PEDAGOGIES: AN INTERNATIONAL JOURNAL, *1*(1), 49–57

Cultivating Students' Discipline-Specific Dispositions as a Critical Goal for Pedagogy and Equity

Melissa Sommerfeld Gresalfi and Paul Cobb
Vanderbilt University

In this article, we argue that conceptions of content should be broadened beyond the ideas, skills, and proficiencies of particular subject matter disciplines. We frame mathematics teaching as a paradigm case in which to argue that a focus on pedagogy should also include an explicit concern for the kinds of dispositions that students are developing towards a particular discipline as they engage in (or oppose) classroom instructional activities. Our purpose in developing this perspective is to focus on students' access to discipline-specific literacies wherein all students have an opportunity to participate legitimately in classroom practices that lead to competence in the short term and to continued engagement in the discipline in the long term.

In this article we argue that conceptions of content should be broadened beyond the ideas, skills, and proficiencies of particular subject matter disciplines in order to consider the kinds of dispositions that students are developing towards those disciplines. Currently, content specialists in areas such as mathematics, science, and social studies focus primarily on deepening teachers' understanding of both central disciplinary ideas and the process by which students might develop those ideas. Recent work in this area has made impressive progress in conceptualising the tools that teachers need to be effective. For example, analyses of types of knowledge for teaching have enabled the field to make great strides in thinking concurrently about both what and how to teach (Ma, 1999; Shulman, 1986, 1987).

However, recent analyses of the process of learning (Brown, Stein, & Forman, 1996; Greeno & Middle School Mathematics Through Applications Project Group [MMAP], 1998; Lave & Wenger, 1991) have demonstrated that learning is more than the acquisition of knowledge and skills. An increasing number of studies il-

Correspondence should be sent to Paul Cobb, Vanderbilt University, Peabody College Box 330, Nashville, TN 37203, USA. E-mail: paul.cobb@vanderbilt.edu

lustrate that what is learned cannot be separated from how it is learned (Beach, 1999; Boaler, 1997; Cobb & Bowers, 1999; Lave, 1988). In explicating this perspective, Greeno (1991) drew an analogy between developing learning in a subject matter domain and acting effectively in a physical environment. Knowing a domain is like knowing an environment and knowing how to use its resources. Knowing includes being able to find out what resources are available and to use those resources productively. This characterisation of competence in a particular domain encompasses the ways in which students engage with that domain and the dispositions towards knowledge that they develop while doing so.

As we use the term, a *disposition* encompasses ideas about, values of, and ways of participating with a discipline that students develop in a particular class and as they move from one class to another (Wenger, 1998). Dispositions thus draw our attention to both the discipline as it is realised in a particular classroom and the extent to which students come to identify with the discipline. Dewey (1913/1975) explicated this relationship when he noted that "true interests are signs that some material, object, mode or skill (or whatever) is appreciated on the basis of what it actually does in carrying to fulfilment some mode of action with which a person has identified [himself or herself]" (p. 43). Thus, students' development of interest or a sense of affiliation with a discipline is inextricably linked to the ways in which they engage with that discipline (Greeno & MMAP, 1998; Lampert, 1990, 2001; Lave & Wenger, 1991; Nasir, 2002). Students' development of increasingly positive dispositions is in turn linked to increased motivation for learning (Cobb & Hodge, 2002), leading them to engage with classroom mathematical activities more deeply and more effectively (Ames & Archer, 1988).

For this article, we focus on mathematics education as a paradigm case. It has been repeatedly demonstrated in mathematics education literature that what students actually learn is inextricably linked to the classroom practices in which they engage (Boaler, 1997; Boaler & Greeno, 2000; Schoenfeld, 1998). Furthermore, the nature of these practices has been shown to affect the ways that students come to think about the domain. Specifically, and most significant for our purposes, students who participate in classroom practices that emphasise the reproduction of predetermined methods and procedures typically report that they find mathematics to be a highly structured, cut-and-dried, rule-bound activity (Boaler, 1997; Lampert, 1990; Schoenfeld, 1998). This orientation towards mathematics is not productive in the short term (in terms of what students are learning) nor in the long term (in terms of students' interest in continuing to take more mathematics classes in the future).

