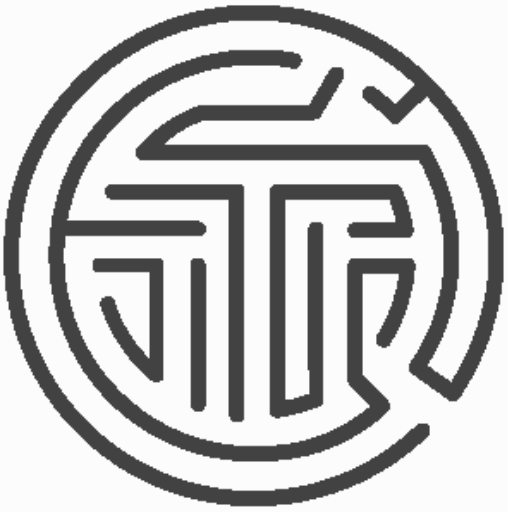
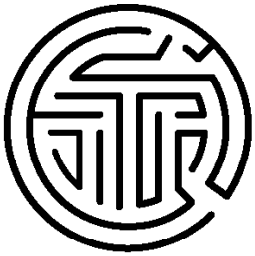


MATHEMATICS FOR ALL PROJECT

ANNUAL REPORT TO THE NATIONAL SCIENCE FOUNDATION

CENTER FOR CHILDREN & TECHNOLOGY



CCT REPORTS

APRIL 2004

MATHEMATICS FOR ALL PROJECT

ANNUAL REPORT TO THE NATIONAL SCIENCE FOUNDATION

PREPARED BY

BANK STREET COLLEGE OF EDUCATION
EDC/CENTER FOR CHILDREN AND TECHNOLOGY

CENTER FOR CHILDREN & TECHNOLOGY

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ACTIVITIES

The Mathematics for All Project is a collaborative effort between Bank Street College of Education and Education Development Center's Center for Children and Technology. The goal of this project is to develop case-based professional development materials to better prepare teachers for supporting individual students, including students with disabilities, within a standards-based mathematics curriculum. The project focuses on general and special education teachers at the elementary level (grades K-6).

Four major objectives guide this work:

- *Development of Cases and Learning Experiences.* Teacher educators from Bank Street's Graduate School, in collaboration with staff members from CCT, are developing five professional development modules. Each module will consists of at least two three-hour multimedia case studies of teaching events involving students with disabilities in mathematics classrooms and activities to guide user interactions with the case materials. A facilitator guidebook also will accompany each module to support teacher educators in the integration of the materials into preservice teacher education courses and in-service professional development programs.

- *Implementation and Pilot-Testing*. Project staff are implementing and pilot-testing the case materials in several preservice and in-service teacher education courses at Bank Street College and revising them based on the results of the pilot tests.

- *External Evaluation and Field-Test.* An external evaluator is documenting the case development process and will field-test the modules in a variety of different preservice and in-service teacher education programs to document their impact on teachers' knowledge, skill, and classroom practices.

- *Publication and Dissemination*. The project team will publish the modules and broadly disseminate them to a national audience of teacher educators utilizing dissemination vehicles such as workshops, online courses, and presentations.

Below we describe in more detail the progress made toward each of these objectives during the first project year and a 10-month pilot phase that preceded the project.

Development of Cases and Learning Experiences. Development activities consisted of case research, the development of multimedia cases, and the design of learning experiences that incorporate the case materials.

Case Research. In preparation for the development of the case materials and learning experiences, the project team conducted extensive reviews of existing case materials on mathematics education and inclusion and of research literature on professional development and mathematics teaching and learning by students with and without disabilities (see Appendix 1 for a selective list of resources reviewed). We also reviewed existing software tools that support the creation of multimedia case studies (e.g., LessonLab, VideoPaper Builder, Case Creator, Quicktime Pro), and con-

sulted with members of our Advisory Board and experts in the field. Based on this information and feedback, the project team developed a preliminary plan for the format and production of the cases.

Case Development. Small, multidisciplinary development teams of project staff are now carrying out the production of the case materials. Each team includes four members who together bring expertise in mathematics education, special education and inclusion, and video production.

