully of the influence of educational practices upon student self-conceptions. As a tool of inquiry in her personalized meaning making, the exam helps Tracey understand herself as a "3," as "rubbish."

In this instance, the test score has become a tool of further inquiry. If we return to Dewey's original semantic differences, what Reay describes here exemplifies a *belief* becoming a *meaning*. When Tracey began her experience with the high stakes examination, she was already using the notion of the test score to understand herself and her potential future, a future that was conceptually limited because of what her teachers communicated low test scores represent. After

[5] Note that the expected, or "normal," score for the tests is a 4.

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taking the test and receiving a low score, Tracey's meaning making seems to become more solidified around her intelligence and potential future path. The tentative language is gone. She *identifies* with her low score. But tools for inquiry are also transactional; Tracey's belief further creates the reality that she is not intelligent and motivated: rubbish. As Dewey tells us, "beliefs, made in reality, reciprocate by making reality still farther, by developing it" (Dewey 1906, 114). The test, originally designed as a tool for understanding some aspect of a student's learning, seems to have become a tool that the student uses to understand herself in other, unrelated contexts. We also know that others may also use test results as tools for identifying Tracey as well – further colluding in the solidification of this tool for thinking.

Tracey's use of the test as tool in other areas of inquiry is a violation of what Dewey describes as the Unlimited Universalism Fallacy (Dewey 1985; Garrison 1997). When judgments about students' intelligence, interests in learning, and even moral natures are universalized and disconnected from the contextual frameworks (i.e., school practices) in which they emerge, educators and others—parents, policymakers, prospective employers—are guilty of using tools for inquiry in contexts and to solve problems in ways that are *unwarranted*. Dewey reminds us that, "when context is taken into account, it is seen that *every generalization occurs under limiting conditions set by the contextual situation*" (Dewey quoted in Garrison 1997, 113, emphasis added). Similarly, Garrison (1997) argues that using inquiry tools in this way helps educators become "blinded from seeing students' strengths and potential" through using "superficial and decontextualized instruments and means used to measure intelligence and ability" (Garrison 1997, 186). Here again arises the need to focus on the context of inquiry – specifically upon the background conditions of schooling which 'culturally sponsors' casting students in particular ways. Tools for inquiry emerge as successful resources for making meaning in the school context, and in so doing they move from beliefs to potential concepts.

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High stakes test scores is but one example of an inquiry tool that arises and is potentially solidified in the specific context of schooling, but there are other tools and contexts to consider. For example, the routine practice of academic tracking may also inspire the development of inquiry tools that subvert the aims of critical pedagogy and aid student resistance to justice-focused inquiry. Tracking advocates argue that it is a merit-based scheme whereby students are divided by their natural abilities and interests into differentiated instructional courses (Ansalone 2001; Oakes 1987, 1990). Because academically tracked class assignments are reportedly developed using a variety of factors—students' prior academic records, test-measured abilities, their career aspirations—tracking proponents argue that it is both an efficient and beneficent sorting mechanism. But like test scores in the last example, because they are not contextualized, academic tracking may inspire the development of tools for inquiry that help both students and teachers understand students' primary motivations and intellectual capacities in damagingly inaccurate ways.

For example, while academic counselors often consult students' past records to determine track placement (Oakes et al. 1992; Mehan et al. 1996; Ball 2003), students of color and lower socio-economic classes disproportionately populate non-academic, vocational, and lower tracks (Oakes et al. 1992). Similarly, girls are frequently tracked into academic courses that prepare them for caring and administrative support positions (Oakes 1987, 1990; Plummer 2000). Consider also the research focused on the "self fulfilling prophecy" of tracking placement with regard to racial and social class identities. As a number of early research studies demonstrate (Persell 1977; Dornbusch, Glasgow, and Lin 1996), track placement may influence teacher perceptions of student abilities in powerful ways, forming a "self fulfilling prophecy" of tracking placement with regard to racial and social class identities. Teachers of lower tracked classes considered their students to be "unresponsive" and less intelligent, while they deemed their

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higher-tracked students to be quite bright. This had practical consequences: "Videotaped interactions revealed that teachers spent more time attending to students who were randomly labeled as having greater academic ability than to students randomly labeled as having less ability" (Dornbusch, Glasgow, and Lin 1996, 410; see also San Antonio 2004, 149). A study by Ellen Brantlinger gives language to this: one interviewed teacher considered the college tracked students to be the "best," the "brightest" or the "good kids," while the others are "troubled" and "less interested in school"(Brantlinger 2003). It is not surprising that research also indicates that students in such tracked classes develop beliefs about themselves as students (i.e., aspects like intellectual capacities and motivation to pursue schooling) that mirror those expressed by their teachers (Gamoran and Berends 1987; Reay 2001; San Antonio 2004). While this arrangement can be read as evidence of social reproduction (Gamoran and Berends 1987), within the context of this discussion, we argue that academic tracking inspires the development of different tools for inquiry—i.e., understandings of one's and others' intellectual capacities—that are then readily available when they make meaning about their own and others' academic interests, intellectual talents, and future goals. Here we are implicating tools for inquiry in the psychologizing and rationalizing of social reproduction through routine school processes, which may manifest as 'resistance.'

