Reference List

Abstract: A collage of the remnants of ethnomathematical history from which algebra sprung.

Abstract: The aim of this article is to provide a conceptual picture of a "Mathematics and Society" curriculum. Examples of such curricula are described, along with discussion of ethnomathematics and self-generated mathematics, the social institution of mathematics, critical thinking and conscientization, and policy issues. (MNS)

Abstract: This article showcases the efforts of the Hispanic Center of Excellence, a federally funded program which is part of the University of Medicine and Dentistry of New Jersey. The Center's goal is to increase the number of Latinos in the health professions. The center, which opened in 1991, offers programs for children as young as 3rd grade who have an interest in the health sciences. Among the resources they offer are an MCAT preparatory program, Gifted and Talented Elementary School Program, and also mentoring and guidance. A major goal of this program is to help "unnoticed" students with modest academic achievement to accomplish their goals, to offer them the right kind of support and encouragement so that they may "shine like never before."

Abstract: Social scientists generally agree that different cultures have different cognitive styles. New educational models which operate within a multicultural framework are necessary. As a result, traditional approaches to training educators must be adjusted if minority groups are to enter teacher education programs. (JL)

Abstract: In this article, the author points out the growing diversity of America's college population. Embracing these differences and using them to expand knowledge, she argues, will contribute to the inclusion of all people in different aspects of our society. She suggests that, by curriculum reform, college faculty can contribute to this inclusion. She suggests a variety of literary resources that college faculty can use to aid them in curriculum reform.


Abstract: This paper defines ethnomathematics and reviews the methods used to incorporate this philosophy into the current teaching of mathematics. Ethnomathematics rejects inequity, arrogance, and bigotry while challenging the Eurocentric bias that denies the mathematical contributions and rigor of other cultures. A review of the literature shows that the teaching of ethnomathematics will bring awareness to students that Europe is not now nor was it ever the center of civilization. Ultimately, this method will present an accurate history of mathematics, use a variety of examples to solve problems from a variety of cultures, and recognize that learning mathematics is a unique process for every individual. (CCM)

   Abstract: Ethnomathematics" refers to the study of mathematical ideas of traditional peoples who have generally been excluded from discussions of mathematics. This college-level text discusses mathematical ideas as they are expressed and embedded in cultures including the Inuit, Inca, Maori, and Bushoong. It also looks at the scope and implications of ethnomathematics and how it relates to other areas.

    Abstract: As the author observes, the philosopher Wittgenstein pointed to the problem of tracing graphs or figures as one that everyone can recognize as mathematical. Related problems have occurred in a variety of cultures. In western Europe, problems of tracing graphs or figures have occurred in Danish folk puzzles, where they were used as an alternative to dancing. Two patterns that are traced out are said to be similar to those on an artifact from Viking times, and are said to have mystical significance; and two others are said to be useful in witchcraft. Similar problems occur in other cultures as well. The article focuses on the context of the puzzles and the methods used to solve them in New Ireland and the Republic of Vanuatu, especially on the island of Malekula. A number of designs from Vanuatu have mystic significance. There is a tradition that one must complete a certain diagram to enter the Land of the Dead; failure results in being eaten. The methods used to draw the diagrams are also very interesting. In many cases, Ascher shows how individual drawing elements are transformed by processes such as reflection and rotation and are combined in systematic ways to draw the figure. Other types of mathematical ideas from Malekula include a drum signaling system with rhythms for each clan, rank, grade of pig, and special phrases, and a six-class marriage system which the elders explained with diagrams in the sand.

    Abstract: Stick charts are a significant part of the Marshallese navigation tradition. Here we focus on the mathematical ideas of modeling and mapping embodied in these charts as well as on the ideas about wave dynamics that they incorporate. These planar representations were used to teach prospective navigators the principles and specifics of the unique Marshallese system of "wave piloting."

    Abstract: Presents a dialogue about ethnomathematics that includes discussions of: quipus (knotted cords) as a form of language, difficulty in defining mathematics, culturally embedded mathematical ideas, philosophy and mathematics, quantification without giving meaning to numbers, and evolution in mathematical thinking. (MKR)

    Abstract: Extensive and readable discussion of the quipu, a system of knotted cords used by the Incas to store massive amounts of information important to their culture and civilization. Includes much information about the Inca culture, as well as an analysis and comparison of how data is stored and managed with a quipu with the way data is handled with computers.

    Abstract: This book, based on research on sociocultural aspects of mathematics education, presents contemporary and international perspectives on social justice and equity issues that impact mathematics education. In particular, it highlights the importance of three interacting and powerful factors--gender, social, and cultural dimensions. The book is research based and presents recommendations for practice and policy and identifying areas for further research. It addresses all aspects of formal and informal mathematics education and applications and all levels of formal schooling. The book is especially intended for researchers, graduate students, and policymakers in the field of mathematics education.

Abstract: In the development of new curriculum whose focus is mathematical activity as signifie, the verb as its signifian should be a center of consideration. This is why the proposed curriculum is named verb-based. In mathematics education, an activity deepens itself in a recursive manner through symbolization of activity. Bishop (1991) widened this concept of activity and claimed each culture has developed its own mathematics through six universal activities.

All the verbs at the primary level in the Japanese course of study were collected and analyzed in this paper. As a result this research showed the structure of activities on mathematical recognition through the verbs under the theory of internalization.


Abstract: Explores possible outcomes of using the "Professional Teaching Standards" as a set of tools to construct productive conversations about teaching. Presents a discussion taking place in the author's third grade classroom illustrating discourse in the classroom, accompanied by the author's commentary on the lesson. (MDH)


Abstract: Part of a special issue on mathematics and culture. A geometry lesson for fourth-grade students that focused on the beadwork designs of the Ute Native American people is described. This lesson invited students to integrate their knowledge of mathematics and the art of the Ute into the knowledge they acquired from social studies. This integration helped students to bridge the gap between school mathematics and real-world mathematics.


Abstract: The Shoshoni are an indigenous people who traditionally inhabited parts of what is now northern Utah, central and southern Idaho, and western Wyoming for the past 14,000 years. While many facets of their historical and recent culture have been analyzed, little investigation has taken place to date concerning their use of mathematics in culturally specific ways. This manuscript is the report of a two-year study involving semi-structured interviews of Shoshoni representatives to describe the culturally specific use of mathematics in Shoshoni traditional living practices. Qualitative research methods were selected in order to gain a rich understanding of the mathematical insight and uses of mathematics for the Shoshoni. The inquiry methods and related interview questions may serve as a model to structure research investigating mathematical practices of other American Indian cultures, thus allowing for a broader understanding of indigenous people and the culturally-specific mathematical practices of each tribe. Insight gained from this research prepares the way for American Indian educators to create culturally specific mathematics curricula reflecting the local culture of those they teach. Reprinted by permission of the publisher.


Abstract: Describes the meanings given to the word "ethnomathematics." Discusses three important publications on ethnomathematics, the new inspiration provided by the First International Conference on Ethnomathematics, and examines the critical mathematical direction represented by Powell and Frankenstein's collection. Contains 14 references. (ASK)
   Abstract: Any concept of ethnomathematics must eventually meet philosophical debates about the nature of mathematics. In particular neo-realist positions are anathema to the idea that mathematics is culturally based, but even modern quasi-empiricist philosophies are challenged by the fundamental relativity implied in ethnomathematical writing. 
   A new way of interpreting mathematical history which may allow for a truly relativist mathematics is described, and some evidence is presented to support this view. The kind of studies which would arise from this perspective on mathematics are outlined.

   Abstract: Presents examples of the use of mathematical modeling in mathematics courses in order to not lose sight of the essence of the mathematical attitude; encourage students' concern with problems that surround them; appreciate human resources; and associate mathematics with other sciences. (MKR)

   Abstract: Having flexible notions of the unit (e.g., 26 ones can be thought of as 2.6 tens, 1 ten 15 ones, 260 tenths, etc.) should be a major focus of elementary mathematics education. However, often these powerful notions are relegated to computations where the major emphasis is on "getting the right answer" thus procedural knowledge rather than conceptual knowledge becomes the primary focus. This paper reports on 22 high-performing students' reunitising processes ascertained from individual interviews on tasks requiring unitising, reunitising and regrouping; errors were categorised to depict particular thinking strategies. The results show that, even for high-performing students, regrouping is a cognitively complex task. This paper analyses this complexity and draws inferences for teaching.

   Abstract: This is an appeal to the readers of this journal to more closely examine intersections of race, gender and power in your writing because such materials are needed to teach future teachers and educators in general (Carl Grant et al., 2000).


   Abstract: Discusses research issues deriving from different interpretations and responses to cultural conflicts in mathematics education and presents a possible research agenda. (25 references) (MKR)

   Abstract: This book breaks new ground in Mathematics Education by taking as its focus the idea of Mathematics as a cultural product and analyzing the educational consequences of this cultural perspective. Drawing on a wide variety of sources and references, the book integrates the literature into a new conceptual schema that demonstrates and substantiates the meaning of Mathematics as cultural product. A new curriculum structure integrating enculturation into the mathematics education curriculum is introduced, as well as exploring the mathematical enculturation process. Finally, there are several important implications for mathematics teacher preparation and for the whole process of teacher education made in the final chapter. Following a preface by the author, the seven chapters include: (1) "Towards a Way of Knowing"; (2) "Environmental Activities and Mathematical Culture"; (3) "The Values of Mathematical Culture"; (4) "Mathematical Culture and the Child"; (5) "Mathematical Enculturation: The Curriculum"; (6) "Mathematical Enculturation: The Process"; and (7) "The Mathematical Enculturators." An extensive bibliography contains over 200 references. (MDH)
Abstract: Mathematics, like many other school subjects, was imposed on indigenous pupils in the colonial schools. According to Bishop, mathematics continues to have the status of a culture-free phenomenon in the otherwise turbulent waters of education and imperialism. Bishop identified three levels of response to the cultural imperialism of Western mathematics: 1) increasing interest in the study of ethnomathematics, 2) creating a greater awareness of one's own culture, 3) re-examining the whole history of Western mathematics itself. Bishop concluded his article claiming the resistance to Western mathematics is growing, critical debate is informing theoretical development, and research is increasing, in particular in those situations in which cultural conflict is recognized.

