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THE ETHNOGRAPHIC RESEARCH TRADITION AND MATHEMATICS EDUCATION RESEARCH

MARGARET A. EISENHART
Virginia Polytechnic Institute and State University

Although in theory ethnography has been put forward as a powerful naturalistic methodology, in practice it has rarely been used by educational researchers because of differences in assumptions, goals, and primary research questions. From my perspective as an educational anthropologist, I describe the research tradition of ethnography—its underlying assumptions, its heritage in holistic cultural anthropology, its goals and research questions, and the organization of its research methods. Throughout, I compare elements of this ethnographic tradition with more common educational research practices. In the final section, I discuss the advantages of improved communication for future research in both mathematics education and educational anthropology.

During the past 10 years, there has been considerable discussion in the educational research community about the value of ethnographic research. Although the discussion has increasingly cast ethnography in a favorable light, there remain clear differences in the research activities of ethnographers and educational researchers. Relatively few educational researchers have actually undertaken ethnographic research, that is, the "holistic depiction of uncontrived group interaction over a period of time, faithfully representing participant views and meanings" (Goetz & LeCompte, 1984, p. 51) or "the disciplined study of what the world is like for people who have learned to see, hear, speak, think, and act in ways that are different" (Spradley, 1980, p. 3). And, only a few ethnographers are doing work that is used by educational researchers.

The situation in mathematics education is, I believe, a microcosm of what is occurring in the educational research community. Numerous mathematics education researchers (I am thinking particularly of constructivists, of those interested in what teachers or students are thinking and actually doing in classrooms, and of those interested in the social context of mathematics education) are posing questions for which ethnographic research is appropriate. However, these researchers tend to use case studies, in-depth interviews, or in-classroom observations without doing what most educational anthropologists would call ethnographic research (Rist, 1980; Wolcott, 1980). On the other hand, educational anthropologists doing ethnographic

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research tend to overlook or subsume explicit academic content in their studies of classrooms, focusing instead on such things as the hidden curriculum, patterns of social interaction, or ideological conflicts in schools. These topics seem to be of secondary interest to many mathematics education researchers. (There are, of course, exceptions in both "camps." See, for example, Bishop, 1985, and Bishop & Nickson, 1983, in mathematics education and Erickson, 1982, in educational anthropology. However, I believe that divergence is the general trend.)

Although some might argue that this division of labor is appropriate or even desirable, I find myself increasingly uncomfortable with it because there seems to be so little communication between the two camps. Researchers in one camp rarely build upon or even cite the work of those in the other. This lack of cross-fertilization is curious indeed when one considers what could be gained by it. Educational researchers wishing to use open-ended research designs to study topics such as student achievement or teacher beliefs—topics traditionally investigated through experimental or survey designs—could find their case strengthened and a variety of methods explicated in the writings of ethnographers over the past 60 years (see Denzin, 1978; Goetz & LeCompte, 1984; Pelto & Pelto, 1974; Spradley, 1979, 1980). Those educational researchers interested in the impact of social context on mathematics education could find much of relevance in the ethnographic literature (see Anyon, 1980, 1981a, 1981b; Cole & Scribner, 1974; Lave, 1977, 1982, 1985). On the other side of the coin, educational anthropologists would find detailed information about students' cognitive processing of mathematics problems (Behr, Wachsmuth, Post, & Lesh, 1984; Carraher & Schliemann, 1985; Fischbein, Deri, Nello, & Marino, 1985) and about teacher and student attitudes toward mathematics (Cooney, 1985; Thompson, 1984) in the mathematics education research literature.

The lack of communication derives, I believe, from the fact that each group speaks a distinct research language. Each poses its major research questions differently and pursues different goals through research. For example, research questions in mathematics education tend to be derivatives of the general question: How can mathematics teaching and learning be improved? The main goals of the research are descriptive and prescriptive: to identify psychological, psychosocial, or instructional factors and processes that affect mathematics education and then to design and implement treatments to achieve better results. In contrast, research questions posed by educational anthropologists interested in mathematics tend to take the general form: Why is mathematics teaching and learning occurring in this way in this setting? The goals are descriptive and theoretical: to identify the sociocultural processes that constitute mathematics education in a particular setting and to make sense of this configuration through the development, modification, or adoption of theories of culture and social relations.

