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Replacing the 'View from Nowhere': A Pragmatist-Feminist Science Classroom.

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Teachers and Problematic Philosophies of Science

Few people would contest the importance of science teachers having an understanding of and appreciation for the history and philosophy of science. Teachers' beliefs in these areas of their profession influence their behavior when teaching science and when implementing approaches to science outlined in curricular and pedagogical guides (King, 1991; Pajares, 1992). In this way, the teachers' philosophies of science effect their doing, or sociology, of science. While they tend to retain certain buzzwords from their science methods courses that are linked to philosophical positions, such as "student-centered" and "hands-on", some teachers do not maintain new epistemological orientations toward science introduced in philosophy of science courses, if they enroll in these courses at all (Levitt, 2002; Lederman, 1992). In other cases, teachers have consciously tried to enact new philosophies in their classrooms, but revert to their old ways when confronted with difficult situations or when confronted with content new to them (Wallace & Louden, 2000). In still other cases, teachers are unaware of the underlying philosophy of science guiding their teaching and inadvertently adopt the positivistic stance that dominates popular images of science and its history. For unclear reasons, progress in philosophy of science has historically been slow to reach the classroom. Instead, classroom practice often continues to adhere to outdated and problematically founded understandings of science—

Those teachers who acknowledge holding a traditional view of science—a considerable proportion of teachers—describe it as "objective, empirical, and involved with issues of the control of nature" (Pomeroy, 1993, p. 269). Correlatively, they view science as a collection of proven facts (Aguirre, Haggerty, and Linder, 1990) and understand their role in the science classroom as distributors of these facts (Tilgner, 1990; Gallagher, 1991). This notion of science renders them local authorities, as they are the only participants in the classroom who dispense the timeless truths of science. Admittedly, science as a stream of factual truths independent of human influence can be a practically preferred form of knowledge in schools, popular culture, and elsewhere. It packages the truths of the world as easily transferable commodities: they travel well in texts, transfer well into notes, and test easily.

In this paper I will delineate this popular, though often unacknowledged or misappropriated, philosophy of science in terms of the "view from nowhere". Like many before me, I believe that thorough, accurate, and useful science education requires a refined understanding of philosophy of science on the part of the science teacher (King, 1991; Gallagher, 1991; Ryan & Aikenhead, 1992). This article explains problems with the dominant philosophy underpinning many classrooms and attempts to flesh out an improved one. In part, I analyze teachers' philosophies of science by studying their classroom practice. This sociological perspective allows me to see how guiding theories do and do not play out in the doing of science within the classroom.

Admittedly, the process of encouraging some teachers to critically examine their own philosophies of science and introducing them to this new approach in an understandable and sustainable way is far from easy. My purpose here, rather, is to lay a theoretical grounding for an

improved philosophy and to offer a rough sketch of some of the ways in which it might take shape in the classroom. Hopefully my argument will persuade teachers and teacher educators who cling to the view from nowhere, consciously or not, to rethink their philosophical framework. My intent is not to abandon these teachers upon saying their view is mistaken, but rather to suggest and illustrate a more robust alternative. In particular, I offer pragmatistfeminism as an area of scholarship which is sensitive to their local concerns, while intent on fleshing out a useful philosophy of science driven by social justice and human need to live in and know the world well.

The Rise of Aperspectival Objectivity

The "view from nowhere" expressed by Thomas Nagel in 1986 is indicative of a notion of objectivity that has developed since the Baconian revolution of science in the 1700's. It continues to operate as the dominant framework for conceiving science in the science classroom, despite having been discounted by most contemporary philosophers of science. The Baconian revolution called for an impartial approach to discovering facts of an absolute reality, which eventually grew into a concern with standardizing scientific inquiries through the use of the scientific method in the 1800's. More recently, objectivity has been conceived as aperspectival and devoid of human biases (Daston, 1994; Solomon, 1998). This notion is most closely aligned with the type of objectivity that we see operating in Nagel's work. Through pedagogical, curricular, and sociological analyses of classrooms, aspects of each historical conception of objectivity, and especially that promoted by Nagel, become evident. I argue that the conception of objectivity as the view from nowhere cannot and should not be maintained in the science classroom any longer.