Abstract: Considered transfer of students' (n=100) mathematical understanding across different task contexts in an integrated process-content approach using open-ended activities and a typical English content-based approach. The integrated approach facilitated transfer. (Contains 26 references.) (MKR/Author)

Abstract: Suggests that contexts may be useful in mathematics instruction in relation to learning transfer and that the factors that determine whether a context is useful are complex. Discusses the context effect, learning in context, how well students identify with tasks taken out of an adult world, and the effects of ethnomathematics. (MDH)

Abstract: Mathematics that exists in the Mende culture, an African tribe in Sierra Leone, includes counting, computation, ratios, fractions, forecasting games, and mathematical applications. Presents The Mende representations of these concepts and discusses implications of their integration into mathematics teaching. (MDH)


Abstract: Discussed is the notion of ethnomathematics as an epistemological approach to mathematics. The relationship between ethnomathematics and mathematics education is described. Suggestions regarding mathematical pedagogy are provided. (CW)

Abstract: Our goal in this paper is to make two points. First, college students, even those who have taken a fair number of mathematics courses, do not have much of an understanding of the function concept; and second, an epistemological theory we have been developing points to an instructional treatment, using computers, that results in substantial improvements for many students. They seem to develop a process conception of function and are able to use it to do mathematics. After an introductory section we outline, in Section 2, our theoretical epistemology in general and indicate how it applies to the function concept in particular. In Sections 3, 4, and 5 we provide specific details on this study and describe the development of the function concept that appeared to take place in the students that we are considering. In Section 6 we interpret the results and draw some conclusions.

36. Carraher, D., & Schliemann, A. D. (2002). The transfer dilemma. The Journal of the Learning Sciences, 11(1), 1-24. Abstract: In this article we provide an overview of research on transfer, highlighting its main tenets. Then we look at interviews of two 5th-grade students learning about mathematical concepts regarding operations on positive and negative quantities. We attempt to focus on how their learning is influenced by their prior knowledge and experience. We take the position that transfer is a theory of learning and we attempt to show that it cannot provide a solid foundation for explaining such examples of learning.

37. Caston, J. J. (1994). The learning experience: Impact on measures of institutional effectiveness. Paper presented at the Sixteenth Annual Leadership 2000 Conference. Abstract: In spring 1994, a study was conducted to compare student outcomes for instructors use of a mixed teaching repertoire (i.e., lecture, student-centered discussion, cooperative learning, and computer-assisted instruction) and those using lectures alone in social science, science/math, humanities, and business classes at Cosumnes River College, in California. Based on surveys of instructors and students and class observations, 22 matched pairs of courses were determined based on instructor technique. In addition, the ethnicity, gender, age, and English-as-a-Second-Language (ESL) status of the 812 students in the lecture-only and the 603 in the mixed-repertoire courses were analyzed to determine group outcomes. Study findings included the following: (1) attendance was generally better in lecture-based than in mixed-repertoire classes especially among 25 or older, native English speaking, white, and female groups; (2) while, students over 25, native English speakers, Asian/Pacific Islanders, Whites, and females earned higher grades in lecture-based courses, students under 25, ESL students, African-Americans, Hispanics, and males earned higher grades in classes using a mixed repertoire; (3) with respect to course completion rates, students in social science mixed-repertoire courses were significantly more likely to successfully complete than in lecture courses; and (4) while students felt they had opportunity to succeed regardless of methodology, they felt they had a greater opportunity to succeed in the lecture group. (Contains 16 references.) (KP)

38. Civil, M. (1995). Everyday mathematics, "mathematicians' mathematics," and school mathematics: Can we (should we) bring these two cultures together? Symposium: "Communities of Practice in Mathematics Classrooms: Reconciling Everyday and Mathematicians' Mathematics?" at the Annual Meeting of the American Educational Research Association Washington, D.C.: Office of Educational Research and Improvement. Abstract: This paper is based on efforts to bring change to school mathematics by trying to develop mathematics classroom communities in predominantly minority classrooms. In these communities, students work towards doing mathematics by working on open-ended, investigative situations; sharing ideas and strategies; and jointly negotiating meanings. Students also need to develop mathematics from their backgrounds and experiences with everyday mathematics. This paper explores the tensions and compromises resulting from the different conceptions of program participants (school and university teacher-researchers, students, and parents) of what mathematics is and of what mathematics children should learn. The work discussed focuses on geometry in a fifth-grade class. An appendix contains written work by students on finding angles on pattern blocks. Contains 38 references. (Author/MKR)

39. Cobb, P., & McClain, K. (2001). An approach for supporting teachers' learning in social context. In F. Lin, & T. J. Cooney (Eds.), Making sense of mathematics teacher education (pp. 207-231). the Netherlands: Kluwer Academic Publishers. Abstract: Our purpose in this chapter is to outline a general approach to collaborating with teachers in order to support the establishment of a professional teaching community. As will become apparent, our goal is to help teachers develop instructional practices in which they induct their students into the ways of reasoning of the discipline by building systematically on their current mathematical activity. We develop the rationale for the approach we propose by describing how our thinking about in-service teacher development has evolved over the last thirteen years or so. To this end, we first revisit work conducted in collaboration with Erna Yackel and Terry Wood between 1986 and 1992 in which we supported the development of American second- and third-grade teachers. In doing so, we tease out aspects of the approach we took that still appear viable and discuss two major lessons that we learned. In the next section of the chapter, we draw on a series of teaching experiments we have conducted over the past seven years in American elementary and middle-school classrooms both to critique our prior work and to develop three further aspects of the approach we propose. We conclude by highlighting broad features of the approach and by locating them in institutional
context.

40. Cobb, P. (1996). Accounting for mathematical learning in the social context of the classroom. *Proceedings of the Eighth International Congress on Mathematical Education*. Abstract: This paper focuses on the issue of accounting for students' mathematical learning as it occurs in the social context of the classroom. In the opening section of the paper, I first clarify why this is a significant issue for myself and my colleagues and develop criteria for classroom analyses that are relevant to our purposes. In the second part of the paper, I outline the interpretive framework that we currently use by presenting a sample analysis. In the final section, I reflect on this analysis to address four more general issues. These concern the contributions of the type illustrated by the sample analysis, the relationship between instructional design and classroom-based research, the role of symbols and other tools in mathematical learning, and the relation between individual students' mathematical activity and communal classroom processes.

41. Cobb, P. (1986). Contexts, goals, beliefs, and learning mathematics. *For the Learning of Mathematics, 6*(2), 2-9. Abstract: Advanced is the hypothesis that students organize their beliefs about mathematics to resolve problems that are primarily social rather than mathematical in origin. The contextuality of cognition, meaning-making, and learning in interactive situations are each discussed. (MNS)


43. Collins, B. (1992). Staff development for multicultural education in mathematics. *7th International Congress on Mathematics Education*. Abstract: A fertile area for the improvement of mathematics achievement in the United States is in staff development for multicultural education. Multicultural mathematics is best defined by what it is not; it is not ethnomathematics, nor simply Afrocentrism or Eurocentrism. Multicultural mathematics furthers the multicultural goals of the school system because it shows minority students that all social groups have contributed to the body of knowledge they learn in mathematics class. Preservice education for teachers is the best opportunity to introduce a multicultural perspective on mathematics. Multicultural mathematics education should be taught in inservice programs as well. Regardless of the depth of instruction necessary to acquaint teachers with multicultural mathematics, the important ingredient is a commitment to inclusion. Problem solving in mathematics provides an opportunity to pose problems from many cultures that highlight many social groups. National standards efforts do not always address multicultural approaches directly, but they do encourage the inclusion of all cultures. Inservice education offerings must also be locally relevant, with emphasis on the cultural groups served. (SLD)


45. Connoly, P., & Vilardi, T. (1989). *Writing to learn mathematics and science*. New York: Teachers College Press. Abstract: The emphasis on writing in the teaching of mathematics and science can empower teachers to reach all sectors of the pupil population. The use of ordinary language can help break the cultural barriers that have prevented minorities and women from achieving well in proportionate numbers in these fields. This volume focuses on pedagogical issues of using ordinary language to teach science and mathematics. Topics addressed by the 23 collected papers include: (1) general issues; (2) writing as problem solving; (3) applications in the classroom; (4) program policies; (5) learning in context; and (6) some responses to this method. (CW)


Abstract: This paper traces the development of guidelines to help education instructors effectively evaluate and provide guided practice for student teachers as they reflect on their professional work. The University of Wisconsin River Falls requires student teachers to videotape their teaching experiences, then reflect on how, why, and where they meet Wisconsin learning outcomes and standards with the videotaped assignments. Students must reflect on how to change and improve their instruction and establish goals for professional development. Instructor feedback on students' reflections is an important part of the effort. Researchers reviewed and ranked five preservice teachers' videotaped teaching and reflections. This led to levels of reflection rubric, which divided reflections into high, medium, and low levels. Three students were then assisted with their reflections as they viewed their videotapes, and they engaged in a dialogue about their teaching. New insights gained by the three guided practice sessions included the need to provide instruction on videotaping, guidelines for editing and reflecting, and instructors' need to provide developmentally appropriate reflective assessments and accompanying assessments. A three-stage developmental model for reflective practitioners emerged which applies the six levels of Bloom's Taxonomy and includes the Ten Wisconsin Teaching Standards. Videotape Reflection Feedback Form (rubric for enhancing peer dialogues or faculty assessments of reflective practice) and the same rubric reduced to reflect this assignment are appended. (Contains 20 references.) (SM)


Abstract: This article discusses how different experimental tools can be used to help high school student to understand geometry and to make connections with other areas of mathematics. Among these tools is a new breed of geometry software that allows students to visualize geometric concepts. These tools, along with a curriculum that supports a spirit of mathematical research, will allow students to increase their achievements in their mathematics classes.


Abstract: The First International Congress of Ethnomathematics took place in Granada, Spain, from 2 to 5 September 1998, hosted by the University of Granada, with the support of several organizations. In this paper I make some considerations on the why's and when of ethnomathematics as an academic research field and report on the ISGEm/International Study Group on Ethnomathematics and its first international congress.


Abstract: Some basic issues which may lay the groundwork for a historical approach to teaching mathematics by developing the concept of ethnomathematics are presented. A historical review and relationships between history and pedagogy are discussed in detail. (MNS)


Abstract: The history and geography of human behavior allows for us to have a new look into the emergence of mathematical ideas in different cultural environments. With this background, we can develop a conceptual framework for ethnomathematics. Scenarios of the future can lead to considerations about the next steps of the ethnomathematics movement.