Our interest in investigating the development of students' dispositions towards mathematics is inspired by two related concerns: what is the nature of the mathematics that is realised in the classroom and that students actually have an opportunity to learn and how are these opportunities to learn distributed among students of different economic, ethnic, and racial backgrounds? Our purpose in focusing on

these issues is to foreground students' access to discipline-specific literacies wherein all students have an opportunity to participate legitimately in classroom practices that lead to competence in the short term and to continued engagement in the discipline in the long term.

THE NATURE OF CLASSROOM MATHEMATICS

In our own work, we have focussed specifically on how classroom norms and practices get constructed and constituted in the classroom (Cobb, Wood, Yackel, & McNeal, 1992; Cobb & Yackel, 1996; Gresalfi, Martin, Hand, & Greeno, 2005; Yackel & Cobb, 1996) and how individual students engage with those practices (Gresalfi, 2004). Understanding what it means to "do math" in a particular classroom is an important starting point when understanding students' dispositions. Specifically, we focus on delineating the nature of the mathematics with which students are engaging, as previous work has demonstrated that the organisation of classrooms has implications for students' interest, motivation, and feelings of competence. These analyses involve unpacking the classroom learning environment by focusing on the ways in which students interact with classroom resources—such as other students, instructional materials, and associated tools—the teacher, and the ways that these interactions shape and are shaped by the development of classroom norms.

In recent work (Engle & Conant, 2002; Greeno & Hull, 2002; Greeno, Sommerfeld, & Wiebe, 2000; Gresalfi et al., 2005) we have focused on the nature of mathematical practices in particular classrooms by focusing on the ways that students are positioned in interaction. We define *positioning* as the way that students are entitled, expected, and obligated to interact with one another as they work on content together (i.e., the ways that they are accountable for one another's understanding or agreement) and the ways they are entitled, expected, and obligated to develop and use particular forms of domain-specific knowledge. Two aspects of positioning have proven to be especially important: the distribution of authority, and the ways that students are able to exercise agency. *Authority* concerns the degree to which students are given opportunities to be involved in decision making and whether they have a say in establishing priorities in task completion, method, or pace of learning. Thus authority is not about "who's in charge" in terms of classroom management but "who's in charge" in terms of making mathematical contributions. For example, in some classrooms, authority is distributed only to the teacher, who is solely responsible for determining the legitimacy of responses. The role of students is limited to making responses and noting whether their contributions are acceptable. In contrast, authority can be distributed more broadly, with students and the teacher jointly determining the legitimacy of one another's contributions by relying on mathematical justifications. The distribution of authority

therefore has implications for the ways that students might interact with mathematical content and with other members of the classroom around mathematical content and for how mathematics gets locally defined and enacted in the classroom. It also has implications for the ways that students are positioned relative to one another and for the rigour of mathematical content with which they are likely to engage. Specifically, being responsible for others' understanding by having to "convince" someone else requires higher standards of mathematical argumentation (Cobb et al., 1992; Engle & Conant, 2002; Greeno, Sommerfeld, & Wiebe, 2000; Lampert, 1990) than simply being accountable to a teacher who gives confirmation of accuracy.

The distribution of authority is inextricably linked to students' agency in the classroom. Following Pickering (1995), we differentiate between two forms of agency: *conceptual agency,* which involves choosing methods and developing meanings and relations between concepts and principles, and *disciplinary agency,* which involves applying an established method. To be effective, classrooms in which authority is distributed to students and the teacher would necessarily have to involve opportunities for students to engage with conceptual agency. In contrast, classrooms in which authority rests solely with the teacher are likely to offer students opportunities to exercise only disciplinary agency.

THE DISTRIBUTION OF OPPORTUNITIES TO LEARN

For many researchers who focus explicitly on equity, the nature of the discipline is inextricably tied to the issue of equity more broadly. These researchers have focused on the nature of pedagogies that are enacted in classrooms and the implications of those pedagogies for opportunities for all students to learn. For example, in her book *The Dreamkeepers: Successful Teachers of African American Children,* Ladson-Billings (1994) investigated the teaching practices of eight U.S. elementary or primary teachers who had been nominated by their principals and by parents as examples of "good teachers." Her observations of these successful teachers led her to note six observed characteristics of "culturally relevant teaching." The characteristics that she identified are closely linked to findings from the literature cited here that connects particular classroom practices to students' development of positive orientations towards mathematics. This connection indicates that aspects of the pedagogical orientations that Ladson-Billings described are important for the development of positive dispositions not just for African American students in the United States but for all students. In the following sections, we discuss four of these six characteristics that are most relevant to our concerns and note how they relate to classroom mathematical practices and thus to the development of students' dispositions.

