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A Critical examination of mathematics

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Materiality and Discourse in School Curriculum: A Critical Examination of Mathematics

Proposal for a 120-minute symposium at Division B, section 1.

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1. Summary

We bring contemporary theoretical approaches to bear on the question of the relationship between the material and the discursive in curriculum studies when researching the effects of power of the school curriculum in generating the inclusion/exclusion of learners. We argue for the need to bring materiality and discourse together in such a way that we might better address the political realities of education. From various international, historical, and theoretical contexts, we critically examine how discourse and materiality intricately define and describe the classifications by which notions of intellectual, social, and economic poverty are organized in the curriculum. Our focus on school mathematics is essential, since this is a curricular area that is seldom approached as a field of cultural politics.

2. Objective

The primary aim of this symposium is to bring contemporary theoretical approaches to bear on the question of the relationship between the material and the discursive in curriculum studies when researching the effects of power of the school curriculum in generating the inclusion/exclusion of learners. More concretely, the panel as a whole will address the following questions:

- (1) In what ways might curriculum studies engage with new theoretical approaches to the relationship between the material and the discursive?
- (2) What sort of politics might emerge from embracing new materialisms in educational theory?
- (3) What kinds of insights emerge for curricular studies in general as a result of examining mathematics education as a field of cultural politics?

3. Motivation and significance

In educational research the intersections of discourse and materiality are seldom explored in the constitution of the curriculum and its effects of power.

Research approaches to the school curriculum that privilege a discursive view have tended to downplay materiality (e.g., Cole, 2003). Similarly, studies focusing on materiality have considered it outside of discourse (e.g., Atkinson, 2002). We propose to undertake an analysis of the relations of discourse and materiality in the curriculum by presenting different readings of mathematics curriculum as cultural politics. The analytical strategy of attending to an increasingly privileged area of the curriculum may be productive in showing connections and possibilities of critical displacement that an analysis of education in general may not achieve. Associated with progress, achievement, development and the wealth of nations, the focus on the individual learning of mathematics maintains the common sense that mathematics is fundamental for society. However, there are few critical studies of mathematics curriculum that see math as an area of cultural, political, social, and historical studies. In reading the field with critical cultural studies we are able to raise sociocultural, political, and theoretical questions that are embedded, though often unnoticed, in a field of research that rarely grapples with these questions. Our focus on materiality and discourse are significant for rethinking how meanings and associations with poverty and exclusion are constructed through math education, as an effect of power that produces school subjects and objects.

4. Overview and structure

Panelists will draw on contemporary theory to examine the relationship between the material and the discursive. We draw on a diverse range of perspectives —Foucaultian, Deleuzian, post-Marxist, and posthumanist— to investigate how materiality and discourse emerge as effects of power in the curriculum. We look carefully at school mathematics as a discursive and material field of educational practices that illustrates how insertions of discourse and materiality generate theses about learners as achievers, intelligent, and included versus poor, deficient, and excluded. This symposium demonstrates how theory from curriculum studies and educational philosophy can be put to work in the careful analysis of educational experiences in mathematics. Our discussion will destabilize the idea that mathematics education research is an internalistic enterprise by exploring how certain material/discursive assemblages have come to matter in school mathematics and how these matters frame what is possible to do, think, and say within the spaces of the school.

The session will start with the chair's framing of the topic. The session will be structured more interactively than most. Each speaker will speak for 10 minutes, followed by a 5 minute interaction with the other presenters. The six papers speak directly to the guiding questions in the overview of the panel. Empirical data and case studies of classrooms, texts and artifacts will be used so that the audience has concrete examples with which to work. The discussant —a highly established scholar who has written extensively about discourse and educational politics— will tease out tensions between the various approaches, and identify emergent questions/problems that push the discussion further. Approximately 20 minutes will be given to an interactive discussion with the audience.