Abstract: Discusses the nature of mathematics, the goals of education, and the political dimension of mathematics. Considers ethnomathematics, the history of mathematics, and advances in ethnomathematics.
Proposes a new conception of curriculum. (ASK)

   Abstract: Part of a special issue on mathematics and culture. Information on ethnomathematics and how it can assist children in schools is provided. The information relates to the definition of ethnomathematics, goals of multicultural mathematics, current mathematics curricula, and consequences of acultural mathematical perspectives.

   Abstract: School mathematics is governed by a powerful tradition as regards both content and methods. In the first stage of the Alternative Course of Mathematics (ALM) project, an analysis is being made of the mathematics used in the everyday life of the community. By interviewing adults and children outside school, an analysis is also being made of the way in which people handle this mathematics, which methods they employ and how, for example, they use modern aids such as the pocket calculator. Both analyses can be related to the concept of "Ethnomathematics" in the broad sense. The main concern of the ALM project is to inquire whether any of this mathematics can be introduced as an alternative in school mathematics and whether any of the methods which people use in their everyday lives or in their working lives can also be presented as a method in school mathematics. Under the ALM project, therefore, parallel to research activities, an experimental scheme is being conducted in various grades to test new methods. (Author/YP)

   Abstract: A course offered to teachers of Native American students focused on the development of culturally relevant activities as part of the science and math curricula. These activities were embedded in a holistic approach to the curriculum, and the informal math and science of the culture were linked with traditional school science and math.

   Abstract: Investigates the mathematical practices used by a home designer and builder. Points out the existence not only of diverse forms of mathematics, or ethnomathematics, but also of diverse ways of doing mathematics. Argues that these idiosyncratic ways of mathematizing, whether pertaining to individuals or to entire cultural groups, should be recognized and legitimized in mathematics classrooms. (ASK)

   Abstract: Millions of young people who could achieve in mathematics and science are being discouraged or prevented from studying these subjects. Access to jobs, status and power in a high-tech, information economy depends upon mastery of these fields, but erroneous beliefs about aptitude are limiting the options for young women, students of color and students from poverty. Curriculum reform efforts are exciting, much-needed improvements, but the single most important change we need is a national consciousness raising. We should hold high expectations for all students and expect virtually all of them to achieve. Outdated and false notions about which groups possess the aptitude for technical subjects should not be used as barriers to access.
Abstract: Fractals are characterized by the repetition of similar patterns at ever-diminishing scales. Fractal geometry has emerged as one of the most exciting frontiers on the border between mathematics and information technology and can be seen in many of the swirling patterns produced by computer graphics. It has become a new tool for modeling in biology, geology, and other natural sciences. Anthropologists have observed that the patterns produced in different cultures can be characterized by specific design themes. In Europe and America, we often see cities laid out in a grid pattern of straight streets and right-angle corners. In contrast, traditional African settlements tend to use fractal structure--circles of circles of circular dwellings, rectangular walls enclosing ever-smaller rectangles, and streets in which broad avenues branch down to tiny footpaths with striking geometric repetition. These indigenous fractals are not limited to architecture; their recursive patterns echo throughout many disparate African designs and knowledge systems. Drawing on interviews with African designers, artists, and scientists, Ron Eglash investigates fractals in African architecture, traditional hairstyling, textiles, sculpture, painting, carving, metalwork, religion, games, practical craft, quantitative technologies, and symbolic systems. He also examines the political and social implications of the existence of African fractal geometry. His book makes a unique contribution to the study of mathematics, African culture, anthropology, and computer simulations.

Abstract: Introduces a few examples of Mangbetu designs and examines their underlying structure. Describes Mangbetu design and analyzes its geometric features. (ASK)

Abstract: This article consists mostly of excerpts from the author's article, "When math worlds collide: intention and invention in ethnomathematics." The author first defines ethnomathematics, then describes five subfields in ethnomathematics: non-western mathematics, mathematical anthropology, sociology of mathematics, vernacular mathematics, and indigenous mathematics. Eglash addresses the dangers of using ethnomathematics as part of the curriculum, as this may unintentionally perpetuate stereotypes by assigning a certain "romantic" or "primitive" meaning to these cultures. Also, the author emphasizes the importance of incorporating the cultural concepts held by students themselves--rather than broad, essentialist concepts--to the curriculum.

Abstract: Despite suggestions for incorporating students' experiences into school math lessons, mathematics education seems to be the last bastion of formalism. This paper reports on a sociocultural study of the use of students' personal experiences in early childhood elementary mathematics lessons. This study documents the use of students' personal out-of-school experiences in classroom math and other subjects and investigates barriers that may prevent such linking. The following questions are addressed: (1) To what extent do teachers currently link school math and students' personal out-of-school experiences? and (2) What influences the use of such linking? The study included observations of lessons in mathematics, language arts, and social studies in public, private, and homeschool settings. Despite recommendations in the literature, results showed that teachers rarely link students' personal experiences to math concepts. Linking is more common in language arts and social studies than in mathematics lessons. This study found that the gap between school math and the life experiences of students is established early in elementary school. It is therefore suggested that any reforms need to be implemented in the early grades as well as higher grades. (PVD)
63. Ernest, P. (1996). Social constructivism as a philosophy of mathematics. Proceedings of the Eighth International Congress on Mathematical Education. Abstract: Social constructivism as a philosophy of mathematics is concerned with the genesis and warranting of mathematical knowledge. These processes take place both in the contexts of research mathematics and in the contexts of schooling, where they concern learning and assessment. A theoretical account of these processes situated in human practices will be given, based on the work of Lakatos and Wittgenstein. The resulting theory might be termed a post-modernist philosophy of mathematics, since it dethrones logic as the foundation of mathematical knowledge in favour of decentred human practices and context-bound warranting conversations. Attention will also be devoted to the relations between the philosophy of mathematics and mathematics education. The fact that developments in the philosophy of mathematics and corresponding informal conceptions have important outcomes for mathematics education is widely noted. What is less remarked is that issues of learning and assessment have significant implications, for the discipline of mathematics and for its philosophy, at least from social constructivist and fallibilist perspectives. This will be discussed, together with other relevant issues.


65. Everson, H. T., Tobias, S., & Laitusis, V. (1997). Do metacognitive skills and learning strategies transfer across domains? Paper presented at the Annual Meeting of the American Educational Research Association. New York, NY: College Entrance Examination Board. Abstract: Current theories of metacognition suggest that effective control of learning by either metacognitive or self-regulatory processes cannot occur without accurate monitoring of learning. Given this theoretical framework, there are questions of whether knowledge monitoring and self-regulated learning abilities are domain-specific or whether metacognitive processes, in particular knowledge monitoring ability, generalize across academic domains. This study examines that issue by exploring the correlations among measures of metacognitive knowledge, learning, and study strategies, and academic achievement across the domains of verbal ability and mathematics. Using parallel measures of knowledge monitoring in both the verbal and mathematical domains, 120 undergraduates estimated their metacognitive knowledge, reported their confidence in the accuracy of those estimates, and completed a self-report measure of learning and study strategies. Results suggest that metacognitive knowledge is generalizable across both the verbal and mathematical domains. The correlations between the two knowledge monitoring measures and students' confidence estimates were also in the expected directions. Moreover, both knowledge monitoring measures correlated with students' grade point averages. Correlations with subscales of the Learning and Study Strategies Inventory were not significant. Findings are discussed in the framework of current theory in metacognition and conceptions of strategic learning. An appendix shows multiple regression results. (Contains 1 table and 47 references.) (Author/SLD)

66. Fasheh, M. (1982). Mathematics, culture, and authority. For the Learning of Mathematics, 3(2), 2-8. Abstract: This article deals with the interaction between mathematics instruction on the one hand and established cultural patterns of belief, thinking and behaviour on the other hand, especially in Third World countries. The article points to the importance of culture in influencing the way people see things and understand concepts, and to the importance of using cultural and societal sources and personal experiences in making the teaching of mathematics more effective and more meaningful, as well as to the ways in which mathematics can be used to deal with some drawbacks in one's own culture and society. In addition, the article points out the conflict that usually arises between existing authorities and the teaching of mathematics when the latter is taught in such a way as to enhance critical thinking, self-expression, and cultural and social awareness. The region under consideration is the West Bank of Jordan (Eastern Palestine) where I spent my school years and over fifteen years as a mathematics teacher and educator.
Abstract: What do we mean by "Western Civilization"? When did the expression originate and why? At a time when there is a widespread perception that "Western Civilization" is undergoing a historic crisis, and when postmodernism, feminist theory, afrocentrism, deconstruction, and other current philosophical schools define themselves as alternatives to, or critiques of, "Western Civilization," this book seeks to trace the development of the concept of Western Civilization and to examine the reasons for its endurance.

Abstract: Frankenstein's mathematics textbook differs a great deal from traditional mathematics texts since it includes not only mathematical content but also approaches to learning mathematics, a social and political context for learning mathematics, and numerous historical insights. The style of the book provides strong support for the idea that mathematics is a human endeavor and mathematics can be a powerful tool for all people. The mathematical topics included integers, rational numbers, numerical operations, and variables. The author "situates the teaching of mathematics within a rationale that links schooling to the wider considerations of citizenship and social responsibility."

Abstract: This chapter discusses Paulo Freire's theories about the nature of knowledge and the range of intellectual traditions that underlie the concept of ethnomathematics. The authors then argue that Freire's epistemology informs the theoretical basis of ethnomathematics. They proceed to categorize and elaborate on areas central to ethnomathematics, and conclude by indicating implications for further investigations of mathematical knowledge and its connections to cultural and political action.

Abstract: Here for the first time in English are two major studies on Education as the Practice of Freedom and Extension or Communication, by the author of Pedagogy of the Oppressed. Education as the Practice of Freedom grows out of Freire's creative efforts in adult literacy throughout Brazil prior to the military coup of April 1, 1964, which eventually resulted in his exile. It describes the basic components of Freire's literacy method. Education in the Freire mode is the practice of liberty because it frees the educator no less than the educatees from the twin thraldom of silence and monologue. Both partners are liberated as they begin to learn, the one to know self as a being of worth and the other as capable of dialogue in spite of the strait jacket imposed by the role of educator as one who knows. Extension or Communication, written in Chile in 1968, applies the lessons of "conscientização" to rural extension. In recent years rural extension based on the U.S. model has spread through Latin America, bringing advanced techniques and products developed in agricultural schools and land-grant colleges to farmers. Freire analyzes the terms "extension" and "communication," and argues that there is a basic contradiction between the two. Genuine dialogue with peasants, he holds, is incompatible with "extending" to them technical expertise or agricultural know-hoe. Not merely a specialized tract of interest only to rural people, Extension or Communication has general significance precisely because it demystifies all "aid" or "helping" relationships. What the authors says of extension agents he might also say of social workers, city planners, welfare administrators, community organizers, political militants, and a host of others who allegedly render "services" to the poor or the powerless.