The preceding discussion of how context influences the development and solidifying of our tools for inquiry is important to critical pedagogy because school practices like high stakes testing and academic tracking help create a background through which teachers and students develop responsive and useful tools for inquiry that help them make meaning within the institutionally specific demands of schooling. This can foster a general lack of appreciation for how concepts function as tools in problem solving in a wide variety of domains including the personal and the academic, helping identities "thicken" over time, with real implications

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(Wortham 2005). Mostly such tools for inquiry lie "below the level of reflection" (Dewey 1980). In this context, student resistance to critical pedagogy may be in part predicated on their lack of experience with recognizing and consciously experimenting with how tools for inquiry guide our meaning making in a wide variety of contexts. Dewey emphasizes that doubting one's conceptual tools may be emotionally and intellectually challenging, even when done apart from loaded topics like those associated with critical pedagogy: "It is dangerous to reflect seriously upon the nature, origin, and consequences of beliefs. The latter are safest when taken for granted without reasoned examination. To give reasons, even justifying ones, is to start a train of thoughts – that is, of questionings" (Dewey 1985, 19). In addition, taking context seriously requires epistemological analyses about the origins and nature of different beliefs, meanings, and concepts. This is complex work that takes time and energy, and at present it seems remote from the priorities given to schools. Regardless, individuals go on living and making decisions in a complex world despite the fallibility of the reasoning tools at hand. One implication of this argument is that critical pedagogues should not only focus on the *content* of issues like race and gender, but also upon the general academic context in which critical pedagogy is situated. Critical pedagogy can benefit from giving increased attention to the way tools for inquiry function more generally in schools. By also focusing on the ways tools for inquiry guide thinking within academic disciplines, it may become possible to help students develop the epistemological dexterity needed to explore how social justice works in contexts that are less personally threatening and emotionally demanding.

The Tools for inquiry in the General Curriculum

We have highlighted Dewey's notion of *tools for inquiry* and have argued for its epistemological importance in social justice education. We have also argued that tools for

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inquiry are shaped by, and shape, the contexts in which problems are solved, often with real implications for individuals and groups. In this section, we turn to a practical consequence of our argument, suggesting that we can fruitfully begin to get the "train of thoughts" moving, as Dewey might say, by helping students understand how conceptual tools influence the ways they make meaning in non-social justice topics found within the general curriculum. Doing so may mitigate the 'resistance' that surrounds beliefs about aspects of students' lives like those associated with gender, which can be felt as highly personal. We cite research illustrating how students can actively explore tools for inquiry within content areas in ways that can extend to support social justice aims (discussed in the final section). Examining how tools for inquiry guide thinking within a subject matter area may be productive because students may not have had the opportunities to use the tools being explored to solve problems and make meaning in their personal lives, and they rarely would be personally incriminated by them. As such, the tools are—psychologically at least—less solidified and already tentatively held. To use Dewey's language, they are at the level of beliefs, not concepts.

The current science education literature is replete with discussions of the benefits of and techniques for helping students approach scientific inquiry as if they were apprentice scientists. Many educators now seek to help students engage in "authentic" scientific inquiry projects, rather than presenting them with uncontested scientific "facts" for memorization. Such experiences foster the conditions in which students conduct developmentally appropriate yet relatively sophisticated scientific inquiry – including the development of hypotheses, experimental design, and data analysis (Rudolph 2000). These approaches contrast with staged experiments in which teachers arrange inquiry topics, hypotheses and experimental designs for their students. The latter represents a more conventional approach to the study of science in which students seek to "discover" pre-established answers and are at least partially (and

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sometimes wholly) graded on whether or not they "got it right" (Trumbull, Bonney, and Grudens-Schuck 2005). Trumbull and colleagues criticize the latter approach, which they call "confirmatory" experiments, because it fails to help students explore how our tools for inquiry function in meaning making:

> Schools continue to emphasize confirmatory exercises that require students to follow explicit procedures to arrive at expected conclusions. …Students thus are rewarded for following directions and for obtaining predetermined correct answers. Consequently, students fail to learn habits necessary for conducting scientific inquiry, such as observing carefully, using theory and observations to formulate hypotheses, designing ways to investigate hypotheses systematically, analyzing and interpreting data, or other aspects of investigations. (Trumbull, Bonney, and Grudens-Schuck 2005, 880)

Such approaches to teaching science not only do harm to the scientific enterprise—teaching students how to do school rather than to engage with science (Lemke 1982)—they ask students to accept tools for inquiry as already solidified, as answering questions without providing them with opportunities to explore how they function as meaning making tools. Echoing Dewey, Sandoval (2005) argues that if students do not have to decide what kind of data to get, they are unlikely to engage in epistemological considerations of what kind of data would be appropriate. If they are not responsible for coordinating data with particular claims, they are unlikely to consider the bases upon which particular claims might be warranted. In Kuhnian terms, students (and perhaps teachers) are taught to be unaware of the paradigms in which they work (Kuhn 1996). Chinn and Malhotra argue that, as a result, "students are likely to fail to learn the heuristics scientists use to reason under uncertainty" (2002, 213). They conclude that "there has been little development of inquiry tasks that enable students to learn how to reason about methodological flaws or how to coordinate theories with multiple studies that may conflict with each other" (2002, 213). One caveat: it is not that guided discovery is *never* appropriate, for even teachers who engage in "authentic" approaches to the study of science may have to supplement open-ended inquiry with highly structured experiences to help students develop the skills

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necessary for reasoning autonomously. The matter is one of emphasis, and does not preclude the judicious use of guided instruction.

Stewart and Rudolph (2001) provide an example of how high school science teachers can engage students in an examination of how tools for inquiry influence knowledge claims within the context of the general science curriculum. They describe a high school evolutionary biology curriculum designed to challenge students to explore how researchers' "fundamental assumptions about the natural world" (Stewart and Rudolph 2001, 220) influence their interpretation of data. To do so, students were introduced to three divergent conceptual frameworks to explain evolution, two from within a traditionally acceptable tradition; Darwin's natural selection model, and Lamarck's "model of use inheritance;" (Stewart and Rudolph 2001, 218) (2001, 218)with the third from Paley's intelligent design theory. Students were given access to data sets and asked to use the different conceptual frameworks to "develop explanations for a particular phenomenon, such as the shape of the carapace in Galapagos tortoises or the seed coat texture and thickness in a hypothetical species of plant" (Stewart and Rudolph 2001, 218). (2001, 218)The focus of the unit was not the transmission of information – but rather to help students analyze data through the three conceptual frameworks to help them explore how each influences scientific meaning making.

The researchers reported that students developed explanations for the evolutionary process based on the different resources of the three different models provided, achieving relatively sophisticated understandings of the ways that the three theoretical frameworks influenced their data interpretation. Because this example contributes to the development of the type of epistemological dexterity we are advocating here, the researchers' discussion is worth quoting at length:

> Key to this section of the course is student exploration of the disciplinary context of each of these three models, focusing specifically on the fundamental

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> assumptions about the natural world on which the various models are based. Darwin's model, for example, posited the existence of species capable of transformation by means of naturalistic forces continuously acting in the world. Paley, on the other hand, assumed the fixity of all species and required the action of metaphysical forces for the initial generation of species. Our goal here was not to lay out in detail the disciplinary structure of each of these models, but rather to simply illustrate the emphasis of this curriculum on the conceptual structure of models dealing with species of diversity. Once students understood both the general conceptual structure of these evolutionary models (that they were developed to account for a particular set of data and depended upon a given array of methodological and metaphysical assumptions) and the specific mechanisms of each, they were prepared to engage each other in debate over the relative adequacy of the models in addressing various empirical problems subsequently presented in class. What emerged in class discussions was a dialogue about the proper and improper use and evaluation of the competing models. (Stewart and Rudolph 2001, 220)

In conclusion, Stewart and Rudolph observe:

> Given the assumptions of any one of the three models, students found that the related model was often perfectly adequate for solving a variety of…problems. (Paley's intelligent design model is a particularly good example of a model with such broad explanatory power.) After recognizing the validity of each model in its own context, the comparative adequacy of the assumptions associated with the various worldviews rapidly became an issue. (p. 220)

Stewart and Rudolph's example directly addresses how knowledge emerges from within the use of specific conceptual tools for inquiry. The teachers created valuable opportunities for students not only to use the different conceptual frames as tools for further inquiry, but also to reflect upon the socio-historical contexts that gave rise to each of the three frameworks they employed. The teachers helped their students contextualize knowledge as emerging from specific inquiry processes, and, it is important to emphasize here, to engage in critical analysis of those frameworks and their influence on further knowledge construction. It provides one model for the approach we are arguing for, which is raising conscious awareness of tools for inquiry as a general method for developing an epistemological dexterity to support the aims of critical pedagogy.