Nagel presents the view from nowhere as a method of understanding that is the ideal

framework for approaching epistemological and scientific endeavors. This notion is primarily concerned with reaching a perspective that is not tied to humanness, values, or the world as we interpret it. Hence, it attempts to achieve a standpoint for explaining the world that is detached from any particular perspective. Operating under a correspondence theory of truth, it aims to mechanistically match descriptions of reality with supposed actual states of affairs, regardless of whether these accounts make sense with lived experience. The view from nowhere strives to see the world in all of its objective, absolute reality and, thus, to derive impartial truths. Nagel does admit that, as humans who necessarily interpret the world through filters of experience and preferences, we are never completely able to overcome some aspects of our subjectivity and therefore can never totally achieve objectivity. Nonetheless, he maintains that we should strive to achieve the most objective standpoint we can by continually repeating the process of detaching ourselves from any particular perspective as we practice science.

Many teachers, some consciously and others inadvertently, have adopted similar beliefs regarding science and objectivity, asserting that science is absolute, factual, and not subject to creativity or values (King, 1991; Pomeroy, 1993; Dickinson, *et al*., 2000). A large portion believe science education should be geared toward "discovery learning"—that being discovery of the facts which compose objective reality (Abell & Smith, 1992; Gustafson, 1995; Skamp & Mueller, 2001). They also believe good science is free from human biases and emotions. In these ways, they uphold the view from nowhere as the best approach to objective science. A large number of teachers have accepted this stance without critically examining the epistemological and ontological assumptions it entails.

Many feminists would argue that those teachers are adopting a stance that is incompatible with their lived experience. Striving to achieve this ideal objectivity entails a belief in

disembodied, aperspectival knowledge that most feminists argue is simply not possible. Traditional empiricists hold that the subjects of knowledge are supposed to be transhistorical, homogeneous, unitary, and disembodied. Many feminists, however, believe that people (the subjects of knowledge), the objects of knowledge, and knowledge itself are always socially and historically located and are, therefore, tied to embodied existence and embodied ways of knowing (Harding, 1993). Additionally, they recognize and appreciate differences amongst perspectives.

If teachers consider the ways in which they have come to know the world, I believe they will discover that knowledge largely stems from bodily experience and transaction of information between people, rather than through a process of distancing their thought processes from themselves in accord with an often narrowly defined method. They may also find that the knowledge which they value most does not necessarily correspond to an absolute reality, but is that which is most useful in their attempts to lead the best lives possible in the world as they experience it. In this way knowledge and value are not fully distinguishable. If credence is granted to this argument, objectivity as an aperspectival approach to discovering facts about an absolute reality is overturned as nonsensical and not necessarily of use for living well in the present or foreseeable future.

According to most feminists and some pragmatists, the acknowledgment of both subject and object as historically and politically situated requires that the subjects and objects of knowledge be placed on a more level playing field. When this is done, objectivity, as a form of responding to the rights and well being of fellow subjects as well as the objects of scientific inquiry, must be considered (Heldke & Kellert, 1995). Objectivity, then, is achieved to the extent that responsibility in inquiry is fulfilled and expanded. It follows that scientists must be

held accountable for the results of their projects and that scientists must acknowledge the political nature of their work. Objectivity understood as such implies relationships between people, objects, and inquiry projects as central to its conception (Sullivan, 2001).

This understanding differs greatly from the view of science operating in the curricular and pedagogical practices of many teachers. Those teachers tend to emphasize technical knowledge that describes sets of evidence or events in precise, mechanistic, and reductionistic ways and ultimately attempts to exercise controlling power over the environment (Pomeroy, 1993). This type of knowledge typically follows from an observation of or experimentation upon an object and, hence, there is no equal or reciprocal interaction between the inquiring subject and the object of inquiry (Oliver, 1990). Further, as Matthew Weinstein (2001) points out, the *National Science Education Standards* themselves focus almost entirely on the role and perspective of the scientist in the classroom. Thus, they exclude the interests and perspectives of the objects with which they work and the other people involved in their larger inquiry project (p. 231).