Abstract: This paper presents an exposition of the mathematics of native peoples of North America related to the Western mathematics traditionally studied at the elementary through college level. This ethnomathematical review is made not only to allow instructors of Native American students to include in the school curriculum relevant mathematics developed by Indian people, but also to offer all students a fuller understanding of the universal nature and power of mathematics. Primary and secondary sources of Indian and Western mathematics were surveyed, summarized, analyzed, and synthesized. Sources of curriculum materials for inclusion of Native American approaches to various mathematical topics are offered throughout. The review concludes with a discussion of the implications for teaching and learning

73. Galbraith, P. (1996). Issues in assessment: A never ending story. Proceedings of the Eighth International Congress on Mathematical Education. Abstract: This talk does not concern itself with aspects such as instrument design, or with how to make techniques or systems work better. Rather it identifies and elaborates points of debate at technical, practical and political levels that make assessment in mathematics at once an important, a stimulating, and a controversial subject.

74. Garegae-Garekwe, K. G. (1998). Bringing ethnomathematics into the classroom in a meaningful way. Paper presented at the 22nd Annual Meeting of the Canadian Mathematics Education Study Group = Groupe Canadien d'étude en didactique des mathématiques. Abstract: This working group discussed some aspects of ethnomathematics that can be brought into the classroom, as well as the reasoning for doing so. Specific mathematical curriculum concepts that can be explored using ethnomathematics and the history of mathematics are discussed. This working group discussed whether the label of "ethnomathematics" is problematic, and what kind of ethical considerations are pertinent in bringing ethnomathematics into the classroom. There was a general consensus that there is a need to understand what is meant by ethnomathematics, and also that the way mathematics is taught in the 21st century should be different from the way it has been taught in the past.

75. Gerdes, P. (1996). On culture and mathematics education in (southern) Africa. Proceedings of the Eighth International Congress on Mathematical Education. Abstract: This article presents evidence that supports the idea that incorporating cultural factors into mathematics education in Africa will improve math achievement in education and contribute to Africa's development in general. Examples are presented of well-known African politicians, historians, scientists, and educators who have lately stressed the importance of cultural factors in education. A short overview of the research done in Africa on culture and mathematics education, or ethnomathematics, is given.

76. Gerdes, P. (1990). On mathematical elements in the Tchokwe "Sona" tradition. For the Learning of Mathematics, 10(1), 31-34. Abstract: This article discusses the mathematical relevance of the drawing tradition of the Tchokwe people of Angola. The study of the Tchokwe drawing tradition is interesting for historical and educational reasons. Several mathematical concepts, such as symmetry, monolinearity, and geometric algorithms, are discussed, as well as possibilities for incorporating them into educational practice. It is believed that the incorporation of this sona tradition in the curriculum, both in Africa and in other parts of the world, will contribute to the revival and valuing of the old practice of the "akwa kuta sona", and it may contribute towards the development of a more productive and more creative mathematics education. Also, an analysis of Tchokwe sona stimulates the development of new mathematical research areas.


78. Gerdes, P. (1998). Women, art, and geometry. Trenton, NJ: Africa World Press, Inc. Abstract: This volume is another in the author's continuing investigation of the mathematics underlying artistic decorations that occur among the peoples of southern Africa. The specific forms are woven handbags (sipatsi) from Inhambane Province, Mozambique, spiral basketwork (titja) from Swaziland, mat weaving by Venda women from the extreme north of South Africa, string figures (buhlolo) from the Thonga in the eastern Transvaal, decorated pottery (oku-taleka) from Southwest Angola, straw broom (mafielo)
among Basotho women, tattoos and body painting (nembo) among Mozambiquan people, pearl ornaments (ovilame) among the Ovimbundu women of Angola, and wall decorations produced by Sotho men and Ndebele women in South Africa. Like the earlier books, this one is very much a catalogue of illustrations, with remarkable symmetries in complicated designs. The author asks how people learn to produce the symmetric designs, how they keep the symmetries accurate, and whether they serve any purpose other than decoration. He concludes with a discussion of the Pythagorean theorem as shown in basket weaving among Ovimbundu women.

79. Gilmer, G. F. (1998). Ethnomathematics: An African American perspective on developing women in mathematics. Paper presented at The First Mathematics Education and Society Conference Centre for the Study of Mathematics Education. Abstract: This paper was written for the NCTM publication - Changing the Faces of Mathematics: Perspective on Gender. Hence, the paper is at the intersection of research and practice. The paper also speaks directly to issues of equality, inclusivity and accountability. The author borrows from gender, ethnomathematics and social context research to guide practice in mathematics teaching and learning. Specifically, the paper focuses on three principles of feminist pedagogy useful for developing mathematical power in all students but especially women students. In addition, the paper presents strategies found to be effective for discerning mathematical ideas in ones own surroundings. Many strategies presented stem from research methodologies of ethnomathematicians. These methods expand and extend ones vision of what mathematics is, who creates it and in what kind of environment mathematical thinking flourishes for women in general and African American women in particular.

80. Gordon, M. (1978). Conflict and liberation: Personal aspects of the mathematics experience. Curriculum Inquiry, 8(3), 251-271. Abstract: For the mathematics experience to be liberating, the curriculum must share how and why mathematical knowledge is developed, with special emphasis on its grounding in belief, intuition and subjectivity, and facilitate our understanding of the world in which we live and create and the beliefs we act upon. (Author)


84. Henderson, R. W., & Landesman, E. M. (1992). Mathematics and middle school students of Mexican descent: The effects of thematically integrated instruction. Santa Cruz, CA and Washington, D.C.: National Center for Research on Cultural Diversity and Second Language Learning. Abstract: This paper reports the effects of thematically integrated mathematics instruction on achievement, attitudes, and motivation in mathematics among middle school students of Mexican descent. A school-university collaborative effort led to the development and testing of a thematic approach undertaken as a means of contextualizing instruction for students considered to be at risk for school failure. Instruction relied heavily on small collaborative learning groups and on hands-on activities designed to help students make real-world sense of mathematical concepts. As hypothesized, experimental and control students made
equivalent gains in computational skills, but experimental students (who received thematic instruction) surpassed controls in achievement on mathematical concepts and applications. The two programs did not have a differential effect on students' attitudes toward mathematics or self-perceptions of motivation in mathematics, but motivational variables did predict achievement outcomes for both groups. Issues related to the opportunity to learn the full range of mathematics content of the curriculum within a thematic approach are examined. (Contains over 50 references.) (Author)


Abstract: The emergent perspective (Yackel and Cobb, 1996) is a powerful theory for describing cognitive development within classrooms. Yackel and Cobb have shown that the formation of social and sociomathematical norms, and opportunities for learning are intertwined. The present study is an attempt to extend the range of application of the emergent perspective to middle high school classrooms. The learning environments we consider are rich in the sense that (i) th tasks in which students are engaged are open-ended problem-situations (ii) the activities around the tasks are multiphased, consisting of small group collaboration on problem solving, reporting and reflection in a classroom forum with the teacher (iii) the tools used are multi-representational software. We identify here some practices rooted in such rich environments from which several sociomathematical norms stemmed. The present study shows that sociomathematical norms do not rise from verbal interactions only, but also from computer manipulations as communicative non-verbal actions.


Abstract: This article examined the acquisition of two mathematical concepts, identity of sets and identity of ordered sets, by young children in two different cultures. Data from a concept formation experiment performed with children in California was compared to data from a similar experiment in Ghana. The learning model used was an all-or-nothing conditioning model. Results support the hypothesis of differing "natural" concepts, or concepts preferred at the outset of the experiment. Although some cultural differences were apparent, results showed that this learning model seemed to be a good approximation to actual response behavior from children in both cultures.


Abstract: Connecting disciplines within mathematics to other subjects of the curriculum, and to the everyday world is an important goal of the NCTM Standards. This yearbook illustrates these connections and is designed to help classroom teachers, teacher educators, supervisors, and curriculum developers. The 26 papers in the collection are organized into five parts. Part One examines general issues and various perspectives as they relate to the development and use of mathematics connections. Part Two focuses on connections within mathematics itself. Parts Three, Four and Five show how to connect mathematics across the curriculum of the elementary, middle, and high school years, respectively.


Abstract: Examines mathematics and mathematics education drawing on antiracist and critical race theorizing to discuss ethnomathematics, languages, and mathematics. Focuses attention on mathematics as dominant and privileged discourses that are entwined with colonialism. Discusses decolonizing
mathematics through ethnomathematics. (SLD)


92. Joseph, G. G. (1987). Foundations of Eurocentrism in mathematics. *Race & Class, 28*(3), 13-28. Abstract: In this article, Joseph suggests that "there exists a widespread Eurocentric bias in the production, dissemination and evaluation of scientific knowledge." He claims that this Eurocentric approach served as a "comforting rationale for an imperialist/racist ideology of dominance" and has remained strong despite evidence that there was significant mathematical development in Mesopotamia, Egypt, China, pre-Columbian America, India, Arabia, and many other countries. Joseph urges the "countering of Eurocentrism in the classroom." His concluding paragraph appears to be a strong statement of support for Ethnomathematics in the classroom.

93. Joseph, G. G. (1995). Mathematics and Eurocentrism. In S. Federici (Ed.), *Enduring western civilization: The construction of the concept of western civilization and its "others"*. Westport, Connecticut: Praeger. Abstract: This article discusses the ethnocentric bias that exists in the British education system. Although there is wide agreement among many professionals that this is a problem, the efforts to create a more culturally balanced curriculum has been met with some resistance. Some politicians and academics believe that an important goal of the education system is to instill a greater awareness of British culture and history. It is feared that this focus on one cultural tradition may "disempower" students of different ethnic backgrounds. The racism inherent in mathematical theory is discussed; other cultures have contributed to the mathematics of today without receiving due credit. The article concludes by outlining the objectives of multicultural/antiracist mathematics.