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Integrating Social justice education and General Curriculum through the Tools for inquiry

In this final section, we move from the general curriculum to topics associated with social justice education like racism and sexism. Similar to Sandra Harding's (1991, 1993) notion of "strong objectivity," we argue that attending to social justice concerns – specifically issues related to how power and social oppression influences discipline-specific inquiry – enhances the disciplinary study regardless of whether or not it furthers social justice aims. But given the frame of tools for inquiry, we suggest that doing so can help advance the more specific, justice-oriented aims of social justice education by helping students analyze how the justice-related social context influences how we make meaning. For the sake of continuity, we again situate examples within science education, but now focus on ones that overlap with justice concerns.

Feminists in particular offer important critiques of how issues of social justice corrupt scientific inquiry tools. Helen Longino (1990) argues that sexism influences the norms driving research; masculine-defined priorities are given more support, and they produce answers that privilege patriarchal gender relations and obscure oppression. Eisenhart and Finkel (1998) argue that women's underrepresentation in science fosters a masculinist bias in the sorts of questions asked in research projects. (1998)For example, they argue that, "problems associated with conceiving a child have, until very recently, received little attention. The focus of work (generally by male researchers) has been on contraceptive techniques and devices to be used by women to prevent contraception"(Eisenhart and Finkel 1998, 26). One can conceive of such biases as consisting of tools for inquiry acting in collusion with the distribution of resources and the gendered composition of research teams to set the parameters for what is most valuable to know and to learn.

A classic, albeit radical example of this critique is clear in how early male scientists interpreted analyses of semen through microscopes as miniature men (with arms and legs):

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"Their observations were framed not by what they saw through their microscopes, but by what they expected to see based on Aristotle's 2,000-year-old idea that women are passive incubators in conception" (Kleinman 1998, 843). While such an example may seem absurd today, the influences may subtly remain. For example, the remnants of patriarchy emerge clearly in Evelyn Fox Keller's (1997) historical account of developmental biology. Keller describes a relatively recent "paradigm shift" in embryonic research in developmental biology due to the abandonment of the sexist metaphors that guided research since the 1920s. She argues that the metaphors prevented researchers from inquiring into embryos in important and alternative ways. The previously dominant discourse was of "gene action," a way to understand the embryonic cell's gene as the driving force in the cell (the masculine part of the cell) while the protoplasm was conceived as feminine. The protoplasm was considered to be passive and relatively unimportant, thus not worth researching:

> By the discourse of gene action, I mean a way of talking about the role of genes in development, introduced in the 1920s and 1930s by the first generation of geneticists, that attributes to the gene a kind of omnipotence – not only causal primacy, but autonomy and, perhaps especially, agency. Development is controlled by the action of genes. Everything else in the cell is mere surplus. …This way of talking not only enabled geneticists to get on with their work without worrying about what they did not know; it framed their questions and guided their choices, both of experiments worth doing and of organisms worth studying. (Keller 1997, 22)

For the next forty years, Keller argues, embryonic research was guided and inhibited by this masculinist conceptual tool. Today, researchers have reconceived the relationship between cytoplasm and genes and argue that the cytoplasm plays a critical role in the "structure of the egg prior to fertilization, is widely regarded as pivotal in the recent renaissance of developmental biology. But it did not depend on new techniques" (Keller 1997, 21). Scientists forty years ago could have used existing technology to advance their research had they adopted a different conceptual framework. Thus, the example demonstrates how tools for inquiry influence the

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knowledge claims one might make about a subject; in this case, it took feminist scientists to rethink the fundamental metaphorical grounding of a field of inquiry to make progress toward understanding embryo development in productive ways. Keller's (1997) example highlights the importance of attending to the tools for inquiry – in her case the metaphorical framework scientists use to make sense of embryos – because they influence the questions scientists ask about embryos as well as their interpretations of the data they collect in their research projects. Furthermore, her example also exemplifies Dewey's argument that rethinking a tool of inquiry can be difficult because it remains in the background as something that is perceived to be stable. In this case, the background tools still guided inquiry even when they failed adequately to resolve the scientific questions raised by the research community.