Teachers Have a High Regard for Their Students

Teachers' demonstration of respect and regard for students as individuals and for their ideas serves to create a positive relationship between students and teacher (which has repeatedly been linked to students' positive valuation of a discipline and their experiences of success; cf. D'Amato, 1992). In addition, a teacher's demonstration of respect is integral to the creation of a safe classroom atmosphere wherein student thinking is the basis for instruction and mistakes are treated as a learning opportunity (Lampert, 2001). Thus, in terms of mathematical practices, holding high regard for one's students might lead to the creation of opportunities for students to express their ideas, to justify the reasonableness of those ideas, and to revise their thinking in light of mistakes.

Teachers Believe That All Students Can Succeed

Teachers' belief that all students can succeed has implications for the ways that they might organise their classrooms and make decisions about the curriculum. Specifically, a teacher who believes that all students can succeed is unlikely to partition his or her classroom into ability groups and is more likely to attempt to reduce status differences by employing pedagogical practices wherein students can learn from one another and can learn about and benefit from their differences (Cohen & Lotan, 1995). For example, such a teacher might organise whole-class discussions and ensure that all students have an opportunity to contribute to the discussions in a substantial way. Doing so effectively with a heterogeneous class requires being especially diligent about emphasising students' accountability to others for making sure that everyone understands so that all students have access to the content of conversations (Cohen & Lotan, 1995; Lampert, 2001; Stipek et al., 1998).

Teachers Encourage Students to Make Connections Between Their Community, National, and Global Identities

Many researchers who are concerned with helping students connect school with their home lives advocate incorporating culturally relevant content into the curriculum and classroom practices (Banks, 1995). However, broadening the curriculum to include references to other cultures is only the first step. Helping students to make connections between their community and school requires more than familiarity with the context or story of a problem. It also requires attending to the links between what it means to do mathematics across settings. As D'Ambrosio (2001) noted, "Much of today's curriculum is so disconnected from the child's reality that it is impossible for the child to be a full participant in it. The mathematics in many classrooms has practically nothing to do with the world that the children are expe-

riencing. Just as *literacy* has come to mean much more than reading and writing, *mathematics* must also be thought of as more than, and indeed different from, counting, calculating, sorting, or comparing" (p. 308). This position implies that classrooms need to include opportunities for students to engage with mathematics in ways that they view as being sensible in light of their experiences outside the classroom (Croom, 1997; Ladson-Billings, 1997). The goal is to let students see mathematics as an activity that is reasonable to pursue for its own sake rather than as an activity that contradicts their "peer" or "social" identities (cf. Fordham & Ogbu, 1996).

Teaching as "Digging Knowledge Out" of Students

Thinking of teaching as a process of building on what students already know is closely linked to the assumption of competence. However, succeeding at teaching by building on student thinking is complex and difficult (Lampert, 2001) and requires significant mathematical knowledge and courage on the part of the teacher (Staples, 2004). Schifter (2001) identified four critical mathematical skills that teachers need to be effective at teaching in this way:

1. Attending to the mathematics in what students are saying and doing;
2. Assessing the mathematical validity of students' ideas;
3. Listening for the sense in students' mathematical thinking—even when something is amiss; and
4. Identifying the conceptual issues the students are working on.

Taken together, these four skills require teachers to value their students' mathematical thinking and to consider what they already know as stepping stones for their development of disciplinary competence. In addition, it requires close and careful listening on the part of the teacher to hear the mathematics in what are not always clear explanations. Finally, teaching as "digging knowledge out" of students requires having a deep understanding of particular mathematical ideas and being knowledgeable about how students usually progress through levels of understanding of those ideas (i.e., pedagogical content knowledge; see Shulman, 1986, 1987).