By adhering to these standards, teachers present science as an activity done for and by scientists only. It can be implied from the stereotypical and disproportionate group of scientists employed in our country, that this is a project for a select group of highly intelligent white men in lab coats. Students as young as kindergarten and practicing teachers have been shown to portray scientists along these stereotypes (Barman, 1997). The word 'scientist' itself is packed with prestige and power, a self-concept differing greatly from, for example, a shy eighth grade science student interested in how the local water table affects the cleanliness of tap water in her neighborhood. This child may feel isolated from the community of inquirers. She may think her project is insignificant compared to those of 'real' scientists—despite the fact that her work may

improve the health of people, animals, and water life in her area.

Insights from Pragmatist-Feminism

Philosopher Richard Bernstein (1991) describes the ethos of pragmatism as revolving around "the themes of anti-foundationalism, fallibilism, the social character of the self and the regulative ideal of a critical community, contingency, and pluralism" (p. 338). This social spirit concerns concrete issues in the world, including oppression, and theorizes them from plural locations while also experimenting with them in specific contexts. It is a framework compatible with the larger aura of science insofar as it inductively forms theory from experience and tests theory in experience in attempt to solve problems in the world. With a substantial history in educational theory, pragmatism links education and science as essential to good living. Within education, pragmatists focus on the habits of good living which students develop; these include habitual attitudes toward and responses to science.

While hard to define feminism as a whole, many elements of feminist thinking compliment and extend the pragmatic approach. Feminists also share concerns with practical problems, particularly those of oppression, existing in the world. They encourage social exploration and theoretical explanation of these problems from a variety of positioned perspectives. Of particular note, feminists argue for pluralism by drawing attention to the unique perspectives of women as well as the mediated experiences of people inhabiting all perspectives. Extending pragmatic concerns with the contexts of problems and theorizing, "Feminism cogently and extensively shows how gender, race, class, and sexual preference are crucial parts of context that philosophy has traditionally neglected" (Seigfried, 1996, p. 39). The pragmatic ethos guides feminist questions about inequity, social responsibility, and promoting satisfactory living for all people in all situations.

While both traditions overlap in these ways, pragmatist-feminists consciously combine the two so as to magnify and apply the pragmatic outlook to feminist concerns and vice versa. When combined, pragmatism and feminism work together to provide a robust philosophy for interpreting the world, including the world of science and the value of objectivity it upholds. It forms a unique, socially responsible framework for understanding science as well as an intricate connection to education as a simultaneous site of real-world problem solving. Importantly, pragmatist-feminism promotes working hypotheses rather than adherence to strict rules, for the former allows for growth and change when the philosophical approach proves to no longer be satisfactory (Sullivan, 2002, p. 230).

Delineating the pragmatic notion of truth central to pragmatist-feminism will be helpful for understanding its appropriateness as a replacement framework for the science classroom. Moreover, this criterion for truth and the more robust sense of objectivity I will later describe show how this scientific framework differs from more general social constructionist approaches. Unlike the "view from nowhere" system which holds a correspondence theory of truth, pragmatists believe ideas become true insofar as they 'work' for us, profitably combine our experiences, and lead us to further experiences that satisfy our needs. Pragmatists, like William James and John Dewey, are concerned with the concrete differences in our lived experiences that an idea's being true will make. Unlike the correspondence theory of truth that underlies empiricism, "pragmatic truth is not the agreement of proposition with reality, but an expression of the anticipated or actual successful completing of a worthwhile leading" (Haddock Seigfried, 1990, p. 294).

Truth is something which occurs when the goals of human flourishing are satisfied, at

least temporarily. Pragmatic objectivity, then, comes to concern embodied and dynamic relationships between people and the world in which they live and cannot be strictly confined to absolute and unchanging truths. This is an enticing framework which compliments lived experience and is aligned with social justice goals—values of good living which cannot be completely distinguished from factual knowledge of the world. It is my hope that science teachers concerned with improving the world as well as their students' knowledge of it, will find it compelling.