95. Katz, V. J. (1994). Ethnomathematics in the classroom. *For the Learning of Mathematics, 14*(2), 26-30. Abstract: Discusses important mathematical ideas taken from combinatorics, arithmetic, and geometry which are considered in the context of their development in various societies around the globe, including Hebrew, Islamic, Italian, Mayan, German, and Anasazi work. (11 references) (MKR)

96. Kawagley, O. (1990). Yup'ik ways of knowing. *Canadian Journal of Native Education, 17*(2), 5-17. Abstract: Explores traditional Yupik means of gaining knowledge through a blending of pragmatic, inductive, and spiritual methods. Proposes teaching mathematics and science to Native youth in a synergistic manner by capitalizing on Native knowledge, skills, and spiritual relationship to nature, then relating these to the Western perspective. Contains 14 references. (SV)

97. Kensinger, K. M. (1991). A body of knowledge, or, the body knows. *Expedition, 33*(3), 37-45. Abstract: In this article, the author discusses the beliefs of the Cashinahua people of Eastern Peru in regard to the origin of knowledge. The Cashinahua believe that knowledge is contained in the body. Knowledge is gained through bodily experiences and expresses itself through bodily activity.

98. Kerka, S. (1995). *Not just a number: Critical numeracy for adults*. (Report No. EDO-CE-95-163). Columbus, Ohio: ERIC Clearinghouse on Adult, Career, and Vocational Education. Abstract: Emerging perspectives on numeracy and their social, cultural, and political implications provide a context for new ways of thinking about adult numeracy instruction. Beyond daily living skills, numeracy is now being defined as knowledge that empowers citizens for life in their particular society. Thus, numeracy has economic, social, and political consequences for individuals, organizations, and society. Despite the myths surrounding math and numeracy, the realities are as follows: numeracy is culturally based and socially constructed; math reflects a particular way of thinking; numeracy reflects cultural values; numeracy
is not just about numbers; math evolves and changes; numeracy is about procedural, practical knowledge; and numeracy involves different ways of solving problems. This perspective of numeracy and math suggests that numeracy instruction should be based on the belief that everyone can do math and everyone uses numeracy practices that may go unrecognized. Literacy and numeracy should be linked and contextualized. Familiar contexts may make math more accessible for those who have been alienated from it. Contextualized math can help learners recognize the math characteristics of everyday situations and can help learners with different ways of thinking. Teaching from the perspective of adult education as a tool for social justice, instructors can change the system in which math serves as a barrier and equip people with knowledge and tools to examine and criticize the economic, political, and social realities of their lives. (Contains 11 references.) (YLB)

Abstract: Traditionally, school algebra has been associated with literal symbols and the operations that are carried out on these symbols. But for the past decade or so, this vision of school algebra has gradually been widening to encompass activities and perspectives that were not previously considered part of algebra. The broader term, algebraic thinking, is being employed more and more often as a vehicle for describing the kinds of encounters students are having with algebra. This paper examines a couple of these newer perspectives in the light of a distinction between algebra and algebraic thinking, discusses some recent research that shows what we might expect from these approaches, and offers a suggestion as to the direction in which we ought to be heading.

Abstract: Student's attachment to school and their academic engagement are important, yet understudied, aspects of the educational experience. This study examined whether students of different racial-ethnic groups vary in attachment and engagement and whether properties of schools influence these outcomes. The racial-ethnic composition of schools was found to a factor in attachment but not engagement. The findings are discussed in terms of the challenges facing racially and ethnically diverse schools.


Abstract: Presents two practices used by rural Brazilians to estimate area of land and volumes of tree trunks. Using an ethnomathematical approach, develops educational ideas involving the interrelations between academic and popular mathematical knowledge in the context of the struggle for land. Discusses contributions of this work to the process of social change. (MDH)

Abstract: This paper describes a research and development project in teaching designed to examine whether and how it might be possible to bring the practice of knowing mathematics in school closer to what it means to know mathematics within the discipline by deliberately altering the roles and responsibilities of teacher and students in classroom discourse. The project was carried out as a regular feature of lessons in fifth-grade mathematics in a public school. A case of teaching and learning about exponents derived from lessons taught in the project is described and interpreted from mathematical, pedagogical, and sociolinguistic perspectives. To change the meaning of knowing and learning in school, the teacher initiated and supported social interactions appropriate to making mathematical arguments in response to students' conjectures. The activities students engaged in as they asserted and examined hypotheses about the mathematical structures that underlie their solutions to problems are constrained with the conventional activities that characterize school mathematics.

Abstract: Fourteen suggestions for improving mathematics instruction for bilingual students are discussed.
The role of language in learning mathematics and in solving problems is the focus of a number of suggestions. (MNS)

Abstract: In this innovative study, Jean Lave moves the analysis of one particular form of cognitive activity--arithmetic problem-solving--out of the laboratory and into the domain of everyday life. In so doing, she shows how mathematics in the "real world", such as that entailed in grocery shopping or dieting, is, like all thinking, shaped by the dynamic encounter between the culturally-endowed mind and its total context, a subtle interaction that shapes both the human subject and the world within which it acts.

Abstract: In this volume Jean Lave and Etienne Wenger undertake a radical and important rethinking and reformulation of our conception of learning. By placing emphasis on the whole person, and by viewing agent, activity, and world as mutually constitutive, they give us the opportunity to escape from the tyranny of the assumption that learning is the reception of factual knowledge or information. The authors argue that most accounts of learning have ignored its quintessentially social character. To make the crucial step away from a solely epistemological account of the person, they propose that learning is a process of participation in communities of practice, participation that is at first legitimately peripheral but that increases gradually in engagement and complexity.

Abstract: This paper outlines a proposed additional knowledge base that can be adopted by beginning teachers of American Indian and Alaska Native (hereafter referred to as Native) students. This additional knowledge base is above and beyond what is now in most mainstream teacher education programs. First, we discuss the idea of a knowledge base for teacher education and explain the need for a specialized knowledge base for Native education. Second, various aspects of that specialized knowledge base are outlined. We begin with the area of educational foundations, and then we describe specialized instructional methodologies and curriculum appropriate for Native students. Finally, we describe needed internship and student teaching opportunities.


Abstract: Analysis of an exemplary lesson by a Yupik first grade teacher reveals that the teacher contextualized the lesson by choosing a cultural activity, using an interactional style of teacher demonstration and student observation and demonstration, and emphasizing the importance of the activity to community and kin. Contains 27 references. (SV)

Abstract: Part of a special issue on mathematics and culture. A development project in Alaska is adapting the knowledge of Yup'ik Eskimo elders in an effort to link the knowledge of everyday situations in southwest Alaska with the spatial abilities needed for elementary school geometry. The aim of this project is
to transform the elementary school mathematics curriculum by integrating local knowledge into culturally-based lessons in mathematics.


Abstract: Utilizing 1990 and 1996 National Assessment of Educational Progress data regarding mathematics achievement, students' backgrounds, and mathematics teacher practices, this paper examines race and SES (socioeconomic status) related disparities in student performance, beliefs about mathematics, and classroom experiences. Although overall mathematics achievement increased between 1990 and 1996, race- and SES-related gaps were not significantly changed. SES differences appeared to account for some, but not all race related differences. An examination of classroom practices revealed many similarities in students' experiences that were consistent with the NCTM (National Council of Teachers of Mathematics) Standards, such as group work and manipulative use. However, other aspects of mathematics instruction, such as the role of calculators, type of assessment used, and the correlation with race persisted even after controlling for SES. The results suggest that white, middle class students are experiencing more of the fundamental shifts called for in the Standards. However, the paper raises cautions about concluding that such instructional differences are causing the race- and SES-related gaps in achievement. The findings emphasize the need to find ways of enhancing the mathematical problem solving skills of lower-SES and African American students.


Abstract: The author proposes that the way students learn and the way teachers teach is greatly influenced by the way in which each party attends to the other. A variety of mathematical images are shown, along with various ways of perceiving each of them. The author encourages the readers to think about how the structure of their own attention has influenced the distinctions they have made in what they have seen. He analyzes some mathematical concepts in metacognitive ways. For instance, where did this question come from? The author proposes that without being aware of the structure of your own attention, you are unlikely to be sensitive to what your students are stressing and ignoring.


Abstract: This article discusses a pre-algebra/functions and relations/algebra of grade 9 mathematics curriculum which was designed and implemented to take place in 2 or every 5 mathematics periods per week throughout the year. This curriculum was based on constructivist learning theory. The author describes one student, Benazhir, for whom the new curriculum did not work. The author suggests that it is important for researchers and teachers to know the limits of their own efficacy, and to be aware of what constitutes ethical behavior in research and teaching.


Abstract: This book consists of a collection of original essays on the work of Paulo Freire, based on diverse experiences of First and Third world contexts. All of authors argue that Paulo Freire is the cornerstone upon which a new vision and strategies of liberation can be built. The book offers a broad interpretive base addressing Marxist and post-socialist, modern and post-modern, hermeneutical, feminist and post-colonial perspectives.

   Abstract: An interview with Jaime Escalante, the determined teacher-hero of the movie "Stand and Deliver," and winner of many prestigious teaching awards including the Presidential Medal for Excellence in Education, in recognition of his successes with at-risk students in East Los Angeles. (TE)

   Abstract: Suggests that the invention and construction of traditional American Indian string figures possess elements associated with mathematical thought: logic-intuition, generality-individuality, and analysis-synthesis. Contains 16 references and several historical observations of string figures. (SV)

   Abstract: Discusses past research involving Piagetian conservation concepts in Native American students; the relation of language to mathematics education; holism in mathematics learning; mathematics and culture; the Outdoor World Science and Mathematics Project, which developed learning modules involving Native Americans; and mentorship in an atmosphere of cultural diversity. (14 references) (MKR)

   Abstract: At the Ringling School of Art and Design in Sarasota, Florida, professor and artist John Sims teaches mathematics through art. Sims believes that math and art have a natural convergence and has created courses such as visual mathematics, creative geometry, mathematics and physics for animators, and art and ideas of mathematics. As an educator, mathematician, and artist, Sims aims to reveal to students the importance of mathematics to the visual arts. One of Sims's main interests is ethnomathematics, which explores the relationship between math, social structures, and the cultural activities of a community and looks at how mathematical ideas have been encoded into works of art. Sims is currently working on a mathematics textbook for artists and has plans to create an international center for mathematics, art, design, and education.