The questions and goals derive, in turn, from different underlying assumptions about human nature in general and the educational process in particular (Cole & Scribner, 1976). Most educational researchers have been trained in the tradition of experimental psychology. Thus, they are accustomed to assuming that the development of cognitive skills is central to human development, that these skills appear in a regular sequence regardless of context or content, that valid constructs of skill development (its antecedents, processes, and consequences) exist, and that these constructs can be used across people, settings, and time to obtain consistent measures of development. Schools tend to be viewed as quasi-laboratories where the students' environment can be constrained to promote the development of certain skills assumed to be good for everyone. Thus constraints, for example, instructional programs, that "work" to improve skill development in some students are examined for their crucial features and extended to other settings, given certain conditions. Research activity focuses on refining constructs of cognitive development, improving measurement devices, and modifying instructional treatments.

Educational anthropologists, on the other hand, have been trained to assume that human behavior and human learning are responsive to a context that is interpreted by participants and that is dominated by social relationships. The school is seen as an institution that, like other institutions in a society, organizes meanings and social relations in particular ways to support the social order of all the groups in the society. Thus, what is taught and learned is expected to vary by group. Research activity, then, focuses on describing manifestations of the social order in schools and developing frameworks for understanding how students, through exposure to schools, come to learn their place in society.

These different assumptions, together with the research goals and questions they underlie, lead researchers to prefer different procedures of inquiry. In the case of most educational researchers, descriptive methods may be useful when searching for relevant features and perhaps when assessing the impact of treatments. However, experimental and statistical methods are preferred because they suggest crucial features, the relatedness of features, and the generalizability of successful treatments. Statistical significance is usually the necessary criterion for recommending a practice or policy. For educational anthropologists, descriptive methods are preferred for mapping social institutions; interpretive methods must be used to make statements about how people understand their worlds. The construction or modification of theories of culture or social relations is usually the necessary criterion of a complete study.

Over time, all these differences have been codified into distinct traditions. The traditions embrace different ways of thinking of, talking about, and doing research. In the remainder of the paper, I use the label *educational researchers* to refer to those who conduct educational research in the general tradition of experimental psychology. I use the label *ethnographers* or *edu-*

cational anthropologists to refer to those who conduct research in the tradition of cultural anthropology.

Because research questions, goals, and underlying assumptions are usually learned implicitly when people are socialized into a profession, they can be difficult even for insiders to explain or compare. It seems easier to talk about research methods, perhaps because they are more likely to be explicitly taught to novices. As long as discussions between researchers trained in different traditions take place only at the level of methods, however, little communication is possible because the questions, goals, and assumptions that constitute methodological choices are not made explicit. That discussions between ethnographers and mathematics education researchers have taken place mostly at the level of method is, I think, evident by the limited understanding of the core ideas of ethnography by mathematics education researchers, and vice versa.

My purpose in this paper, then, is to more fully explain—from my perspective as an educational anthropologist—the difference between the ethnographer's assumptions, goals, questions, and, finally, methods and those of traditional educational researchers. In the next section, I assume that most readers are familiar with the general outline of the positivistic research tradition dominant in educational research, and I concentrate on the interpretivist tradition of ethnographic research. (For an excellent comparison of positivist and interpretivist traditions, see Bredo & Feinberg, 1982, pp. 3–27, 115–128.). In the final section of the paper, I discuss the advantages of better understanding for future research in both mathematics education and educational anthropology.

THE ETHNOGRAPHIC TRADITION

Interpretivist Assumptions

Many of the tenets of ethnography derive from a philosophical position sometimes referred to as *interpretivism* that is quite different from the logical positivism underlying traditional educational research. For those trained in the positivist tradition, interpretivism defines a distinctly different system for organizing and conceptualizing research—a system that must be grasped before its research goals, questions, and methods will appear rational or sensible to the positivist.

Central to interpretivism is the idea that all human activity is fundamentally a social and meaning-making experience, that significant research about human life is an attempt to reconstruct that experience, and that methods to investigate the experience must be modeled after or approximate it. Denzin (1978) describes the major components of the interpretivist view as follows:

> The social world of human beings is not made up of objects that have intrinsic meaning. The meaning of objects lies in the actions that human beings take toward them. . . . Social reality as it is sensed, known, and understood is a social production. Interacting individuals produce and define their own definitions of situations [and] the process of defining situations is ever-changing. . . . Second, humans are . . . capable of . . . shaping and guiding their own behavior and that of others [intentionally and unintentionally, and] humans learn . . . the definitions they attach to social objects through interactions with others. (p. 7)

From this perspective meanings and actions, context and situation are inextricably linked and make no sense in isolation from one another. The "facts" of human activity are social constructions; they exist only by social agreement or consensus among participants in a context and situation. What counts as marriage, gender roles, teaching, calculation, the right answer, or whatever depends on the ways (and whether) these things are defined and used in human groups (Bredo & Feinberg, 1982, p. 116). In other words, it makes no sense for the interpretivist to do things like catalog beliefs about mathematics without also considering the contexts in which these ideas are important.