5. Papers

5.1 Desultory Materiality: Exploring the Potential Role and Limits of Appeals to Materiality in Critical Curriculum Studies

Stefan Bengtsson, Uppsala University, Sweden

My paper discusses how we can conceive of the relationship between materiality and discourse, and in what way our conception of materiality can be seen limit the political in critical curriculum research. The presentation will raise the dualism of material/ideal by reflecting on the how this dualism can have be seen to have been dissolved by Wittgenstein (2001), who has put forward that material aspects and ideal aspects can be seen to merge in relation to pragmatics and context. This merger suggests that it is in relation to context and practice that, *both*, word and thing attain *sense*. To what extend does an appeal to materiality allows us for a more suitable exploration of the 'political realities of education'? In order to judge the suitability of such a *de-* or *in-*scription of realities of education, it is necessary to specify what the real is, as well as to specify its relationship to materiality. As it might become apparent, the innuendo that the attention to materiality entails suggests that there is a privileged affinity between materialism and the real.

In this affinity, there exists the danger of an association with naïve realism, were we in an appeal to materiality might hope to find essential or universal properties, that linger in the real. Here the presentation aims to make a double intervention. Firstly, a conception of a Lacanian (Lacan, 1966) real, as a pure negativity, is introduced and reconceptualised as a form of pure temporality. As temporality, the real can be seen to have disruptive effects on practices of meaning-making which we according to Laclau (1990) will conceive as spatialization. Mathematic forms of reasoning, as a particular form of meaning-making, that is to say spatialization, can in this form be seen to be threatened by temporality, the event, or better *Ereignis* (Derrida, 1978), which as an experience of the inexhaustibility of the object.

Secondly, it is not a conception of the properties following materiality that is 'insufficiently' addressed in critical curriculum studies, but *existence*. Sense, meaning, values and the political are ultimately understood to stand in relation to Being, which emerges out of the historicity of practice, of doing things with things. On the other hand existence, the ontic (Heidegger, 1967), is confined to plain presence-at-hand, *Vorhandenheit*. Yet, it is between this Being, which is a result out of sense-making in the world, and existence that this presentation creates a zone of tension which it will aim to relate to conditions of possibility for political action. The issue becomes: To what extent does existence, or non-existence, be conceived to affect possibilities for meaning-making in mathematics education?

Derrida, J. (1978). *Writing and Difference* (p. 342). Chicago: University of Chicago Press.

Heidegger, M. (1967). *Sein und zeit* (Elfte, unv.). Tübingen: Max Niewmeyer Verlag.

Lacan, J. (1966). *Écrits* (2005th ed.). London and New York: Routledge.

Laclau, E. (1990). *New reflections on the revolution of our time*. London:Verso.

Wittgenstein, L. (2001). *Philosophical Investigations*. (G. E. M. Anscombe, Ed.) (3rd ed.). Oxford: Blackwell Publishers.

5.2 Concrete Abstractions: Constructing Equivalence and the Child's Reality through Inscriptions of the Equal Sign

Jennie Diaz, University of Wisconsin, Madison, USA

The movement from 'concrete' to 'abstract' reasoning is privileged in the modern mathematics curriculum in the United States. As an example, teaching students the equal sign as a relationship of sameness seems to require the use of classroom materials, manipulation of 'hands-on' objects, and interpretation of visual images. As students move away from this series of visible and 'concrete' practices in the development of a seemingly more sophisticated 'abstract' thought, they apparently gain access to pass through to higher level reasoning that is algebra.

Giving intelligibility to the equal sign as a relationship of sameness, *concrete* and *abstract* organize the practices of teaching and learning equality in math education. Yet, concrete and abstract do not simply order the flow of materials in the classroom. Rather, they form the practices of knowing equality by inscribing a logic of representation and comparison embedded in the materials of the classroom. This logic flows through the objects of the school and organizes possible ways to see, think, and enact the math curriculum as well as the 'learner' it assumes.

My purpose is to take the knowledge of equality and the equal sign as an event of the math curriculum that has been historically inscribed by overlapping systems of reason. As an event, the equal sign emerges as 'reasonable' and 'intelligible' in the curriculum, but is only possible to think and act upon as an assemblage of historical, and therefore cultural and political, discourses (Foucault, 1984). These discourses order the rules and standards by which equality and the equal sign move into the curriculum and maintain its status as a concrete and manipulable, yet abstract 'fact' (Poovey, 1998). Carrying a representational and comparative logic, the discourses and their material practices enable identifications and differentiations of 'developmental' levels of reasoning and intelligence in children.