The development of individual cases begins with the selection of a classroom for videotaping. To identify potential classrooms we are drawing on the large network of public and private classrooms that Bank Street College and EDC are working in and seeking recommendations from our colleagues and advisors for classrooms known to have achieved some degree of success in including students with disabilities in a standards-based mathematics curriculum.[1] Our primary reason for identifying exemplary classrooms is not to model practice for teachers to replicate. Rather, we have found that even in classrooms considered exemplary for their inclusion practices, teachers often struggle to meet the needs of the broad range of students in their classrooms. Other classroom selection considerations include the type of curriculum used, the kinds of disabilities that students in the classroom have, the grade level of the class, the inclusion model being used, the geographic location of the school, and the demographic background of teachers and students. Across the cases, we are aiming for diversity in all of these variables.

Potential classrooms are visited by at least two members of a case development team. During these visits, the team members observe one or more mathematics lessons and interview the teachers to verify that the classrooms meet our criteria and that the teachers and students are willing to be videotaped.

Once a classroom has been selected, the case development team will meet with the teacher or teachers to begin planning for the lesson that we will videotape. The planning meeting includes discussions of the content of the lesson and the needs and strengths of individual students. Teachers also receive letters and informed consent forms for parents that they distribute to students and collect once signed by their parents (see Appendix 2 for a copy of the letter and form). In addition, the case development team may conduct further observations of mathematics lessons to better get to know the students and the flow of events within the classroom.

One or a few days prior to the planned video shoot, the case development team conducts a preproduction visit to the classroom to plan for camera placements and sound recording, as well as to collect background materials (such as samples of student work and still images of classroom displays) and consent forms. As part of this visit, the team will meet with the teacher(s) to review the plan for the lesson, finalize the selection of two or three students who the cameras will focus on, and review the logistics of the videotaping procedure.

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[1] In aiming for exemplary classrooms, our primary goal is not to document perfect practice for teachers to replicate. Rather, we have found that even in classrooms that are considered exemplary for their inclusion practices, teachers struggle to meet the needs of the broad range of students in their classrooms. By aiming for exemplary classrooms we often end up with relatively typical ones.

The video shoot is typically completed in one day and consists of three parts. First, the team videotapes a planning discussion with the teacher during which he or she reviews the lesson plan, describes the range of learners in the classroom, and discusses the strengths and weaknesses of the focal students (see Appendix 3 for the questions asked during the planning discussion). Next, the team videotapes the math lesson, using multiple cameras focused on a different focal student in order to capture the lesson through the lenses of individual children. An additional camera follows the teacher throughout the lesson (see Appendix 4 for production guidelines for project staff). Following the lesson, the team conducts and videotapes a debriefing conversation with the teacher, during which he or she reviews the lesson and reflects on students' work together with the case development team (see Appendix 3 for a list of questions addressed during this conversation). After the taping concludes, we shoot still images and collect materials relating to the lesson (e.g., information written on the board, handouts, student work). In some instances, we videotape a follow-up interview with the teacher after he or she has reviewed the initial videotape.

All of the resulting footage is edited for production quality only to preserve the real time unfolding of events during the lesson. All dialogue is transcribed, and added as captions to the video. We also are in the process of developing video descriptions, which will be added as an option on a secondary audio channel to ensure the accessibility of the case materials to visually impaired users. Currently, the video files for each case are saved as QuickTime files on CD-ROM. The files are organized in three parts (planning, lesson, and debriefing). The lesson is indexed for key events (e.g., mini lesson, small group work, reporting back to the large group). Materials relating to the lesson (e.g., handouts, samples of student work) are scanned and included on the CDs as image files and/or text documents. In addition, the case development team develops context materials that describe the setting (the school and the classroom), the mathematics of the lesson, the background of the focal students, the teacher's strategy for addressing all learners, the development of mathematical thinking within the content area featured in the lesson, and what teachers need to know about teaching the specific mathematics content of the lesson to diverse learners (see Appendix 5 for an initial draft of contextual information for Case 1).

Building on the lesson study model, each of our cases consists of 3-4 hours of real-time digital video, including math lesson and the teachers' planning and debriefing conversations. The video documents the experiences of two or three focal students who are carefully selected in consultation with the classroom teacher to represent the range of learners in that classroom. Each case also presents a range of the background materials collected, such as information about individual learners, samples of student work, lesson plans, handouts and worksheets, information about the math of the lesson, information about inclusion issues, expert testimony, and links to related resources.

To date, we have collected and developed materials for four cases (see Appendix 6 for an overview of various selection criteria satisfied by each case). These cases are described below. Two more cases will be developed by June 30, 2004.