The interpretivist further assumes that identifiable social groups construct coherent systems of belief and action from *intersubjective meanings*. These are "meanings and norms implicit in . . . the practices [of individuals], practices which cannot be conceived as a set of individual actions, but which are essentially modes of social relation, of mutual action" (Taylor, 1982, p. 173). These are not the meanings that people can express but rather the

> set of ideas . . . constitutive of [expressions and behaviors themselves]. These must be the common property of the society before there can be any question of anyone [using them] or not. Hence they are not subjective meanings . . . but rather intersubjective meanings, which are constitutive of the social matrix in which individuals find themselves and act. (Taylor, 1982, p. 173)

Because intersubjective meanings are implicit, the ways in which beliefs and actions make sense may only be accessible to insiders.

Thus, for an outsider—for example, a researcher—to understand human activity, it is necessary to first make a "studied commitment to actively enter into the worlds of interacting individuals" (Denzin, 1978, p. 8), and in so doing, to actively engage in an interpretive process. Blumer (quoted in Denzin, 1978) put it this way:

> We . . . must . . . look upon human life as chiefly a vast interpretative process in which people, singly and collectively, guide themselves by defining the objects, events, and situations which they encounter. . . . Any scheme designed to analyze human group life in its general character has to fit this process of interpretation. (p. 3)

Interpretivist Research Goals

The purpose of doing interpretivist research, then, is to provide information that will allow the investigator to "make sense" of the world from the perspective of participants; that is, the researcher must learn how to behave appropriately in that world *and* how to make that world understandable to outsiders, especially in the research community. Thus, the researcher must be involved in the activity as an insider and able to reflect upon it as an outsider. Conducting research is an act of interpretation on two levels: The experiences of participants must be explicated and interpreted in terms

of the rules of their culture and social relations, and the experiences of the researcher must be explicated and interpreted in terms of the same kind of rules in the intellectual community in which he or she works (Bredo & Feinberg, 1982; Denzin, 1978; S. Harding, 1985; Latour & Woolgar, 1979).

Interpretivist Research Questions

The research questions posed by interpretivists are intended to get at the intersubjective meanings of participants' and researchers' worlds. The questions ask first, What is going on here? and second, What intersubjective meanings underlie these "goings on" and render them reasonable? Note that "intersubjective meanings cannot be measured by aggregating data on individual beliefs or attitudes, or by standardized recording of individual behavior, just as the grammar of a language cannot be mapped by averaging individual usages" (Bredo & Feinberg, 1982, p. 124).

It is primarily within this tradition that ethnographic methods developed and make sense. I turn next to these methods.

Ethnography

The development of ethnography as a systematic research approach is usually associated with anthropologists' general interest in obtaining a "holistic" understanding of exotic groups and, by comparison, a better understanding of one's own group. However, it is important to realize that some nonanthropologists have developed or used research approaches that are virtually identical to ethnographic methods (see the examples discussed in Goetz & LeCompte, 1984, pp. 23–31), that ethnographers have been influenced by other disciplines and by positivist orientations, and that cultural anthropologists do not share a single definition of culture. Thus their specific methodological approaches will vary (Jacob, 1987). In what follows, I describe a general form of ethnography as it might be used by many cultural anthropologists.

> The central aim of ethnography is to understand another way of life from the native point of view. The goal of ethnography, as Malinowski put it, is "to grasp the native's point of view, his relation to life, to realize *his* vision of *his* world." . . . Rather than *studying people*, ethnography means *learning from* people. (Spradley, 1980, p. 3)

> The scope of the investigation mandated residence in the community and strongly suggested that studies should be conducted in the native language of the participants. The ethnographer was to study a society from the perspective of a child, by learning its language and basic patterns . . . and gradually becoming inducted into its life ways. This immersion into another culture allowed researchers access to the phenomenological views of participants. (Goetz & LeCompte, 1984, p. 15)

This definition of ethnography has its modern origins in the *holistic cultural anthropology* (Jacob, 1987) of Malinowski (1922), who emphasized the integrated social systems in which humans live and the need for close contact with and involvement in a group in order to understand its workings (Pelto & Pelto, 1974, p. 243).