As our discussion of these four characteristics of "good teaching" indicates, the focus of the kind of pedagogy that Ladson-Billings investigated is not restricted to the concepts and skills that students need to learn; it also includes students' learning about what it means to be a learner. The intent of these aspects of effective pedagogy is to enable all students to participate substantially in classroom mathematical practices and to develop competence and a sense of affiliation with and empowerment towards the discipline as they do so. Moses and Cobb (2001) highlighted the importance of disciplinary empowerment in postindustrial societies, particularly for students from traditionally marginalised groups:

> It's not so cool or hip to be completely illiterate in math. The older generation may be able to get away with it, but the younger generation coming up now can't—not if they're going to function in the society, have economic viability, be in a position to meaningfully participate, and have some say-so in the decision making that affects their lives. They cannot afford to be completely ignorant of these technological tools and languages. (p. 14)

This call further emphasises the need to be as concerned with the kinds of dispositions that students are developing as with the disciplinary ideas and skills that they are developing. Focusing on the ways that students are engaging with mathematics and supporting their development of an active, empowered relationship with the discipline is crucial in fostering positive ideas about the role that mathematics can play in their future lives (Boaler & Greeno, 2000; Martin, 2000; Moses & Cobb, 2001).

CONCLUSION

Reorganising classroom practices to include a focus on the dispositions that students are developing towards a particular subject matter involves reframing what it means to teach and learn. It is not sufficient to focus exclusively on the ideas and skills that we want students to learn. Teaching with students' dispositions in mind requires attending to how the discipline is realised in the classroom and to implications for students' development of a sense of affiliation with a discipline (Boaler & Greeno, 2000). The effort required to enact these changes would not come without benefits, however. Understanding how dispositions take form and attempting to foster the development of increasingly positive and productive dispositions towards learning in a subject-matter domain will allow us to begin to address the current well-documented gap between who actually has an opportunity to be successful in ~~the~~ classrooms.

REFERENCES

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology, 80*(~~3~~), 260–267.

Banks, J. A. (1995). Multicultural education and curriculum transformation. *Journal of Negro Education, 64*(~~4~~), 390–400.

Beach, K. (1999). Consequential transitions: A sociocultural expedition beyond transfer in education. *Review of Research in Education, 24,* 101–140.

Boaler, J. (1997). *Experiencing school mathematics: Teaching styles, sex, and setting.* Philadelphia: Open University Press.

Boaler, J., & Greeno, J. G. (2000). Identity, agency, and knowing in mathematical worlds. In J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning* (pp. 171–200). Westport, CT: Ablex.

Brown, C. A., Stein, M. K., & Forman, E. A. (1996). Assisting teachers and students to reform the mathematics classroom. *Educational Studies in Mathematics, 31,* 63–93.

Cobb, P., & Bowers, J. S. (1999). Cognitive and situated learning perspectives in theory and practice. *Educational Researcher, 28*(2), 4–15.

Cobb, P., & Hodge, L. L. (2002). A relational perspective on issues of cultural diversity and equity as they play out in the mathematics classroom. *Mathematical Thinking and Learning, 4*~~(2/3)~~, 249–284.

Cobb, P., Wood, T., Yackel, E., & McNeal, G. (1992). Characteristics of classroom mathematics traditions: An international analysis. *American Educational Research Journal, 29,* 573–604.

Cobb, P., & Yackel, E. (1996). Constructivist, emergent, and sociocultural perspectives in the context of developmental research. *Educational Psychologist, 31,* 175–190.

Cohen, E. G., & Lotan, R. A. (1995). Producing equal status interactions in the heterogeneous classroom. *American Educational Research Journal, 32*~~(1)~~, 99–120.

Croom, L. (1997). Mathematics for all students: Access, excellence, and equity. In J. Trentacosta & M. J. Kenney (Eds.), *Multicultural and gender diversity in the mathematics classroom: The gift of diversity 1997 yearbook.* Reston, VA: National Council of Teachers of Mathematics.

D'Amato, J. (1992). Resistance and compliance in minority classrooms. In E. Jacobs & C. Jordan (Eds.), *Minority education: Anthropological perspectives* (pp. 181–207). Norwood, NJ: Ablex.

D'Ambrosio, U. (2001, February). What is ethnomathematics, and how can it help children in schools? *Teaching Children Mathematics, 7*~~(6)~~, 308–310.