Case 1

The first case features a 3rd grade classroom in an urban public school that is engaged in a lesson on numbers and operations, derived from the Investigations in Number, Data and Space curriculum. About half of the students in the classroom are classified as in need of special education services and have individualized education plans (IEPs). There are two teachers in this classroom. One is a general education teacher and the other is a special education teacher. The lesson consists of a teacher-led review that describes the use of arrays to model multiplication problems and a small group activity during which students work in pairs using coins as manipulatives to find the factors of 100. The focal students are two boys, one with language delay and one with attention deficit disorder, and one girl, who is struggling with mathematics concepts and skills.

Case 2

In the second case, the case follows a Kindergarten class from an urban public school as it focuses on geometry. The classroom has 23 students, including three English Language Learners, and 1 student with an IEP. There is one general education teacher in this classroom. The teacher uses the Investigations in Number, Data and Space curriculum. The mathematics lesson consists of a mini-lesson, in which the teacher introduces 3-dimensional shapes, followed by choice time, during which students work in small groups to complete one of three activities (creating pattern block designs, completing pattern block puzzles, or conducting a shape hunt). The focal students are two girls and one boy. One of the girls is an English Language Learner and the other girl has spatial processing difficulties. The boy has strong problem-solving strategies.

Case 3

The third case focuses on a 5th grade classroom from a suburban public school. The lesson is based on the Investigations in Number, Data and Space curriculum and focuses on numbers and operations. The classroom is a low-achieving, tracked mathematics classroom with 15 students. The teacher is a general education teacher with training in mathematics leadership. Seven of the students in this class have an IEP for speech and language issues, learning disabilities, or developmental disabilities. The math lesson consists of a teacher-led mini-lesson on multiplication cluster problems; small group work time, during which students work on a cluster problem; a teacher-guided large group discussion reviewing the cluster problem; and another small group work time, during which students develop story problems for a number sentence. The focal students are two boys and a girl. One of the boys is autistic; the other has an emotional disability. The girl is an English Language Learner with expressive language difficulties.

Case 4

The fourth case shows a 4th grade classroom from an urban, dual language school. The mathematics lesson focuses on data analysis. The teacher is a bilingual general education teacher who uses the Investigations in Number, Data and Space curriculum. There are 26 students in the classroom, all of whom are bilingual. None of the students have been classified as in need of special education services, but several students have learning difficulties. The lesson consists of a mini-lesson, during which the teacher introduces students to statistics, followed by small group work time, during which students (working in pairs) estimate and count the number of raisins in a snack box and record and organize the raisin data. The case documents the lesson through the experience of two boys and one girl. One boy is academically strong and particularly facile with math, while the second boy is easily distracted and has difficulties expressing his ideas through language. The girl struggles academically and has difficulty putting her ideas into words.

Learning Experiences

The case development teams create the learning experiences. The development process typically starts with a desired purpose or learning goal, such as helping teachers develop skill in carefully observing students at work or in analyzing mathematical tasks. The case development team carefully reviews the video footage for a given case and then selects one or more five- to ten-minute segments that support the desired learning goal.

In addition to identifying video segments, the team develops introductory activities, such as hands on exploration of tasks that are shown in the video, and follow-up activities, such as questions for discussion. The team also develops context materials and assembles background information, such as the lesson plan and articles about teaching and learning specific mathematics concepts or about teaching students with a specific disability. Background information is distributed in the form of handouts or as a reference list.

So far, the project team has developed two basic kinds of learning experiences that have been implemented, with minor variations across different course or workshop contexts (see Appendix 7 for a sample of workshop and course session outlines).

Observe and Discuss. In this experience, participants learn how to carefully observe individual children and to take descriptive notes based on their observations. The course or workshop facilitator provides background information about the classroom and the mathematics of the lesson. Course or workshop participants view one or a few short (3-5 minutes) segments of the video materials showing an individual child in different situations during the lesson. Participants share their initial impressions in small groups, and then view the segment again and take descriptive notes. Subsequently, they share their notes, discuss their observation and note-taking techniques, and reflect on what, if anything, differed the second time they screened the materials.