Consistent with the interpretivist orientation, however, it is not enough just to take on the views of those being studied. The researcher must also be able to step back from the immediate scenes of activity and to reflect on what is occurring from the perspective of someone who is aware of other systems and of theoretical perspectives on sociocultural systems.

Ethnographic Methods

Four methods of data collection are commonly used by ethnographers in an attempt to understand (holistically) the worlds of others and themselves. The first is *participant observation* (for a detailed discussion of participant observation, see Denzin, 1978, Chapter 7; Spradley, 1980). Participant observation is the ethnographer's major technique for being both involved in and detached from the topic of study. Participant observation is a kind of schizophrenic activity in which, on the one hand, the researcher tries to learn to be a member of the group by becoming part of it and, on the other hand, tries to look on the scene as an outsider in order to gain a perspective not ordinarily held by someone who is a participant only.

There are a number of decisions to make about one's role as a participant observer. Some people choose to be primarily an observer and less of a participant. Others choose to become very involved in the activities of the group. One's role may change during the course of the study, and decisions about role affect not only what one does during the study but also how one uses the results (see Denzin, 1978, pp. 186–191; Goetz & LeCompte, 1984, pp. 93–106; Gold, 1958). The decision to be at one end of the continuum or the other depends on the nature of the research problem and the extent to which one can actually be a participant or an observer. For example, an adult researcher wishing to understand the mathematical concepts of young children will find full participation in the children's world of mathematics difficult; observation will be easier. In contrast, a researcher trying to understand the concepts of a teacher can expect to participate more fully and will find unobtrusive observation more difficult. Multiple researchers with different status positions in the group and mechanical recording devices may be necessary in order to gain information from both the participant and observer points of view.

A second method used to collect data is *ethnographic interviewing* (for a detailed discussion, see Goetz & LeCompte, 1984, pp. 119–142; Spradley, 1979). Interviews are the ethnographer's principal means of learning about participants' subjective views; thus, ethnographic interviews are usually open-ended, cover a wide range of topics, and take some time to complete. Interviews are also helpful to inform the researcher about activities beyond his or her immediate experience, such as relevant historical events or events occurring in other places.

These interviews take various forms: from the very informal interview, much like having a conversation with someone (except that one must try to

remember the conversation so it can be written down later); to long audiotaped sessions focused on a particular topic; to highly structured interviews in which the researcher begins with open-ended questions, then uses answers from the original open-ended questions to structure more focused questions, and then is finally able to convert responses into numerical form (see Clement, 1976; Eisenhart, Shrum, Harding, & Cuthbert, in press; Harding & Livesay, 1984).

A third method for collecting data is to *search for artifacts* (Denzin, 1978, pp. 219–228; Goetz & LeCompte, 1984, pp. 153–159). This method is a content search of written or graphic materials available on the topic of study. Searches of documents and other artifacts are the researcher's primary method of apprehending the context broadly (e.g., historically, economically, artistically, spatially), more broadly than would be possible by experiencing it directly. Any information produced by participants or others and in tangible form may be useful.

The fourth method is probably the most unusual, at least to those familiar with the positivist model of doing research. This method of data collection is *researcher introspection*. This method involves the researcher herself or himself reflecting on the research activities and context (see Denzin, 1978, pp. 67–72; Pelto & Pelto, 1974, pp. 245–260). The ethnographer regularly records the kinds of things that are happening to her or to him in the research situation. In this manner, the ethnographer tries to account for sources of emergent interpretations, insights, feelings, and the reactive effects that occur as the work proceeds.