   Abstract: With a background in both mathematics and civil rights, Robert P. Moses is the founder and guiding hand of the Algebra Project, an interactive curriculum designed to help inner city and rural students in the U.S. better understand mathematical concepts. It works by bringing students through a five-step process in which they use their physical surroundings as tangible references for mathematical ideas. The Algebra Project is being used in Chicago, Atlanta, Boston, and other urban school districts in the U.S., as well as in the Mississippi Delta, where Moses organized voter registration drives among African-Americans in the 1960s.
   Part 1 of *Radical Equations* highlights the roots of the Algebra Project in the southern civil rights movement, and how that movement helped local leaders emerge through organizing around issues for which a consensus had been built. Part 2 of the book shows how Moses applied the lessons he learned to developing the Algebra Project.

   Abstract: This study uses information from both teachers and students to explore how the perceptions of each other's investment in the relationship affects the productivity of the relationship. Using NELS 1998 she found that teachers' perceptions that the student puts forth academic effort and and students' perceptions that teachers are caring are weakly associated with mathematics achievement for most students.

   Abstract: This monograph addresses concerns about mathematics and science instruction and educational outcomes for Native students. The sociocultural contexts of schooling and community come together in
particular ways to influence how Native children learn and, consequently, their life outcomes. It is important to look beyond the performance of individual students to the systems in which they are educated and to the historical and social influences on how mathematics and science are conceptualized and taught. Methods for implementing current mathematics and science reforms are shaped by assumptions about what children should know and be able to do. This monograph seeks to make such assumptions and the Western cultural values underlying them more explicit, and suggests that a generic approach to reform is ineffective and inequitable. Student differences with implications for teachers' choices about instructional strategies include differences in: (1) ways of knowing with regard to mathematics and science, rooted in varying world views; (2) approaches to learning and problem solving; (3) communication styles, strategies, and uses; and (4) cultural values about use and sharing of particular kinds of knowledge. Ethnoscientific and ethnomathematical (forms embedded in cultural activities, the workplace, or everyday life) can serve to contextualize instruction—to provide real-life connections that make classroom theories and practices meaningful. Several examples demonstrate how such connections can be made. A set of guidelines is presented for instruction that bridges cultures and situates mathematics and science learning in meaningful contexts for Native students, as well as for all underserved students. Contains 130 references. (SV)

Abstract: American Indian students have had inadequate opportunities for success in school, particularly in mathematics and science, because of how they are typically taught. The article identifies sources of the problem, discussing education reform, assumptions about mathematics and science, culture-based variations in ways of knowing, and methods of improvement. (SM)

Abstract: This book challenges the Eurocentrism of mathematics. It reviews the non-History of mathematics, as well as the contributions of China, India and the Islamic World. The authors provide suggestions for inclusion of mathematics from these other sources in curriculum, and culturally alternative approaches to mathematical problems.

Abstract: This article investigates possible differential effects on of small classes on achievement using data from Project Star, a four-year randomized experiment of the effects of class size.

Abstract: An historical perspective reveals that sophisticated mathematical activity has been going on in the Latino culture for thousands of years. This paper provides a general definition of the area of mathematics education that deals with issues of culture and mathematics (ethnomathematics) and defines what is meant by the term Latino in this essay. Discussion includes pre-Columbian mathematics (the vigesimal systems of the Olmecs and Aztecs and the decimal system of the Incas with recommendations to teachers for teaching of these systems), commentary on pre-Columbian mathematics, mathematical activity in Latin America, and Latino mathematicians in the United States. Contains 34 references. (MKR)

Abstract: This first volume of strategic activities is designed to develop through a hands-on approach, a basic mathematical understanding and appreciation of fractals. The concepts presented on fractals include self-similarity, the chaos game, and complexity as it relates to fractal dimension. These strategic activities have been developed from a sound instructional base, stressing the connections to the contemporary curriculums recommended in the National Council of Teachers of Mathematics’ Curriculum and Evaluation Standards for School Mathematics. Where appropriate the activities take advantage of the technological power of the graphics calculator. These activities make excellent extensions to many of the topics that are already taught in the current curriculum. Together, they can be used as a complete unit or as the beginning for a semester course on fractals.
Abstract: The relationships between student achievement, student culture and practitioners' attitudes and expectations were investigated. Student achievement was defined as academic performance but also included perceptions, rationales and explanations for student behaviors and conduct. Student culture described student's Mexican American origins, customs and beliefs. Practitioners' attitudes described how middle school personnel perceived Mexican American high and underachieving students generally, and practitioners' expectations described how personnel interacted and behaved toward Mexican American students. Results indicated that Mexican American students perceived themselves and school personnel perceived these students as different from Anglo students. Mexican American cultural traditions were also perceived as inferior and disadvantageous by high achieving Mexican American students and by personnel. Underachieving Mexican American students generally valued their cultural traditions more positively than high achieving students becoming resistant to learning when these traditions were marginalized in school. Student achievement was also related to student compliance, student appearance, styles in written and verbal communication and practitioners' perceptions about the willingness of Mexican American students to practice and support Anglo norms. These findings are congruent with theories that discuss relationships between student achievement, student culture and practitioners' attitudes and expectations. Theories about school failure occurring less frequently in minority groups that are positively oriented toward their own and the dominant culture were contradicted and not supported in this research.


Abstract: Discusses the question of whether to teach the mathematics of mathematicians and scientists or develop the mathematics as the set of skills and procedures that a cultural group knows and uses in life. Offers suggestions using examples from field work with Navajo Indians and Turkish immigrants. (10 references) (MKR)

Abstract: This document contains the proceedings of the annual meeting of the Canadian Mathematics Education Study Group. Papers include: (1) "What Does It Really Mean To Teach Mathematics through Inquiry?" (Raffaella Borasi); (2) "The High School Math Curriculum" (Peter Taylor); (3) "Triple Embodiment: Studies of Mathematical Understanding-in-Inter-action in My Work and in the Work of CMESG/GCEDM" (Thomas E. Kieren); (4) "Awareness and Expression of Generality in Teaching Mathematics" (Louis Charbonneau and John Mason); (5) "Communicating Mathematics" (Douglas Franks and Susan Pirie); (6) "The Crisis in School Mathematics Content" (Malgorzata Dubiel and David Reid); (7) "Abstract Algebra: A Problems-centered and Historically Focused Approach" (Israel Kleiner); (8) "Algebraic Understanding" (Lesley Lee); (9) "Students' Explanations in Linear Algebra" (Tommy Dreyfus); (10) "Mathematics Teaching--How It Could Be Done" (George Kondor); (11) "Mathematics Teachers'
Needs in Dynamic Geometric Computer Environments: In Search of Control" (Douglas McDougall); (12) "Teachers Taking Action: Using the National Mathematics Profile To Improve Teaching and Learning" (Sandra Frid); (13) "Materials To Stimulate Mathematical Thinking at the Elementary Level--A Progress Report on the Kindermath Project" (Ann Kajander); (14) "Tomorrow's Mathematics Classroom: A Vision of Mathematics Education" (Gary Flewelling, Bill Higginson, Geoff Roulet and Peter Taylor); (15) "A Model for the Development of Algebraic Thinking" (Mohamed Mosaad Nouh); (16) "Working towards Curriculum Renewal in Undergraduate Mathematics" (Sandra Frid and Joanne Tims Goodell); (17) "A Conjecture on the History of Mathematical Word Problems: Were the Word Problems Ever Practical?" (Susan Gerofsky); (18) "Desperately Seeking Something: Dilemmas Surrounding the Interpretation of Teachers' Interventions" (Jo Towers); (19) "Scarborough Review of Grade 12 Mathematics" (Lynda Colgan, Peter Harrison and Clara Ho); and (20) "Teaching of Graph Theory for High School and College" (Abraham Bar-Shlomo Turgman). (ASK)

Abstract: This is a rich and comprehensive collection of articles and chapters on the cultural dimensions of mathematics. The theme is ethnomathematics. This is an emergent area of study which begins with the mathematics of oral cultures, but which ends up encompassing the nature, history, use and politics of mathematics in its varied extra-academic cultural settings. Readers wanting a clearer definition of ethnomathematics can turn to no better source than this volume. No comparable collection exists, and the editors have performed a valuable service in putting together this volume, and introducing the sections themselves. Rather than some obscure aspect of anthropology, the papers in this collection demonstrate the relevance of ethnomathematics for practicing mathematicians, mathematics teachers and educators, as well as for historians, sociologists and philosophers of mathematics.

Abstract: In this interview, Arthur B. Powell and Marilyn Frankenstein elicit a perspective on the importance of teacher-student relationships for academic, social, and political learning through the voice of mathematician and Massachusetts Institute of Technology Professor Emeritus Dirk Jan Struik, who was 103 years old at the time of the interview. Through his words, we gain insights into European schooling from the end of the 1800s to the present, and into the intellectual and political life in the early part of this century. We learn about the impact of McCarthyism on intellectual freedom in the United States and about the importance of ethnomathematics from a man who not only lived through these times, but who also became an active political intellectual during this period of history. In this context, Struik discusses his intellectual, academic, and political trajectories, relating stories of his life as a student, teacher, mentor, colleague, professor, political activist, and Marxist intellectual.

Abstract: Part of a special issue on mathematics and culture. Oware is a board game from Africa that offers rich opportunities for all children to construct and expand strategic thinking and arithmetical ideas and explore key social behaviors. Furthermore, the introduction of oware can help children to understand the encoding of mathematical ideas into diverse cultural products. In addition to helping children build mathematical concepts, this game facilitates their interaction with aspects of African culture. The rules of oware, excerpts from an oware game, and other mathematical and cultural ideas of oware are discussed.

Abstract: This article is a paper prepared by Working Group 21, The Teaching of Mathematics in Different Cultures, Subgroup 2, Preparing Teachers to Teach Diversity, at the 8th International Congress on Mathematical Education. This paper attempts to address the question: How can teachers become active
students of authentic mathematics which takes culture into account, so that they may choose and guide authentic mathematics activities for their students while addressing multicultural goals? This paper discusses two endeavors which have sought to answer this question. The first is a graduate course titled Ethnomathematics, which is offered for prospective and practicing teachers. The second was a research project which investigated activities of high school mathematics students from a variety of cultural backgrounds, and sought to find ways in which these activities might be used to facilitate the construction of mathematical concepts in a high school mathematics classroom. Concepts of ethnomathematics and academic mathematics are compared and contrasted. Ways in which mathematics can be re-constructed to include cultural mathematics or ethnomathematics are discussed.