Task Analysis. This learning experience is designed to help participants develop skill in analyzing the demands of specific mathematical tasks and how these demands interact with the strengths and weaknesses of individual learners. It is also designed to contribute to participants' understanding of alternative materials, tools, and instructional strategies for a specific mathematical task and to their skills in devising modifications for a given task to better support individual children. The course or workshop facilitator provides background information about the classroom and the mathematics of the lesson. As part of this introduction, participants view a video segment of the teacher introducing a specific task to the children in his or her class. Course or workshop participants then explore the task portrayed in a given lesson themselves, hands on, and take notes about what a learner needs to be able to do in order to successfully complete the task. Participants are introduced to Mel Levine's (2002)[2] framework, which identifies eight different neuro-developmental functions that come to play in any given learning task, including conceptual, language, visual-spatial, organizational, memory, attentional, psycho-social, and motor functions. Participants are asked to use the neuro-developmental framework for the analysis of one or more video segments from the lesson. Participants view a video segment of one or more individual children engaged in the task and use the framework to analyze how each student handles the various dimensions of the task.[3] Based on these analyses, participants discuss which aspects of the task helped each child to be successful and which aspects made them less successful. Participants then discuss instructional strategies that could help to more effectively support the individual children observed.

In one variation of this learning experience, we have explored participants' use of the editing features of QuickTime Pro to isolate video clips within larger segments and use these clips as evidence or illustrations of specific task dimensions they are analyzing. Participants import their clips into Microsoft Word or PowerPoint to create a multimedia report that includes their notes and video segments that illustrate their response.

Pilot Testing of the Case Materials and Learning Experiences

We have had extensive opportunities to pilot-test our materials in graduate courses offered at Bank Street College of Education and workshop presentations conducted at national conferences. A variety of learning experiences that incorporate case materials have been used in 13 courses, which included 266 teacher candidates. The materials were also used in one course and one workshop for in-service teachers, reaching 33 participants. In addition, through three workshops for professional development providers, we were able to share and test our materials with 103 teacher educators from around the country.

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[2]Levine, M. (2002). A mind at a time. New York: Simon & Schuster.

[3]This component of the learning experience has been adapted from materials developed by Amy Brodesky and Fred Klein as part of the NSF-funded Addressing Accessibility Project.

TABLE 1: MATHEMATICS FOR ALL PILOT TESTS 2002-2004

SEMESTER	COURSE	PARTICIPANTS	MATERIALS USED	LEARNING GOAL
Spring '03	Math for Teachers (Metnetsky)	18 Preservice Teachers	Factors of 100	Observing Students
Spring '03	Math for Teachers (Melnick)	26 Preservice Teachers	Factors of 100	Observing Students
Spring '03	Math for Teachers (Melnick)	24 Preservice Teachers	Factors of 100	Observing Students
Spring '03	Developmental Variations (Marschke-Tobier)	21 Preservice Teachers	Factors of 100	Observing Students
Summer '03	Research in Mathematics Education (Dubitsky)	17 In-Service Teachers	Factors of 100	Observing Students
Fall '03	Math for Teachers (Metnetsky)	19 Preservice Teachers	Pattern Block Puzzles	Task Analysis
Fall '03	Math for Teachers (Melnick)	27 Preservice Teachers	Pattern Block Puzzles, Cluster Problem	Task Analysis
Fall '03	Math for Teachers (Melnick)	23 Preservice Teachers	Pattern Block Puzzles, Cluster Problem	Task Analysis
Fall '03	Conference Group (Marschke-Tobier)	4 Preservice Teachers	Pattern Block Puzzles,	Task Analysis
Fall '03	Bank Street Faculty Seminar (Project Team)	18 Teacher Educators	Factors of 100	Observing Students
Fall '03	AMTE Workshop (Moeller & Dubitsky)	10 Teacher Educators	Factors of 100	Task Analysis
Spring '04	Math for Teachers (Melnick)	25 Preservice Teachers	Cluster Problems	Task Analysis
Spring '04	Math for Teachers (Melnick)	27 Preservice Teachers	Cluster Problem	Task Analysis
Spring '04	Developmental Variations (Marschke-Tobier)	28 Preservice Teachers	Factors of 100	Observing Students
Spring '04	Observation & Recording (McKeever, Moeller)	24 Preservice Teachers	Factors of 100	Observing Students, Task Analysis
Spring '04	Early Language and Literacy in Sociocultural Contexts (Lesch)	24 Preservice Teachers	Pattern Block Designs	Observing Students
Spring '04	Math Saturday Workshop (Project Team)	16 In-Service Teachers	Factors of 100	Task Analysis
Spring '04	NCSM Workshop (Dubitsky, Melnick & Moeller)	55 Teacher Educators	Cluster Problem	Task Analysis

The graduate courses in which we have used the materials include mathematics methods courses, special education courses, and foundational courses on child development, as described below:

Mathematics for Teachers in Diverse and Inclusive Educational Settings (Grades N-6). This course provides students with an overview of mathematics learning for children from nursery school through grade six. The New York City Department of Education accepts one credit of this course as special education credit. The course is offered every semester with multiple sections.