Reading the event of the equal sign through a lens focused by the cultural studies of Foucault (2002) and Deleuze (1994), I explore the historical inscription of 'concrete' and 'abstract' as embedded in the systems of thought that order the emergence and repetition of math materials in the curriculum in the mid twentieth century. Since materials never emerge in isolation, data will be gathered at the intersecting discourses of equality that organize the notions of 'concrete' and 'abstract' as representations of a particular 'reality' that is simultaneously tangible and impalpable 'truth'.

This paper is significant in the way that it opens a space to question the materials, concepts, and practices that link 'achievement' to the child's ability to reason abstractly about equality as sameness while concretizing notions of inequality as undesirable difference, inadequacy, or deficiency.

Deleuze, G. (1994). *Difference and repetition* (P. Patton, Trans.). New York: Columbia University Press.

- Foucault, M. (1984). Nietzsche, genealogy, history. In Rabinow, P. (Ed.) *The Foucault Reader*. New York: Pantheon, p. 76-100.
- Foucault, M. (2002). *Archeology of knowledge*. New York: Routledge.
- Poovey, M. (1998). *A history of the modern fact: Problems of knowledge in the sciences of wealth and society*. Chicago: The University of Chicago Press.

5.3 The Micropolitics of Material Assemblages: Mapping the Content/expression Binary in Mathematics Classrooms

Elizabeth de Freitas, Adelphi University, USA

Deleuze and Guattari (1987) argue that micropolitical processes precede power relations, and that social interaction demands an analytic framework that thinks power in more expansive ways. Since the concept of the “political” could be said to always imply a people or community, it seems that Deleuze and Guattari are radically shifting its referent, or in the least redirecting our attention to molecular forms of interaction as unexamined sites of the political. One can argue that this approach aligns with post-humanist work in science studies (e.g., Barad, 2007) and new materialism (e.g., Bennett, 2010), where the material world itself is taken to be animate with force, in such a way that matter is no longer assumed to be inert or passive, simply awaiting our sentient structuring impulse. Micropolitics offers a way of studying the emergence of political structures or social assemblages produced through forces that operate alongside the political agent acting with its own intentionality and will (Webb, 2008).

This presentation will take up this question in the context of mathematics classrooms. Since mathematics is often considered an entirely cognitive activity pertaining to immaterial, ideal abstract forms, it represents a particularly challenging case study for micropolitics and new materialism. The current focus on “communicating mathematically”, however, calls for careful analysis of how the material and the discursive operate in these classrooms. We need to rethink discourse in terms of material assemblages. In the context of the classroom, language is less about information and more about imposing ‘semiotic coordinates’ on the child. The bodies in the classroom are ‘emitting, receiving, and transmitting’ the ‘order-word’ that constitutes language as obedience (p. 77). Language is not a code nor is speech the communication of information. Language is a material act or effectuation: To “order, question, promise, or affirm is not to inform someone about a command, doubt, engagement, or assertion but to effectuate these specific, immanent, and necessarily implicit acts” (p. 77).

Using video data of a middle school mathematics classroom, I show how students’ repeated ambiguous use of indexical language (“this one”) actually decenters language as the legislator of truth (and the vehicle of explanation) and disperses power instead across various material objects (diagrams, pointers, projectors). I argue that the content/expression binary is in motion during such instances. Through such an analysis, we begin to see how the students actions re-territorialize mathematical thinking and shift the nexus of content and expression so that mathematics itself is bound in the tangled assemblage.

- Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Durham: Duke University Press.
- Bennett, J. (2010). *Vibrant matter: A political ecology of things*. Durham, NC: Duke University Press.
- Deleuze, G. & Guattari, F. (1987) *A thousand plateaus: Capitalism and schizophrenia*. Minneapolis: University of Minnesota Press.
- Massumi, B. (ed.) (2002) *A Shock to Thought: Expression after Deleuze and Guattari* (New York, Routledge).
- Webb, T. (2008). Remapping power in educational micropolitics. *Critical Studies in Education*, 49(2). 127-142.