School science and epistemological dexterity. Feminists' arguments about the influence of gender beliefs on inquiry have led to calls for teachers in schools to help students analyze knowledge claims in more sophisticated ways that parallel the arguments we are making here with regard to the tools for inquiry. For instance, Maralee Mayberry recommends that educators should

> demonstrate early on that the facts and concepts they are presented with are relative to a certain system of thought or worldview. That will empower students to gain an understanding of how all knowledge is constructed within a social context. Even the seemingly benign fields of math and physics can be understood and taught as contextualized disciplines. (Mayberry 1998, 452)

Elaine Howes (1998) provides a specific example of such epistemological study. Howes describes a sophomore-level high school biology unit in which students work in groups to study prenatal testing and then present their findings in role-plays. She asks students to consider

> Why is the doctor recommending this test? During what time period in the pregnancy is this test used? What, specifically, do geneticists and doctors use this test to find out? What are the possible dangers of this test? Would you choose (or

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> encourage your wife to choose) to have such a test?[6] Do you think that women should be required to have such tests? (Howes 1998, 882)

During the process of their personalizing the issues associated with the various prenatal testing choices facing them, students took on different perspectives – from those of doctors and nurses, to those of the pregnant women and other family members. As a result, students explored how one's social position influenced what sorts of questions one might ask about the tests as well as what criteria were most important in making decisions about their role within pregnancy. For example, students concluded that much of the science literature focuses on the fetus and gives very little attention to the needs and concerns of the mother (Howes 1998), a power-related dynamic that has important implications for understanding the relationship between scientific and social practices in prenatal testing.

Howes (1998) argues that students' scientific inquiry processes were linked to their individual perspectives and the resources they drew on to guide inquiry. She demanded that students focus their study on pregnant women in ways that were previously not encouraged by the tone and scope of the scientific literature the students were consulting. Unlike the example regarding evolutionary biology we discussed earlier, this example has the potential to personalize the inquiry to an even greater degree while still helping students explore how their meaning making tools influence what they come to know. Because of the personal nature of Howes' unit, the related gender dynamics became part of students' conceptual toolset for understanding prenatal issues, providing an example of how social justice concerns can be mobilized as part of the general curriculum by focusing on tools for inquiry.

[6] Howes regrets her framing of the relationships in the unit within the limited bounds of heterosexual marriages, arguing she should have adopted more inclusive terms.

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Conclusion

We began this discussion with the story of Charles Darwin finding a tropical shell in a surprising location. The tale is one where the background beliefs of scientific inquiry justifiably helped Darwin's teacher and more experienced geologist reject the find as evidence of a new way of interpreting geological history. We return to it to emphasize that while the ensuing discussion has focused on the ways tools for inquiry can lead one to make unwarranted assertions about the world, especially the social world of the school, such thinking tools are nonetheless essential for inquiry of any sort to proceed. As we also argued at the opening, one of the essential goals of classroom inquiry guided by social justice education is to help students explore how power relationships associated with specific topics of social justice like race, gender, social class, and sexuality influence how they understand themselves and their social worlds. Such work is personal—and personally implicating—and as thinking resources become more solidified with *use*, asking students to question what have been successful tools for making meaning may be a threatening and disorienting process *in itself* even without the more difficult emotional challenges associated with interrogating aspects of one's own identity like gender or race.

The analysis also supports and adds a crucial dimension to Applebaum's thesis that resistance to social justice education consists of at least two mutually reinforcing dynamics: students' refusal to *think with* new conceptual resources and their *persistent use* of ones that support oppression. We argue that we can help students prepare for thinking with the emotionally-charged conceptual resources offered in social justice education by helping students gain experience and comfort with epistemological analysis by emphasizing tools for inquiry, including within the context of specific general curriculum disciplines. Doing so may minimize the emotional attachment that surrounds social justice beliefs that students actively use. (We

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emphasize that we are not trying to 'soften the blow' to individuals who suddenly come to terms with oppression—rather, we are proposing a kind of developmental approach to delivering it.) It is important to emphasize that when critical educators ask students to think about a topic like gender, they do so amidst an established context in which students are actively making meaning about the very object of inquiry they are offering. Unlike the study of race or gender, engaging in an analysis of how a conceptual resource guides meaning making within another area of academic inquiry may be more developmentally appropriate. The topic explored may be removed enough from their immediate social experiences that they do not bring solidified and *immediately used* tools for inquiry into the classroom experience. As a result, students may be able to develop more epistemological dexterity, the ability to explore and understand how their tools for inquiry help them make meaning and to resolve questions within the context of general academic study. In this way, the general curriculum can support the sort of epistemological dexterity needed to support critical pedagogy in both direct and indirect ways.

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