Diagnosis of Learning Problems and Intervention Techniques for the Mathematics Educator. This course conveys the process of clinical teaching. Through focus on an individual child, students examine the practical and theoretical aspects of learning style, language as a learning tool, perceptual abilities and disabilities, dyscalculia, and specific arithmetic disability. This course is being offered both as part of the preservice Teacher Education program as well as the in-service Mathematics Leadership program.

Research in Mathematics Education. This course is designed to increase students' understanding of qualitative research. It enables students to increase their understanding of the principles of qualitative research, to read and understand articles reporting research studies, and to develop and implement qualitative research. This course is offered as part of the in-service Mathematics Leadership program.

Developmental Variations. The purpose of this course is to increase participants' awareness and understanding of the educational, social, cultural and developmental implications of disability. A range of specific disabilities is discussed with an emphasis on their impact on typical developmental expectations and educational progress. One of the main objectives of the course is to prepare all teachers to recognize, comprehend, accept and meet the needs of students with disabilities who are in their classrooms.

The Study of Children in Diverse and Inclusive Educational Settings through Observation and Recording. In this course, each student conducts an in-depth study of a child. Students learn to use a variety of observational approaches and recording techniques as basic assessment tools to increase their understanding of and skill in planning for children who are developing normally, as well as children with disabilities and special needs. The New York City Department of Education and the New York State Division of Teacher Certification accept one credit of this course as teaching special education credit.

Early Language and Literacy in Sociocultural Contexts: Supporting Development and Adapting for Disability. This course examines communication, language, and literacy as they emerge in infancy through early childhood (birth-8). Special attention is given to the integrated nature of learning in these early years, encompassing social, physical, emotional, and cognitive growth. Throughout the course students are introduced to communication disorders and other disabilities of the early years that affect language and literacy learning. Students learn about and develop examples of balanced early literacy environments and approaches appropriate for different early childhood settings.

*Early Childhood Supervised Fieldwork/Student Teaching/Advisement***.** Students conduct fieldwork in an appropriate setting with supervision and advisement. Students in advisement participate in weekly small-group conferences with their advisor. These seminars include the exchange and analysis of ongoing professional experiences and provide a forum for integrating theory and practice.

Pilot testing typically has involved the implementation of one learning experience, usually one-to-three hours long, within a course or workshop session. In a few instances, project staff have implemented multiple learning experiences during multiple sessions of the same course, such as Mathematics for Teachers in Diverse and Inclusive Educational Settings (Grades N-6); Diagnosis of Learning Problems and Intervention Techniques for the Mathematics Educator; and The Study of Children in Diverse and Inclusive Educational Settings through Observation and Recording.

Research and Evaluation

Research and evaluation efforts are ongoing and have accompanied the project since the pilot phase. The primary purpose of these efforts so far has been formative. Emergent findings have been used to inform the refinement of the case development process and the case materials and learning experiences. External evaluators from the Center for Technology and School Change (CTSC) of Teachers College, Columbia University, have conducted the research in collaboration with the project team. Activities have included the documentation of the case development process, the development of research procedures and instruments, data collection from the pilot tests, and collection of baseline data for the summative evaluation, described in more detail below.

Documentation of the Case Development Process. To document the case development process and assess its efficiency and effectiveness the external evaluation team observed project meetings, conducted interviews with project staff, and collected documents such as faculty reflection papers, meeting notes, and production guidelines and handouts developed by the project. These data were analyzed thematically to address the following questions: How is the product defined and developed? Where and how is the product piloted? How is the product refined? What are the benefits of having faculty design, develop, and implement the multimedia case study materials? How are the perspectives of participants in the development process valued and included? What are the issues that may impact the development and quality of the case study process?