5.4 Progress, Wealth and Mathematics Achievement
Paola Valero, Aalborg University, Denmark

I am interested in discussing the historical conditions that make it possible to formulate the idea that the mathematical qualifications of citizens in modern states is connected to the progress and economic development of nations. I interconnect apparently unrelated areas in an attempt to shed light on the grid of intelligibility that makes it possible to fabricate children's differential achievement in mathematics as a social fact connected to the wealth and development of nations.

The emergence of the connection between people's mathematical qualifications and social progress can be traced to the end of the 19th century. During the second half of the 19th century, mathematics teachers in different countries struggled to make mathematics part of the classic school curricula. During the second industrialization, the justification for the need for mathematics education was formulated in the first international mathematics education journal (Laisant & Fehr, 1899). In the times of the Cold War, a similar argument emerged, however the justification was related to keeping the supremacy of the Capitalist West in front of the growing menace of the expansion of the Communist Soviet Union. Nowadays, professional associations argue that the low numbers of people in STEM fields can severely damage the competitiveness of developed nations in international, globalized markets.

The narrative that connects progress, economic superiority, and development to citizen's mathematical competence is made intelligible as a result, among others, of the growing series of comparative information on educational achievement and development. Such reports can be seen as performances of the comparative logic of Modernity that operates differential positioning, not only among individuals but also among nations, with respect to what is considered to be the desired and normal level of development and growth. "Mathematics for all" can be seen as an effect of power that operates on subjects and nations alike to determine who are the individuals/nations who excel, while creating a narrative of inclusion for all those who, by the very same logic, are differentiated. The mathematics school curriculum in the 20th century embodied and made available cosmopolitan forms of reason, which build on the belief of science-based human reason having a universal, emancipatory capacity for changing the world and people. The 'homeless mind' ([Popkewitz, 2008, p. 29](#)) that school mathematics has operated is a type

of individuality where the subject is set in relation “to transcendental categories that seem to have no particular historical location or author to establish a home” (p. 30). In this way, subjects are inserted in a logic of quantification that makes possible a scientific rationality based on numbers and facts for the planning of society. The mathematics curriculum is an important technology of the self that inserts subjects into the forms of thinking and acting needed for people to become the ideal cosmopolitan citizen.

Laisant, C.-A., & Fehr, H. (1899). Préface. *L'Enseignement Mathématique*, 1(1), 1-5.

Popkewitz, T. S. (2008). *Cosmopolitanism and the age of school reform: Science, education, and making society by making the child*. New York: Routledge.

5.5 Constructing Materialities and Poverties through Numbers: PISA and Turkey

Aysegul Mester, University of Wisconsin, Madison, USA

Numbers are not only taken for granted as the “neutral tools” of designing the very basic activities of daily lives, but they are also respected as “objective guiders” when thinking and acting on the material conditions of daily life through various social comparisons in and among contemporary societies at both national and international scales. In these social comparisons, peoples, nations, and countries are willingly and by consensus evaluated by various discursive scales, the level of their modernities in relation to their material conditions are measured, the results are compared to each other, and put on a continuous (de)valuing process. Furthermore, problems and solutions respectively and in a pre-determined order are aimed to be reflected on numbers as “mirrors” by which the right path to do some sort of action to heal the conditions of materiality is thought to be illuminated. Especially through psychological and statistical methods which make possible these social comparative tools operate intelligibly, numbers are assumed to act as sole descriptors of various types of poverties (cultural, historical, intellectual in the scope of this study). These assumptions construct the foundational motivation of this study.

This study inquiries into the given “neutral” and “objective” role of numbers used in social comparisons via the investigation of a well-respected comparison tool of modern schooling: PISA (Programme for International Student Achievement) and the case of PISA in Turkey. Through using the method of discourse analysis and the theory of historical materialism from a Foucaultian perspective, I trace the echos, effects, and reflections of the PISA test scores of Turkish students in mathematics from various data resources such as newspapers, journals, articles, magazines, social networks, published interviews, governmental and international policy documents. Via my focus on the material objects and conditions considered to be signifying parameters of poverty by PISA, I attempt to trigger the sole descriptive roles attributed to numbers.