Thus far, it has become evident that pragmatist-feminists call the role of perspective into play. They disavow the possibility of a transcended view from nowhere, existing as disembodied and transhistorical. Interestingly, the feminists' focus on perspective was nearly historically paralleled by developments in science itself, such as relativity theory and the Heisenberg uncertainty principle, which also called the existence of an observer-independent standpoint into question (Crowder & Warburton, 1995; Roth, 2000). Some feminists with pragmatic concerns, like Lisa Heldke and Stephen Kellert, hung on to the conception of objectivity as independent of a *particular* perspective, but instead suggested that objectivity is best achieved by actually including a maximum number of concrete perspectives (1995, p. 372). Pragmatist-feminists like these fashion objectivity through interdependencies among multiple and diverse perspectives, while maintaining rigor and critical capacities.

Concerns with the inclusion of multiple perspectives can be traced to Sandra Harding's early work on feminist standpoint epistemology (1986, 1993, 1994) that supports a different notion of objectivity. With roots in the Hegelian master/slave relationship, feminist standpoint theorists argue that women, as oppressed people, are able to notice the oppressor's failure to fully achieve his or her proclaimed objectivity. Often, these women are able to point out the

andocentric and sexist underpinnings that affect the results of scientific studies. Science, then, would benefit by beginning from the lives of women in that they could contribute the pluralistic and diverse viewpoints needed to unmask the harmful prejudices acting in some scientific endeavors. Interestingly, some students already hold similar views as indicated by a 1992 survey of high school students in which 11% agreed with the statement, "women would make somewhat different discoveries because, by nature or by upbringing, females have different values, viewpoints, perspectives, or characteristics such as sensitivity toward consequences" (Ryan & Aikenhead, p. 569). While not entirely expressing Harding's view that the oppressed have a more objective stance than the oppressor, these students do show an inkling that women, as a uniquely positioned group, may have key insights and traits to lend science by virtue of their position.

Feminist standpoint epistemologists argue that women's experiences provide the foundation from which important scientific questions rise and that women can be a starting point for achieving maximal objectivity. Although Harding acknowledges the situatedness and valueladenness of the human perspective, she still maintains a conception of objectivity in her early work that is more closely aligned with that of traditional empiricism. She believes that a more clear, representationalist, vision of the world can be uncovered by starting from the lives of women. Nonetheless, science can profit by starting from the lives of the oppressed and this aspect of the feminist standpoint theorists' understanding of objectivity, one in accord with pragmatic situated pluralism, will be useful for constructing a new, pragmatist-feminist notion.

Many science teachers uphold the scientific method as a procedure for maximizing objectivity through overcoming human values, emotions, and opinions (Harding 1993; Gardner, 1998). They tend to see the world of science as hierarchical and competitive, where the most

objective and value free scientists and theories prevail through adherence to said method. By way of teachers, media, and other cultural influences, this belief has trickled down into the viewpoints of students. Resultingly, the majority of students shun the role of contextual values and support the statement that "the best scientists are always very open-minded, logical, unbiased, and objective in their work" (Ryan & Aikenhead, 1992, p 568).

Some feminists, however, embrace those unwanted values that science teachers see as subversive to methodological knowledge and not capable of being consistently tested by empirical experiments. Alison Jaggar (1998), for instance, holds that emotions are essential elements of knowledge construction, play an intentional aspect in judgment making, and influence the way we observe the world. Due to their intricate and inseparable link to human life, emotions cannot be removed through an appeal to a standardizing method. On the contrary, emotions can be constructively used while practicing science. For instance, joy at a discovery may lead an inquiry in a new direction or fear may indicate a problem with the study at hand. Teachers should encourage students to recognize and respond to these emotions.