Development of Research Procedures and Instruments. The team has begun to develop research instruments and procedures to document the implementation of the case materials and learning experiences and to assess the impact on teacher educators and participants in the learning experiences. These instruments include questionnaires for course or workshop participants, a protocol for observing the implementation of learning experiences and for collecting related documents, interview guidelines for faculty, as well as guidelines for faculty reflection papers. Sample instruments are included in Appendix 8. We have used these research instruments and procedures during our pilot tests and refined them based on formative feedback. We have also begun to collect a list of questions for the expert reviews of the materials that will commence in Year 2 of the project.

Collection and Analyses of Data from Pilot Tests. In conjunction with the pilot tests, we have collected a variety of data including session outlines, ethnographic field notes and video recordings from course or workshop observations, handouts, interviews with faculty, reflection papers written by faculty, student work samples, and questionnaires completed by course or workshop participants. The data have been used to document the implementation of the case materials and learning experiences, to assess the responses of workshop and course participants to the pilot tests, and to determine what aspects of the materials and learning experiences need refinement.

Collection of Baseline Data for the Summative Evaluation. The external evaluation team has conducted interviews with and collected a variety of documents from participating faculty, such as course syllabi, reflection papers from the pilot phase. These data will serve as baseline indicators and will be used to analyze the impact that the project is having on participating teacher educators.

Dissemination. Our dissemination efforts have focused on sharing information about the project with mathematics educators and researchers, and on establishing relationships with publishers to help ensure the national distribution of the professional development materials we are developing.

We have conducted 11 workshops and presentations at national conferences such as the annual meeting of the Association for Mathematics Teacher Educators (AMTE), the Society for Information Technology in Teacher Education (SITE), and the National Council of Supervisors of Mathematics (NCSM). A comprehensive list of workshops and presentations conducted during the past year is included in the Education and Outreach Activities section of this report. The purpose of these workshops and presentations has been to share the project's emerging findings and to let others know about the availability of the materials. The workshops have also provided us with opportunities for obtaining formative feedback on the case materials and learning experiences.

Written reports that document the process of developing the case materials and learning experiences and describe experiences with their implementation are in preparation. These reports will be made available through the technical report series of the EDC's Center for Children and Technology and will be submitted for publication in professional journals.

We have initiated conversations with several companies that have expressed an interest in publishing our materials. These include Heinemann, ETA Cuisenaire, and Pearson Publications.

Other Activities. The Institutional Review Boards of Bank Street College and the Education Development Center have conducted reviews of our research and development procedures and have issued their approval.

We are currently preparing for a meeting of our advisory board, which will be held on May 17, 2004 at Bank Street College.

FINDINGS

At this initial stage of the project, our results include what we have learned about the design, development, and use of the case materials and preliminary evidence about the impact of the materials on teachers and teacher educators.

Design, Development, and Use of the Case Materials

Formative research has played a critical role in helping us refine the format for the case materials, the production process as well as the use of the case materials in teacher education courses and workshops.

Format and Content of the Case Material. Our work during the pilot phase of the project resulted in the following decisions about the format of the case studies:

- Pilot testing helped us chose a conversational format, rather than a presentation or an interview format, to allow case team members to participate in and add their perspectives to the planning and debriefing components of the lesson. Pilot testing also helped us to refine the questions we are asking the teachers during the planning and debriefing conversations in an effort to elicit key information about the lesson while keeping these conversations as concise as possible.

- Reviews of the video from the lessons and feedback from teachers and teacher educators helped us to refine what kinds of information we want to document about the lessons. Our pilot work highlighted the importance of maintaining a focus on the focal students throughout the lesson, and of carefully capturing their work as well as their interactions with other students and the teacher during the lesson. It also helped us to recognize the need for additional video footage that focuses on the teacher and the larger classroom context and the need for still images that document classroom displays, the blackboard, and student work.

- Feedback from preservice and in-service teachers and teacher educators helped us to clarify what kinds of contextual information and background materials are necessary for users to make sense of the video materials. The materials requested include samples of student work; information about the school, the classroom, the focal students, the mathematics of the lesson, and the mathematical context (what preceded and followed the lesson); a description of the task, the learning goals, and the teacher's strategy for addressing all learners in the lesson; what teachers need to know about teaching the specific mathematics content of the lesson to diverse learners; expert reviews of the lesson materials, and more information about the neuro-developmental framework.