When the ethnography is underway, all four of these methods are often employed together. Each is useful for providing a different perspective on the topic of interest. Once in the field, researchers employ their methods flexibly in an attempt to maximize opportunities to view the scene from many different perspectives and comprehend it holistically. In ethnographic research, the more perspectives represented, the stronger the research design, because each additional perspective contributes to a more complete picture of the scene of interest. About this Denzin (1978) says,

> Concepts and research methodology act as empirical *sensitizers* . . . [thus they] open new realms . . . but concomitantly close others. Two important consequences follow: If each method leads to different features of empirical reality, then no single method can ever completely capture all the relevant features of that reality; consequently [social scientists] must learn to employ multiple methods in the analysis of the same empirical events. This is termed *triangulation*. (p. 15; see also chap. 10)

Although the four methods described above constitute the primary data sources of ethnographic research, other methods of data collection (e.g., surveys, observation schedules, quasi-experiments) often supplement the corpus of data and contribute to triangulation. These methods are most often used to address questions unanswerable through ethnographic methods alone; for example, How typical is a particular action or event? How much time is spent in various activities? At what specific point in cognitive deliberations does a person experience processing difficulties? Note that these materials, often quantitative, are used primarily to generalize an interpretation, not to make it in the first place.

Systematic procedures exist for analyzing all the material described above. The purpose of these procedures is to identify meanings held by participants and researchers and to organize the meanings so they make sense internally (to the actors) and externally (to others).

Basically, ethnographic analysis consists of text-based procedures for assuring that the views of participant and researcher remain distinct and that all aspects of the material are taken into account. Generally, the procedures involve defining "meaningful" units of the material (meaningful to participant or researcher) and comparing units to other units. Like units are grouped together into categories. Categories are compared to all other categories and relationships between them posited. Categories and the relationships among them are considered and reconsidered in light of old material and as new material is gathered (see Denzin, 1978, pp. 27, 191–196; Goetz & LeCompte, 1984, pp. 164–165; Spradley, 1979, 1980).

Data collection and analysis proceed together throughout the period of study. The collection of new material and subsequent analysis may raise new research questions or lead to insights that become incorporated into, or sometimes radically redirect, the study itself as well as later data collection and analysis procedures. Erickson (1986, pp. 143–144) has described the process as "repeated trials at understanding recurrent events." At each trial, the focus of data collection and analysis is shifted slightly so that different features are attended to and different possible explanations are considered. Repeatedly, the researcher "tests" an emergent theory of culture or social organization by trying out various kinds of questions, methods, and interpretations. The ultimate goal is a theoretical explanation that encompasses all the data and thus provides a comprehensive picture of the complex of meanings and social activity.

Specific analysis strategies vary. Spradley (1979, pp. 92–204; 1980, pp. 85–154), for example, describes a procedure for organizing material into *domains* or major categories of meaning (these may include statements or behaviors) in which the elements are treated as if they were equivalent (1980, p. 88). Then all known elements in all domains are listed, and the meaning of elements within and between domains is compared in order to identify components that distinguish one domain from another. This sorting procedure may be done by the researcher alone but is more adequately done by researcher and participants together in order to preserve participant meanings and to fill in gaps in the researcher's material. The next step, usually done only by the researcher, is to organize meaningful components into plausible themes, or constitutive rules, that if used by an outsider, would allow him or her to make sense of the participants' world in the same

way they do. The final step is to consider the themes in light of existing sociocultural theories.

Erickson (1986, pp. 145–156), in contrast, describes a procedure for developing assertions about "what's going on," searching the corpus of material for confirming and disconfirming evidence, and producing an evidentiary record to warrant the acceptance of certain assertions. Then substantiated assertions are interpreted by recourse to theories.

Still others, such as Smith and Pohland (1976, based on Glaser & Strauss, 1967), describe a *constant comparative* method in which social activities are compared to each other as they occur, constituent incidents are identified and categorized, and relationships between categories are posited and tested in new situations. Thus the researcher generates categories and relationships and refines them as the social activity unfolds in time and space. Ultimately, substantiated categories and relationships between them are integrated into a theoretical whole, a *grounded theory*. (There are many more issues involved in ethnographic data collection and analysis than can be summarized here. For detailed discussions of the issues raised here and other concerns such as entry into the field, relationships with participants, sampling techniques, and methods of recording data, consult the works of the authors cited in this section.)

Reliability and Validity

As with other types of research, ethnographers have developed standards for judging the credibility and quality of their work. Standards for assessing reliability or validity are crucial here, but the nature of the research itself requires that these standards be met somewhat differently than they are in more familiar kinds of educational research designs.

Reliability, both external and internal, has historically been a problem for ethnographers because their work is sensitive to specific conditions and interactions (Goetz & LeCompte, 1984, pp. 208–235). Ethnographers search for locally and personally relevant meaning and organization from the settings, situations, and people being studied. They approach social scenes as units located in a particular time and space; they construct images that are designed to communicate the special characteristics of the scene under study. These features of ethnography do not lend themselves easily to replication in other settings or by other researchers.