140. Presmeg, N. C. (1998). A semiotic analysis of students' own cultural mathematics. Paper presented at the 22nd Annual Meeting of the International Group for the Psychology of Mathematics Education. Abstract: An ongoing research project that investigates how mathematics educators can prepare prospective and practicing teachers to cope with cultural diversity is presented. The first component of this project is investigation of the ways that students can use their cultural identities and practices in constructing mathematical ideas that belong uniquely to them through a graduate course called "Ethnomathematics." The second is the investigation of ways teachers can facilitate students' construction of such uniquely personal cultural mathematics ideas in a high school classroom. The third component is the development of a grounded theoretical framework in which to situate the two previous components using semiosic chaining. The semiotic framework developed is being applied to the work from the graduate course and to the high school project, which took place in the 1995-96 school year. Data from the graduate project consisted of student journal entries, field notes, and more than 170 student project reports collected since 1993, some of which are described. The high school project involved seven students from differing ethnic backgrounds. Evidence from these students makes a strong case that traditional mathematics teaching does not facilitate a view of mathematics that encourages students to see the potential of mathematics outside the classroom. Although their own reports indicated that students were involved in many life activities with mathematical aspects, they continued to see mathematics as an isolated subject without much relevance to their lives. Semiosic processes may be used to illustrate connections as symbol systems are constructed in a bridge between cultures. Symbolism provides possible connections between mathematical ideas frozen in academic mathematics and practices, and different symbolism would facilitate the construction of different mathematics structures and concepts with increased relevance to students from different cultures. (Contains 33 references.) (SLD)

141. Presmeg, N. C. (1997). A semiotic framework for linking cultural practice and classroom mathematics. Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education (19th). Abstract: With the increasing recognition that connections are an important component in the pedagogy of school mathematics (National Council of Teachers of Mathematics, 1989), there is a need for a theoretical framework that addresses the ways in which the real experiences and cultural practices of students may be connected with mathematics classroom pedagogy. In this paper, the objective is to construct such a theoretical framework, drawing on literature from semiotics and ethnomathematics. Examples and evidence that suggest the efficacy of this framework in connecting school mathematics and mathematical ideas constructed from cultural practice are drawn from the literature and from data collected in a research project in a multicultural high school mathematics class. Seven high school students from African American, Caucasian, Asian American, and Hispanic American cultural backgrounds described their lives and cultural heritages as bases for the development of culturally responsive mathematics curricula. (Contains 1 figure and 12 references.) (SLD)
Abstract: Issues related to the improvement of mathematics and science education pertain to Native students as well as to the general population. Native students are most successful at tasks that use visual and spatial abilities and that involve simultaneous processing. Instruction should build on Native students' strengths. Experiential learning and cooperative learning are two methods that are particularly effective with Native students in improving student attitudes and problem-solving abilities and reducing mathematics anxiety. Storytelling techniques can be used to develop culturally relevant problems. Career days show students the uses of mathematics in the real world. Curriculum development strategies include establishing the relationships and connections between mathematics and other subjects, and incorporating culturally relevant materials, such as Maya or Inca mathematics and science. Strategies of exemplary programs include summer math camps for Native students, summer institutes to improve teacher instructional skills and methods, after-school and summer enrichment activities in science and engineering, instructional materials developed to accompany a science series on public television, magnet schools, after-school college preparatory courses in mathematics, and parent resource centers. Recommendations are offered related to instructional methods, program development, and federal funding. This paper contains over 130 references.

143. Reyhner, J. (1992). Teaching American Indian students. Norman, OK: University of Oklahoma Press. Abstract: The book, Teaching American Indian Students, is a multidisciplinary volume of research on Indian education by professionals who examine a wide range of issues on teaching, language and multicultural education. The research presented in the book not only gives theories, but practical applications of teaching and reference sources for finding materials. The whole focus is on teaching styles relevant to American Indian students. The work presented reinforces how culture and community are related to the success of a young Indian child’s education. The book focuses on five main topics: multicultural education; curriculum, language reading, and teaching. Senator Ben Nighthorse Campbell wrote the forward and tells of his upbringing and determination to get an education. The section on Multicultural Education gives the reader an overview of the history of Indian Education, bilingual education, and the empowerment of Indian students. The section titled, Instruction, Curriculum and Community, focuses on the adaptation of instruction and curriculum to culture, and the parent-teacher relationship. The section on Language Development looks at Indian English and language development of native students, especially in the area of English as a second language. Reading and Literature follow in the next section on improving reading comprehension, the whole language approach, and teaching American Indian literature. The final section Teaching in the Content Area highlights teaching and learning style findings in mathematics, physical education, science and social studies. For educators and researchers, the book provides a comprehensive list of references, literature and teaching resources, and a recommendation list for Indian children’s literature.

144. Rosa, M. (2000). From reality to mathematical modeling: A proposal for using ethnomathematical knowledge. Unpublished doctoral dissertation, California State University, Sacramento. Abstract: Based on review of the literature, there is a need for curriculum reform in mathematics. The literature supports the view that ethnomathematics and mathematical modeling can provide tools needed to move the curriculum reform forward. New concepts for mathematics curriculum call for the use of different methodologies and strategies to ascertain students' development in mathematical thinking and understanding. Additionally, mathematics curriculum reform would benefit students by introducing a curriculum that demonstrates the evolving nature of mathematics and its connections with real-world problems. It is important to apply ethnomathematics as pedagogical action and mathematical modeling as methodology to understand that mathematics provides mathematical models to explain real-life situations. It is the purpose of this study to investigate the importance of ethnomathematics and mathematical modeling in the mathematics curriculum in elementary, middle and high schools.

145. Rosin, R. T. (1984). Gold medallions: The arithmetic calculations of an illiterate. Anthropology & Education Quarterly, 15(1), 38-50. Abstract: This study of one part of the cognitive system of an illiterate Indian (his method of enumeration, computation, and evaluation) demonstrates the sophisticated conceptualization of which he is capable,
independent of a writing system. (Author/CMG)


Abstract: The book gives a close up look at communications patterns, including significant differences, between Athabaskan and English speakers in a northern Canadian community. The study gives very specific examples of many of the issues in current discussions of literacy and schooling, e.g., de-contextualization of discourse, the social construction of disability, etc. The book might be excellent reading for special education teachers or for anyone who has experienced the differences between Native and non-Native ways of communicating but who has never heard these differences discussed in such details.


Notes: LC Control Number: 00056016
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Abstract: This book focuses on the non-Western challenge to Eurocentric education, in particular, the way that challenge has been conceptualized in terms of indigenous knowledge. The editors and authors maintain that the study of indigenous knowledge injects a dramatic dynamic into the analysis of knowledge production and the rules of scholarship. Such a dynamic opens a new discussion in not only the discipline of education but in a variety of scholarly fields including philosophy, cultural studies, agriculture, health, nutrition, religion, and music. This book delineates not only what constitutes indigenous knowledge but how it can be used in various educational contexts—both non-Western and Western. Indeed, Western curriculums may never be the same after studies of indigenous knowledge are infused into them.


Abstract: This paper presents a theoretical framework for investigating the role of algorithms in mathematical thinking. In the study, a combined ontological-psychological outlook is applied. An analysis of different mathematical definitions and representations brings us to the conclusion that abstract notions, such as number or function, can be conceived in two fundamentally different ways: structurally—as objects, and operationally—as processes. These two approaches, although ostensibly incompatible, are in fact complementary. It will be shown that the processes of learning and of problem-solving consist in an intricate interplay between operational and structural conceptions of the same notions.

On the grounds of historical examples and in the light of cognitive schema theory we conjecture that the operational conception is, for most people, the first step in the acquisition of new mathematical notions. Thorough analysis of the stages in concept formation leads us to the conclusion that transition from computational operations to abstract objects is a long and inherently difficult process, accomplished in three steps: *interiorization, condensation,* and *reification*. In this paper, special attention is given to the complex phenomenon of reification, which seems inherently so difficult that at certain levels it may remain practically out of reach for certain students.


Abstract: Explores two metaphors for learning, the acquisition metaphor and the participation metaphor. After a critical evaluation of the interpretations and applications of these metaphors, the question of theoretical unification of research on learning is addressed, stressing the dangers of too great a devotion to one single metaphor. (SLD)

Abstract: In this article, the author speaks about the use of metaphor in the learning of mathematics. She contrasts the differing models of the acquisition metaphor and the participation metaphor. Acquisition metaphor forms the foundation of traditional ways of teaching, and this is the model that is emulated in older textbooks. The acquisition metaphor is based on the idea that knowledge is gained; in other words, learning is the acquisition of something. Participation metaphor views learning as a process with no concrete finishing point. In participation metaphor, the learner is in a constant state of "doing" rather than an endstate of "having." The author states some of the pros and cons of each metaphor, and discusses some of the ramifications of the transition from acquisition to participation metaphor in the teaching of mathematics.

153. Skinner, L. (1999). Teaching through traditions: incorporating native languages and cultures into curricula. In K. G. & T. J. W. I. Swisher (Eds.), Next steps: Research and practice to advance Indian education (pp. 107-134). Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools. Abstract: This chapter discusses challenges to the perpetuation of American Indian languages and cultures, as well as successful strategies and practices for developing culturally relevant curriculum. A review of the history of U.S. assimilative educational policies towards American Indians leads into a discussion of the importance of language in maintaining cultural continuity and Native identity; the five stages of language preservation; and the recognition by the federal government, embodied in the Native American Languages Act of 1990, of the rights of American Indian tribes to determine their own linguistic destinies. The general population's lack of knowledge about American Indians is discussed. Seven values common to traditional Native education are identified that could form the basis of a tribal code of education or curriculum, and six recommendations are offered to move public schools toward equality and equity. An overview of successful models of culturally relevant curriculum in the U.S. and abroad is followed by a call for a National Native Curriculum Project, funded by the U.S. Department of Education, that would have regional offices develop locally researched Native curricula. The result would be a curriculum in every U.S. school that would change years of misinformation and enable students to view concepts, issues, events, and themes from the unique and diverse perspectives of Native groups. Contains references in endnotes and a bibliography. (TD)

154. Skovsmose, O. (1996). Critical mathematics education: Some philosophical remarks. Proceedings of the Eighth International Congress on Mathematical Education. Abstract: Mathematics education must serve also as an invitation for participating in democratic life in a highly technological society, in which conditions for democracy may be hampered by exactly the technological development for which mathematics education also serves as a preparation. This challenge signifies the importance of critical mathematics education. However, what then is the nature of critical mathematics education?