Douglas Allchin (1991) argues that many of our cultural and ethical values may actually bolster those of science. He asserts that "some values in science govern how we regulate the potentially biasing effect of other values in producing reliable knowledge. Indeed, a diversity of values promotes more robust knowledge where they intersect" (p. 1). A chief example of such a regulatory value would be a commitment to democratic interaction. Enacting democratic dialogue and consensus (albeit temporary) in the classroom, can potentially provide policing of harmful biases operating in some inquiry projects. Granted, however, democracy is also capable of maintaining those biases as well. When democratic attention is explicitly directed toward oppressed, multiple, and diverse perspectives, though, the chances of this problematic

maintenance occurring are minimized. Finally this attention shapes the resulting knowledge in ways that make it more trustworthy than simply socially constructed science.

On another note, pragmatist-feminists are concerned with the political nature of science and its ability to bring about social change. John Dewey, a key pragmatist educational philosopher, strongly supported a contextually immersed notion of the scientific method as a way to verify ideas as pragmatically true and ultimately bring about changes needed to adapt to and improve the human condition. Within the practice of science, Dewey argued that scientists must be honest with their data and must take social factors into consideration, thereby achieving a new type of socially conscious objectivity that serves a functional purpose. Unlike many science teachers, however, Dewey and James strongly contended that truth is not reached at the conclusion of one practice or a certain number of repetitions of a precisely patterned scientific method. Instead, the inquiry process must be carried on continually, with constant revision and expansion in order to get at a fuller view of lived experience, rather than just partial abstractions or collections of facts relevant to technical subject matter. Pragmatists call for praxis between these partial bits that can practically help us meet our immediate needs through action and the larger theoretical goals of answering enduring (and perhaps unanswerable) questions about life through reflection (Rescher, 2000, p. 110). The truths that arise out of this process, then, are temporary, falsifiable, and more aligned with goals of improving life.

Implementing a Redefined Objectivity

Through this discussion of pragmatist-feminist objections to objectivity conceived as the view from nowhere, a new form of objectivity is being shaped. This reformed conception is a responsible and socially conscious objectivity that is achieved at the intersection of willfully included multiple and diverse perspectives. It is a standpoint employed not in regard to an

absolute reality disconnected from human experience, but rather in regard to our everyday, lived experience. It is not relativistic in that it allows for and requires judgments to be made about the status of life, the trustworthiness of inquiry, and the effects of each scientific endeavor. Because of their potential hindrance to improving human life, it calls for a ridding of values that are racist, sexist, classist, ageist, gender biased, or based on sexual preference. Thus, it identifies and casts out values that do not promote a satisfactory leading, while cherishing those that do. Furthermore, this form of objectivity requires the conscious inclusion of oppressed perspectives and capitalizes on the insights they may have to offer. It is not a detached objectivity, but rather an objectivity that genuinely arises out of and accurately considers our shared, though varied, existence. As such, it has a practical and functional value.

I believe that this pragmatist-feminist objectivity should replace the view from nowhere currently employed in many science classrooms. Science, as a content area, should become concerned with facts and theories that are pertinent to our continued and improved existence as humans rather than a collection of fixed facts seemingly distant from the lives of students learning them. The pragmatic truth of these concepts and explanations should be verified through scientific experiment met with similar demands from our environment. Hypotheses and theories that are not verified as immediately capable of leading to further satisfying experiences should be stored for potential future use, but not be labeled true at present. As inquiry, science in the classroom should be concerned with problems and issues facing humans, culture, and society, especially those of immediate and local importance. This differs from the more positivistic objectivity which assigns scientific importance without thorough or, in some cases, even initial consideration of the role of humans and their needs. It is in this regard that the feminist, social

justice orientation of such inquiry is most clear. As feminist, it is centrally concerned with the local problems and the well being of all people, especially minorities or those historically oppressed. These guiding concerns extend the pragmatist-feminist framework beyond social constructionism.