I argue that numbers placed in the set of principles of the techniques they operate in are not descriptive but exclusively constructive of what is made intelligible to be considered poverty in relation to constructed notions of

materiality. My analysis also let me argue that embedded in these constructions are the correlations created between the material objects and children's minds. These correlations determine new modes of existence for the child to be, new definitions of modernity for the nation to act, and new configurations of history for the country to make, in order to avoid mutually constructed notions of intellectual, cultural, and historical notions of poverty respectively.

The significance of the study is two-layered. It is one of the very few studies that treats PISA test scores not isolated from but as productions of historical, cultural, and global conditions that make their intelligibility possible. Second, Turkey's case as an educational setting that is going through an intensive reform process by following the European Union integration regulations can stimulate future researches in similar national settings of inclusion/exclusion at the transnational context.

5.6 *The Materiality of Exclusion and the Ideology of Research*

Alexandre Pais, Aalborg University, Denmark

Baldino and Cabral (2006) create a parody concerning exclusion in schools. The authors suppose that we enter an elementary school and ask the staff where "exclusion" happens. Who can answer such a question? Where to locate exclusion in schools? It seems as if exclusion has no "materiality", no precise site where it is happening. It seems as if it is a name to represent some structural impalpable reality, resulting from several complex factors, having to do with teacher engagement with the students, with the quality of the mathematics learning, with issues of race, gender, and social class, with lack of resources, and so on. Equity is understood as a complex phenomenon involving several dimensions, not identifiable in some place or in some practice. From this perspective, achieving equity means to fight in different battles (for groups of people considered to be in disadvantage, inequity of resources, teacher formation, mathematical content for social justice, etc.). In this paper I shall argue that such dissemination of the problem of inequity disavows its materiality. Mathematics education as a research field will be used to illustrate how postmodern moves in educational research, and its emphasis on discourse and identity politics, functions as the necessary ideology of current capitalist schooling, by the way it provides a fantasy screen enabling research to perform as if the problem of exclusion could be solved by changing discourses alone.

I draw on Lacanian psychoanalysis, particularly the contemporary reading of Lacan made by Žižek, to show how the *real* of schools—that is, its materiality, the fact that schools are economical places—has to be repressed by existing postmodern educational research—and its emphasis on discourse and identity politics—in order for research to be possible. The method used to analyze research can be called *ideology critique*, and is based on Žižek's recent revitalization of this Marxist concept. It consists in showing the incongruities between the discourse emanating from research and its actualization within a life world context—in this case, schools. What normally runs well within the research discourse, when actualized in a specific practice, often encounters a series of obstacles which end up perverting the official intention. Usually research proceeds by eliminating such obstacles, so that

the official aims can be fully actualized: equitable mathematics education, valorization of different cultures, useful and critical mathematics. However, an ideology critique sees these obstacles as symptomatic points which allow one to grasp the political and economical relevance of mathematics in the school system.

- Baldino, R., & Cabral, T. (2006). Inclusion and diversity from Hegel-Lacan point of view: Do we desire our desire for change? *International Journal of Science and Mathematics Education*, 4, 19-43.
- Vinner, S. (1997). From intuition to inhibition—mathematics education and other endangered species. In E. Pehkonen (Ed.), *Proceedings of the 21th PME* (Vol. 1, pp. 63-78). Helsinki: University of Helsinki.
- Žižek, S. (2008). *For they know not what they do: Enjoyment as a political factor*. [First edition 1991]. London. Verso.

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- Cole, M. (2003). Might it be in practice that it fails to succeed? A Marxist critique of claims for postmodernism and poststructuralist as forces for social change and social justice. *British Journal of Sociology of Education*, 24(4), 487-500.
- Popkewitz, T. (2009b). Globalization as a system of reason: The historical possibility and the political in pedagogical policy and research. *Yearbook of the National Society for the Study of Education*, 108(2), 247–267.
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