157. Sleeter, C. E. (1995). An analysis of the critiques of multicultural education. In J. A. Banks, & C. A. McGee Banks (Eds.), Handbook of research on multicultural education (pp. 81-94). New York: Macmillan Publishing Company. Abstract: Published criticisms that have been leveled against multicultural education in the United States are reviewed, and their implications for the field's development are discussed. The majority of critics either deem multicultural education too radical, or they argue that it is too conservative. Conservative critics
usually argue that multicultural education lacks intellectual rigor, is not founded on sound theory, and does not address the real causes of underachievement by minorities. Many of their criticisms seem to arise from the unease white America seems to feel about its own future. Radical opponents criticize multicultural education for embracing an individual mobility more than collective advancement and structural equality. In answering both types of criticisms, multicultural education must assert itself as a shift in decision-making power in education away from dominant groups and toward oppressed groups. Supporting theory must be strengthened, and multicultural education must be sold to the general public if it is to succeed in effecting change. (Contains 129 references.) (SLD)

Abstract: Introduction to "Empowerment Through Multicultural Education." Questions about student diversity are examined by considering the extent to which society serves the interests of all, and by examining the empowerment of members of oppressed groups to direct social change. The contributions of multicultural education to empowering young people are highlighted.

Abstract: In this chapter, Christine Sleeter addresses how it is possible to educate White students in a way that encourages them to challenge the current social order. This involves modifying the attitudes and perceptions of dominant ethnic groups. When introducing material that challenges the perspective of students from dominant groups, Sleeter proposes that teachers adopt a "non-authoritarian" classroom orientation rather than a coercive one. This is so that students will experience this new pedagogy as liberating rather than coercive. Sleeter discusses the tendency of Whites to minimize racism and the psychology of institutional racism and how it can be challenged.

Abstract: This article discussed the dichotomy that exists between classroom knowledge and cultural knowledge, and the role of the curriculum in empowering students. At the heart of this dichotomy is the difference between regenerative knowledge, which is constantly changing and is maintained by interactions among people, and reified knowledge, which has been decontextualized and is seen as static and "real." The authors argue that classroom knowledge should include a perspective of history from the students' point of view, so as to make it relevant and empowering for them. A study is described, which involved interviewing students, interviewing faculty and administrators, and observing in classrooms in a junior high school in a working-class neighborhood. The study showed that these students were learning that they have little control over public institutions and learning, and that they were not absorbing school knowledge as a conceptual system to help them understand and act on their environment. The authors do not suggest that traditional classroom knowledge should be done away with, but rather that there should be a bridging of the gap between school knowledge and cultural knowledge.

Abstract: Part of a special issue on mathematics and culture. There is a natural connection between ratio and African and Afro-Cuban drumming, as the combination of numerous rhythms, each with a pattern repetition of varying length, produces a polyrhythmic song. The repetitions of pattern consist of a given number of one type of beat combined with a specified number of another type of beat or a ratio of one beat to the other. A mathematics lesson in which fifth-grade students learned to play three mathematically disparate rhythms on conga drums as an introduction to the study of ratio is described.


   Abstract: The purpose of this study was to determine if influences of educational productivity factors on mathematics achievement and attitude toward mathematics are the same for African Americans and other ethnic groups. Using Walberg's Educational Productivity Model as a framework, this study estimated the influence of various factors on mathematics achievement and attitude outcomes for students of various ethnic backgrounds using NELS 1998.


   Abstract: This paper discusses the author's personal experiences in developing and implementing a problem-based college mathematics course for liberal arts majors. This project was initiated in response to the realization that most students are dependent on "patterning" learning algorithms and have no expectation that self-initiated thinking is a characteristic of learning. The problem-based version of college mathematics presented here uses no required text; instead a packet of activities and project assignments accompanies material designed to add structure to the course. The paper addresses concerns about increased faculty workload in teaching for critical thinking and the additional time required for formative assessment. Using examples from the author's own experience in the classroom, it compares advantages and disadvantages of instructor-graded formative assessment with the suggested self-grading technique. The latter allows the instructor: (1) to see the learner's initial response, (2) to see what information the learner has gained from the discussion session, (3) to measure the learner's level of comprehension, and (4) to review only one set of papers in order to make small adjustments in the learner's understanding. A graphing activity and a self-assessment rubric are appended. (CH)

   Abstract: Five contributors report on their perspectives of the seventh International Congress on Mathematical Education (ICME): (1) "Thoughts of an ICME Regular" (Z. Usiskin); (2) "Encouragements and Disturbances" (D. L. Brekke); (3) "A Brief Note on Errors" (A. Lax); (4) "Then and Now" (L. Rogers); and (5) "Walled Cities" (B. Johnston). (MDH)


   Abstract: The author describes how our understandings of "difference" might affect the way we view cognition and mathematics education. She discusses the implications of her research on cognitive development, class, and gender. She discusses the role of context in the transfer of knowledge, and argues that context should not be viewed in a single model of cognitive development. She speaks of the pathologization of difference and the fundamental errors within this reasoning.

Abstract: Ethnomathematics, a growing academic field of study and teaching style that looks at the interaction between math and culture, is gaining popularity in community colleges as well as in other areas of higher education. Although skeptics have dismissed ethnomathematics as a politically correct fad, professors involved in the movement are succeeding in bringing diversity, culture, and a more accurate history to math instruction.

Abstract: Using a sociocultural framework, the authors describe scientific literacy and the importance of mediated activities for scientific learning. The difference between empirical and theoretical learning is introduced as an important aspect for teachers to understand as they work with students learning scientific concepts. Components of scientific literacy are described, and recommendations for teaching in the zone of proximal development are provided. A conceptual model adapted from ethnomathematics is introduced to demonstrate the effect of theoretical learning on cultural change, using an intergenerational study from Chiapas, Mexico, as an example. Reprinted by permission of the publisher.

Abstract: The field of instructional design (ID) has enjoyed considerable success over the last two decades but is now facing some of the pains expected along with its growth. Based largely on behavioristic premises, ID is adjusting to cognitive ways of viewing the learning process. Originally a primarily linear process, ID is embracing new methods and computer design tools that allow greater flexibility in the management and order of design activities. In the present climate of change, many practitioners and theorists are unsure about "what works"; for example, how to apply ID to the design of a hypertext system or an on-line performance support system. Our purposes are (1) to review new methods and tools for doing ID, (2) to survey some promising models of training design that incorporate cognitive learning principles, then (3) to offer some guidelines for the design of training programs based on those learning principles.

Abstract: The performance of a group of grade 9 mathematics students trained to use a self-explanation procedure during study was compared with that of students who used their typical study procedures. The processing activities used by the students during the study session and those used in a subsequent problem-solving test were observed. The focus of analysis was on the knowledge access, knowledge generation, management, and elaboration activities used by students. The self-explanation group showed more frequent use of each type of activity and also obtained higher scores on the problem-solving test. The difference in posttest performance of the groups was greatest on a set of far transfer items. Of particular note was the carryover effect of self-explanation training on students' processing in a subsequent problem-solving session. The relationships among the processing activities, students' beliefs, prior knowledge, and posttest performance were examined using a partial least squares path analysis procedure. Use of the self-explanation method had an indirect effect on performance, this effect being mediated by associated knowledge access and knowledge generation activity. There was no direct effect of method on performance. The strongest predictor of performance was the level of knowledge generation activity. The students' prior knowledge measure had weak direct and indirect effects on performance. Appendixes include: code labels and descriptions of three major categories of events: an illustration of direct and indirect paths in written solutions of two students; and descriptions of manifest and latent variables used in path analysis. (Contains 31 references, 4 tables, and 2 figures.) (Author)

Abstract: This paper sets forth a way of interpreting mathematics classrooms that aims to account for how
students develop mathematical beliefs and values and, consequently, how they become intellectually autonomous in mathematics. To do so, we advance the notion of sociomathematical norms, that is, normative aspects of mathematical discussions that are specific to students' mathematical activity. The explication of sociomathematical norms extends our previous work on general classroom social norms that sustain inquiry-based discussion and argumentation. Episodes from a second-grade classroom where mathematics instruction generally followed an inquiry tradition are used to clarify the processes by which sociomathematical norms are interactively constituted and to illustrate how these norms regulate mathematical argumentation and influence learning opportunities for both the students and the teacher. In doing so, we both clarify how students develop a mathematical disposition and account for the students' development of increasing intellectual autonomy in mathematics. In the process, the teacher's role as a representative of the mathematical community is elaborated.

   Abstract: This book identifies the obstacles to greater social justice and educational equality as the produce of capitalism and proposes socialism as the radical form of change necessary to remove them.

   Abstract: Descriptions of numeration systems, geometry in art and architecture, and mathematics in games which reveal a highly developed mathematics existing all over the African continent. Includes regional studies of Nigeria and Kenya. Very readable. Ideas can be adapted for the classroom.

   Abstract: Discusses the writing of the book "Africa Counts: Number and Pattern in African Culture" and relates efforts to introduce multicultural perspectives into the mathematics curriculum at the elementary and secondary levels. Proposes what needs to be done to introduce ethnomathematical perspectives into the curriculum. (24 references) (MKR)

   Abstract: This brightly coloured picture book gives examples of sign language and finger counting as traditionally practised in the marketplaces of Africa. It also acts as an introduction to the different peoples, customs, regions and languages of Africa, showing how various groups exchange their produce and use finger counting to overcome language barriers - and inviting the reader to participate.

   Abstract: The educational failure of ethnic minority children in the industrialized countries has persuaded some educators of the need to incorporate multicultural perspectives into the mathematics curriculum. All societies have developed mathematical practices appropriate to their daily lives and cultures, an area of mathematics known as "ethnomathematics." Benefits of incorporating students' cultural background into the mathematics program include the following: (1) increased self-esteem on the part of language minority children; (2) increased interest when instruction is related to daily life; and (3) appreciation of different ways of thinking. Impediments to combining multicultural aspects with the mathematics curriculum include the following: (1) lack of materials, (2) inadequate teacher training; (3) stereotipic views of what constitutes a "proper" curriculum; and (4) overemphasis on student performance on standardized tests. A list of 11 references and an illustration of an African sand drawing are also included. (FMW)