Dewey, J. (1975). *Interest and effort in education.* Carbondale: Southern Illinois University Press. (Original work published 1913)

Engle, R. A., & Conant, F. (2002). Guiding principles for fostering productive disciplinary engagement: Explaining an emergent argument in a Community of Learners classroom. *Cognition and Instruction, 20*~~(4)~~, 399–483.

Fordham, S., & Ogbu, J. U. (1996). Black students' school success: Coping with the "burden of acting White." *Urban Review, 18*~~(3)~~, 176–206.

Greeno, J. G. (1991). Number sense as situated knowing in a conceptual domain. *Journal for Research in Mathematics Education, 22*~~(3)~~, 170–218.

Greeno, J. G., & Hull, G. (2002). *Identity and agency in non-school and school worlds.* Paper presented at the conference for After-School Programs and Supplementary Education, Open Society Institute, New York.

Greeno, J. G., & Middle School Mathematics Through Applications Project Group. (1998). The situativity of knowing, learning, and research. *American Psychologist, 53*~~(1)~~, 5–26.

Greeno, J. G., Sommerfeld, M. C., & Wiebe, M. (2000). Practices of questioning and explaining in learning to model. In L. R. Gleitman & A. K. Joshi (Eds.), *Proceedings of the twenty-second annual conference of the Cognitive Science Society* (pp. 669–674). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Gresalfi, M. S. (2004). *Taking up opportunities to learn: Examining the construction of participatory mathematical identities in middle school students.* Unpublished doctoral dissertation, Stanford University, Stanford, CA.

Gresalfi, M. S., Martin, T., Hand, V., & Greeno, J. (2005). *Constructing competence: An analysis of student participation in the activity systems of mathematics classrooms.* Manuscript in preparation.

Ladson-Billings, G. (1994). *The dreamkeepers: Successful teachers of African American children.* San Francisco: Jossey-Bass.

Ladson-Billings, G. (1997). It doesn't add up: African American students' mathematical achievement. *Journal for Research in Mathematics Education, 28*~~(6)~~, 697–708.

Lampert, M. (1990). When the problem is not the question and the solution is not the answer: Mathematical knowing and teaching. *American Educational Research Journal, 27*(1), 29–63.

Lampert, M. (2001). *Teaching problems and the problems of teaching.* New Haven, CT: Yale University Press.

Lave, J. (1988). *Cognition in practice.* Cambridge, England: Cambridge University Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* New York: Cambridge University Press.

Ma, L. (1999). *Knowing and teaching elementary school mathematics.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Martin, D. (2000). *Mathematics success and failure among African-American youth: The roles of sociohistorical context, community forces, school influence, and individual agency.* Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Moses, R. P., & Cobb, C. E. (2001). *Radical equations: Math literacy and civil rights.* Boston: Beacon Press.

Nasir, N. S. (2002). Identity, goals, and learning: Mathematics in cultural practice. *Mathematical Thinking and Learning, 4*(2/3), 213–247.

Pickering, A. (1995). *Mangle of practice: Time, agency, and science.* Chicago: University of Chicago Press.

Schifter, D. (2001). Learning to see the invisible: What skills and knowledge are needed to engage with students' mathematical ideas? In T. Wood, B. S. Nelson, & J. Warfield (Eds.), *Beyond classical pedagogy: Teaching elementary school mathematics* (pp. 109–134). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Schoenfeld, A. H. (1988). When good teaching leads to bad results: The disasters of "well-taught" mathematics courses. *Educational Psychologist, 23*(2), 145–166.

Schoenfeld, A. H. (1998). Toward a theory of teaching-in-context. *Issues in Education, 4*(1), 1–94.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1–22.

Staples, M. (2004). *Developing a community of collaborative learners: Reconfiguring roles, relationships and practices in a high school mathematics class.* Unpublished doctoral dissertation, Stanford University, Stanford, CA.

Stipek, D., Salmon, J. M., Givvin, K. B., Kazemi, E., Saxe, G., & MacGyvers, V. L. (1998). The value (and convergence) of practices suggested by motivation research and promoted by Mathematics education reformers. *Journal for Research in Mathematics Education, 29*(4), 465–488.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* Cambridge, England: Cambridge University Press.

Yackel, E., & Cobb, P. (1996). Sociomathematical norms, argumentation, and autonomy in Mathematics. *Journal for Research in Mathematics Education, 27,* 458–477.