Following Goetz and LeCompte (1984, pp. 211–220), however, ethnography can and should be made replicable if researchers carefully and thoroughly describe (a) the choice and use of settings and people in the study, (b) the social conditions under which the study takes place, (c) the role and status of the researcher in the study, (d) the theoretical or analytic constructs used to guide data collection or analysis, and (e) the data collection and analysis procedures used. This information should be presented so that other researchers are able to undertake similar studies to determine whether similar findings emerge elsewhere, whether the same findings are validated elsewhere, or whether the same findings emerge for someone else analyzing the original corpus of data.

The nature of ethnography makes it potentially quite strong in validity, especially internal validity. Long periods of time in the field in order to become familiar with participants' perspectives, the requirement that the researcher's actions and interviews be conducted in the idiom of participants, and the fact that the researcher is directly involved in the lives of those being studied converge to increase the chances that constructs and procedures make sense in the social reality of the group being studied.

Although ethnographers usually make such context validity a priority of their work, they also carefully describe and account for factors that may affect the internal validity of their information: (a) historical context, (b) selection of settings and people, (c) maturation or mortality of informants, and (d) observer reactive effects (Goetz & LeCompte, 1984, pp. 220–232; Denzin, 1978, pp. 196–201). Of particular concern is the possibility of drawing erroneous conclusions from spurious relationships in the data. Experimental and survey researchers may use statistical tests of significance to assist them here; the ethnographer's job is more difficult. He or she traces all possible relationships and causes through the full corpus of data until thoroughly convinced of the validity of the conclusions. This process necessitates a careful search for alternative or disconfirming evidence and the elimination of rival or alternative explanations, both in doing the research itself and in presenting the findings (Denzin, 1978; Erickson, 1986; Goetz & LeCompte, 1984).

Problems of external validity are reduced as obstacles to comparability across groups are overcome. Here again, a careful description of settings and people, the conditions of study, and the constructs used give other researchers the information necessary to assess the typicality of a situation and thus the appropriate comparison groups and translation issues.

Ethnographic methods are not appropriate or useful for all kinds of research. As already suggested, ethnography is not a good choice when the researcher's primary purpose is to assess the generalizability of a finding. In addition, it is not well suited for studies in which the researcher's active role can only be minimal. Ethnography depends on the researcher's active and personal involvement in data collection and analysis; where this involvement is unlikely or impossible, ethnography should not be used. Cole and Scribner (1976) have pointed out that traditional ethnography (that described here) is inadequate when psychological characteristics of individuals are a major focus of research. As part of their legacy from interpretivism and anthropology, ethnographers tend to attribute differences in cognitive performance to context rather than to individual (innate) ability. (Conversely, psychologists tend to attribute the same differences to ability, not context.) At the same time, ethnographers are reluctant to manipulate con-

text in order to determine the impact on cognitive performance. Thus the methodology is limited in its ability to account for the impact of context on thought. I return to this point in the last section of the paper.

Ethnography also has other internal limitations. Consistent with interpretivism, ethnographers begin their work with the assumption that those being studied are not crazy or stupid but are in some sense unknown and behave reasonably in terms of some coherent system yet to be defined (Bredo & Feinberg, 1982, p. 124). There is a danger here that the ethnographer will try to make sense of things that do not belong together (Bredo & Feinberg, 1982, p. 127) or will assume that an interpretation that fits is the only or the best one (Winch, 1982, p. 142). These dangers make it even more imperative for the ethnographer to use triangulation so as to be able to consider alternative organizations and interpretations of data.

There is also the problem that the ethnographer's stance of relativism may prevent him or her from considering that some systems, some reasons, or some behaviors are better or more adaptive than others. To overcome this limitation, the ethnographer must become a kind of systems broker, able to see and understand the implications of systemic alternatives—not an easy perspective to achieve.