The new objectivity should also be both physically and mentally engaging, suggestive of the pertinence and importance of participating in such inquiry. It should welcome critique and challenging questions regarding its ethical and appropriate use. As an attitude, science should be taught as a complex, critical, intricate, and valuable, socially concerned stance. Teachers should approach objectivity from a human perspective, rather than one that is disembodied and striving toward an impossible knowledge of a detached, absolute world. I will conclude by suggesting several curricular and pedagogical approaches to science that I think are well aligned with this pragmatist-feminist understanding of objectivity and science as a whole.

Wolff-Michael Roth and Angela Calabrese Barton have each suggested the use of autobiography in the science classroom (2000; 2000). While not explicitly pragmatist-feminists, their ideas are in accord with the pragmatist-feminist orientation. Roth argues that "autobiography and other first-person methods enacted together with critical doubt are important aspects in making rigorous any disciplinary method" (2000, p. 2). This increased rigor is evidenced in the intersubjectivity that is arrived at by having all participants in a class put their autobiographies out on the table and then striving to interpret each one with respect to the scientific inquiries of the class. Roth believes it is necessary to know the autobiography of the scientist, as the observer, because her background influences her observations.

As each person constructs her autobiography, she is able to make herself aware of her prejudices, pull them into doubt, and change or eliminate them if needed. Roth insists that an

essential aspect of the autobiographical genre is that it is written for "the other" to hear and that the other is given the agency of assigning meaning to it. Insofar as people lack ownership of language as a whole, "autobiography as written text is therefore also associated with alienation, for we always have to use the words which are not entirely our own, but always also belong to the Other" (2000, p. 7). In our context, classmates, as others, are assigned the task of translating and rearticulating each student's life story in such a way that critically examines the attitudes, beliefs, and experiences that each student brings to the classroom. Of course, students in more powerful positions may construct the other as subordinate. Teachers need to be aware of and combat this tendency, perhaps by encouraging an ethic of care within this potentially harmful situation (Haddock Seigfried, 1996, p. 268).

A more overtly pragmatic use of autobiography would be to employ it as a tool for bringing the habits which constitute one's self into consciousness so that they can be improved. These may be habits of prejudice or habits of distrust of science. Through autobiography, then, we shape a new identity for ourselves and for others. When autobiography is constructed in light of specific scientific inquiry, we redefine and reposition ourselves as both the subjects and objects of science. As embodied beings who cannot achieve observer-independent objectivity, we can critically bring together knowledge of our autobiographies and varied perspectives to form an inter-subjectivity that avoids relativism and allows for scientific progress. Furthermore, a sense of solidarity among the students may be revealed as they discover similarities in their experiences with science through the sharing of their stories.

Angela Calabrese Barton adds that science education reform often calls for a focus on "everyday life" (2000, p. 38), but suggests that, through an understanding of the importance of autobiography, the focus should really be on lived experience. She notes that examples from

"real life" typically used in the science classroom are often geared toward specific experiences of privileged males—experiences that fit neatly with the concept being explained. For instance, I recall my high school physics teacher explaining velocity derivatives by referring to the flight of a model rocket. I had never in my life seen a model rocket and the example had little use for me, no matter how accurately the rocket displayed the concept at hand. Autobiographies, however, show that lived experience is much more complex, hence, challenging "neat science" (2000, p. 38). Autobiography, then, can provide the medium for connecting science to such complicated lived experience, thereby making science useful in terms of explanation and improving environmental conditions. Many teachers claim that science should be similarly student-centered (Levitt, 2002), yet they uphold epistemological assumptions in their teaching which promote learning that is achieved by students abstracting themselves from their social and historical positions and is, therefore, "student-less," regardless of the rhetoric that masks it.

Much of Calabrese Barton's work rests on her understanding of scientific knowledge as local and reflexive. Localness is tied to pragmatist-feminism in that local knowledge is concerned with the immediate social uses of science and its products. Michael Bryne and Alex Johnstone (1987) call for a similar concern with the social uses and effects of science in the classroom. They suggest science classes that consider practical problems that may relate to other academic subjects, such as social studies, and reflexively deal with pressing issues in that community, like the use of birth control. "Consequently we need to provide opportunities for students to think about science in the context of wider social, economic, and applied problems, and in so doing help them to learn to apply critical standards both in science and in sciencerelated

contexts" (p. 333). Similarly, Donald Oliver suggests what he calls "grounded knowing"

in the science classroom. This type of knowing is opposed to technical knowing in that it is a deeper, holistic, and more connected way of defining our complex relationships with our culture and the natural world.