Implications for Mathematics Education and Educational Anthropology

When ethnography is placed within the context of interpretivism and cultural anthropology and then compared to traditional educational research and psychology, it is clearer why ethnography has not translated easily into research in mathematics education. Six characteristics distinguish the work of ethnographers and mathematics education researchers. The first difference is the limited way in which mathematics education researchers (compared to ethnographers) enter into the lives or activities of those they are studying. Undoubtedly, active participation in the lives of subjects violates some of the cardinal principles of experimental design and thus makes educational researchers nervous. However, the anthropologically influenced work of Cole and associates (Cole & Means, 1981; Cole & Scribner, 1974; Gay & Cole, 1967; and Lave, 1977, 1982, 1985) suggests another way of thinking about experimental conditions, a way closely associated with interpretivism. These researchers have consistently tried to understand mathematical problem solving *in the same way* as their subjects. They have lived with their subjects, interviewed them, and manipulated their mathematical environments extensively over long periods of time in an attempt to learn how to respond to mathematical problems as their subjects do. The capability to establish conditions in which researcher and all subjects respond in the same way to problems has now become a baseline criterion of comparative research (Cole & Means, 1981). Although some mathematics education researchers are now open-endedly and descriptively investigating what students and teachers know and believe about mathematics, most stop short

of trying to emulate the problem-solving activities of their subjects. In addition, at least some of this work in mathematics education seems to be predicated on the idea that by understanding existing, "natural" knowledge and beliefs, researchers can bridge the gap between subjects' capabilities and the capabilities that researchers or teachers believe students should have. This understanding is only a partial step toward interpretivism inasmuch as these researchers rarely subject their own views to the same scrutiny (see, for example, Burger & Shaughnessy, 1986).

The second difference is the limited way in which mathematics education researchers have been sensitive to the intersubjective meanings that might constitute the schools, classrooms, and instructional dyads they study. These meanings are outside the purview of experimental research or psychology; they are neither recognized nor measurable within it. Consistent with experimental psychology, mathematics education researchers tend to assume they know the intersubjective meanings of the group they are studying. The policies and instructional programs, the arrangements of time and space, and the distribution of rewards are assumed—not examined—in most research in mathematics education. This is not the case if one looks at research in classrooms done by anthropologists, or teams including anthropologists or sociologists (see Anyon, 1980, 1981a, 1981b; Lave, 1977, 1982, 1985 for studies of mathematics; Au & Mason, 1981; Borko & Eisenhart, 1986; Hart, 1982, for examples in reading). Similarly, the knowledge about schools in general and mathematics in particular that students learn and use at home and in peer groups is rarely considered relevant to mathematics education researchers even though these processes have been shown to be very important in structuring opportunities for students to learn in school (Heath, 1983; Willis, 1977). Finally, the meanings encoded in the language of mathematics—in the way it is presented to and used by students—have not been a focus of much investigation in mathematics education. If mathematics education researchers used or worked with anthropologists, answers to these broader questions could be joined together with what is already known about cognitive processes and operations to provide a more complete picture of mathematics education. The writings of Bishop and Nickson (1983) and Bishop (1985) suggest a movement toward a greater recognition and explicit study of these components in the future of mathematics education.

The third difference, related to the second, is that mathematics education researchers rarely use sociocultural theories to help interpret their findings. Again, this territory is outside psychology, yet it offers another perspective that could be useful—not to replace existing theories, but to suggest new domains and relationships for study.

On the other side of the coin, educational anthropologists (compared to mathematics education researchers) give only limited attention to (a) cognitive abilities or (b) theories of cognitive development and information

processing. These two topics are generally outside the scope of sociocultural theories and, as usually formulated, contradict the thrust of interpretivism; anthropologists resist them because of their acontextual, ahistorical, and asocial features. Yet, for the same reasons given above, cognitive theories might be joined with sociocultural theories in efforts to create a comprehensive theory of human activity.

Finally, educational anthropologists rarely concern themselves with trying to do anything about educational problems. The relativist, dynamic, and interrelated-system tenets of interpretivism and holistic cultural anthropology lead many anthropologists to believe that their interpretations are too limited to serve as a basis for change. These tenets also discourage the manipulation of variables or the constraining of natural events in the proactive way often necessary to make choices—choices about what to do on Monday morning, choices no educator can ignore. Many educational anthropologists are also guilty of failing to follow where their theories, so elegantly created, lead them. For example, although sociocultural theories provide powerful frameworks for understanding why some mathematics outcomes persist in the long run despite variations in teachers, students, instructional programs, community climate, and so forth, educational anthropologists have rarely tried to create the conditions necessary to change undesirable outcomes. By joining with mathematics education researchers and other educators who, by necessity, must grapple with how to interpret research findings into practice, educational anthropologists could move into a new and potentially fruitful domain of study.

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AUTHOR

MARGARET A. EISENHART, Associate Professor of Education and Anthropology, College of Education, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061