All of these social concerns with science coalesce with William Cobern's (1996) promotion of the public understanding of science as based in the public's legitimate interests *in* science, rather than in the interests *of* science (p. 12). That is, the public's ability to use science for social purposes, rather than merely as a false way of objectively arriving at a (non-existent) absolute reality. I would add that an excellent way to constructively reveal the ever-changing purposes and effects of scientific inquiry is through student role-playing. By assuming and imagining the role of a beauty product test rabbit, a starving family receiving Golden Rice, or an infertile couple undergoing in vitro fertilization, students are able to discover the local and humanistic aspects of science as well as envision new uses for science on a global scale. Importantly, these roles would be reflexively undertaken with regard to previously shared autobiographies, thus challenging and reconfiguring student identities as inquirers.

Douglas Allchin (1999) suggests that "science teachers who understand the multi-faceted relationship between science and values can guide students more effectively in fully appreciating the nature of science through reflexive exercises and case studies" (p. 1). Allchin sees the classroom as an ideal place where the values and perspectives of many people can be brought together, rather than transcended, in a scientific pursuit to form a more robust type of objectivity. This bringing together of perspectives, then, requires an open discussion on the part of the teacher concerning the shaping role of the values the students bring with them. These values can be put to use in objectivity building by pulling them into the critical consciousness of the entire class. In a constructivist setting, students can be first asked to reflexively consider those values

that they hold and those values supported by the scientific process. Outside and overarching values can also be brought into play by the employment of historical case studies in the classroom. Being able to reflect on the currently evident consequences of past values in scientific inquiry in those case studies will allow for their effects to be clearer for students. Then the students and teacher can decide as a community how those values should be objectively dealt with as they carry out their scientific inquiry in the present.

Finally, Maralee Mayberry (2001) suggests a feminist pedagogy, rather than a collaborative learning pedagogy, to be used in the science classroom. She charges collaborative learning with being "a social reproductive pedagogy that encourages students to gain proficiency in the dominant discourse of existing science systems, whereas feminist pedagogy is a socially transformative pedagogy that invites students to critically analyze existing science systems and their relationship to social oppression and domination" (pp. 145-146). She claims that collaborative learning involves a disembodiment from the doer of science in that each student becomes abstracted from their socially historical position in order to conform to the discourse practices of the dominant group. Here, this would involve both a forced perception and practice of an idealized objectivity as a view from nowhere. In feminist pedagogy, one's embodiedness is valued as a part of one's identity that can be brought forward democratically in a dialogical process of scientific inquiry. It should be noted, though, that feminist pedagogy is collaborative in the sense that it brings together a diverse and embodied group of learners, typically with at least one common concern. This critical pedagogy meshes well with the socially conscious, responsible, and embodied pragmatist-feminist conception of objectivity and science for which I am arguing.

In closing, I believe that I have fashioned more robust, practical, and democratically

rigorous conceptions of science and objectivity through consideration of pragmatist-feminism. Studies have shown that to encourage the participation of all students, especially girls and people of color, “science teaching needs to be more concrete, to make connections to lived experience of the student, to engage students in social collaboration, and to consider topics of contemporary interest (Sanders, Koch & Urso, 1997; Kahle, 1994; Sadker & Sadker, 1994)” (Koch, 2002, p. 21). The philosophy of science and its corresponding pedagogies described here do just that. Objectivity, as I have described it, is applicable to the socially and historically constructed world in which we live and its study. Finally, this refashioned objectivity can and should be put to work in science classrooms, replacing masculinist, homogenizing, nonsensical, and potentially harmful objectivity as the “view from nowhere”.

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