- Our review of case materials and software developed by others and our pilot implementations helped us to define the kinds of user interactions we would like our case materials to support. These include the capability for teacher educators and participants in teacher education courses or workshops to bookmark or index sections of the video materials, to select and edit sections of the video materials, to annotate sections of the video materials, to access and print the transcript or sections, and to perform key word searches within the transcript, as well as the ability to slow the action while playing back the video.

Case Production Process. The review of the video footage and background materials by project staff and feedback from advisors and course and workshop participants helped us to refine the videotaping, sound recording, and editing processes in the following ways:

- To ensure the best quality of the video footage we have found that pre-production visits to the classroom are essential. During these visits we carefully review with the teacher the flow of the lesson, the materials that will be used, the activities that students will be engaged in and where students will be sitting. We also explore the lighting and sound conditions in the classroom as well as the physical placement of furniture and other objects in the classroom. The visit helps us to plan for the positioning of cameras, to eliminate potential problems with lighting, background noise, and physical objects. It also helps the camera people anticipate what will be recorded, and clearly delineate and coordinate what each member of the case development team will be documenting. In order to minimize students' distraction by the video production, we have found it helpful to bring our equipment to the pre-production visits and to set up the equipment early on the day of the shoot. This provides opportunities for students to explore and satisfy their curiosity about the video cameras. We carefully explain to students that the purpose for the videotaping is to help teachers learn about teaching mathematics and emphasize the need for them to act as naturally as possible. We also tell them that if students act silly or wave it will make the video unusable for us and that we will have to edit those sections out. Other things we learned about the video production process were to eliminate the need to change tapes during the lesson so that the whole lesson will be captured and to start all cameras simultaneously to facilitate the editing process.

- After trying several different alternative options, we found that wireless microphones provided us with the best possible solution to record good quality sound within the classroom. Our goal was to achieve maximum sound quality without drawing too much attention to the video production process. We felt that using directional microphones on booms was not an option because it would have doubled the number of adults needed in the classroom and would have likely distracted students. We found that directional microphones attached to the camera and built-in microphones sometimes did not carefully record what a focal student was saying. We also tried out tabletop microphones but found that the use of mathematics manipulatives created too much background noise for them to pick up the sound well. We are currently using omni-directional wireless microphones to record focal students as well as other students that are in close proximity to them. We explain to focal students that they have been selected to serve as the mircophone carriers for their class, a responsibility that they take very seriously. We carefully plan with the teacher prior to the shoot where focal students will sit during whole group meetings and small group work to ensure that the voices of all children will be recorded and to avoid sound interference. For recording the teacher, we have found that a directional microphone attached to the camera works well.

- Formative feedback from teacher educators and workshop and course participants also helped us to refine our editing techniques. For instance, it helped to clarify how we need to combine video footage and sound tracks from multiple cameras for parts of the lessons during which the whole class meets. We also learned where and how to insert still images to ensure the readability of the white boards and displays used in the lesson and to provide visual illustrations for ideas and objects discussed in the video. Further, we clarified how to best locate captions on the screen, how to ensure their readability against differently lighted and colored backgrounds, and how to time the captions. We have also tried out a variety of video compression techniques and storage options. Our goal is to maintain an acceptable viewing quality while minimizing storage space. We are currently using the Final Cut Pro 4 Codec compression tool with the following settings: Sorensen 3, FPS (frames per second): 15, Bit rate: 90 kbps, Size: 240 x 320, and are exploring options for more compression to further reduce the required storage space. We have made the case materials available in DVD and CD-ROM format, but have found that many of the computers that faculty and participants in workshops and courses have access to do not readily support a DVD format. Therefore, we are currently making the case materials available in CD-ROM format.

Development of Learning Experiences and Their Implementation. Pilot testing of the learning experiences helped us to understand how they integrate into different course and workshop contexts and how they need to be refined. We found that the learning experiences flexibly fit into a variety of different courses and workshops. We were able to integrate and use the same set of materials and learning activities within mathematics methods courses, special education courses, as well as foundation courses.

For the two different types of learning experiences we have tested so far (observe and discuss; task analysis), we have found that two or three five to ten minute video clips are usually sufficient for a two-hour long facilitated learning experience. The type of video segments we have found useful to show as part of the two types of learning experiences piloted so far include (1) a video segment of the focal student at work at one or more points during the lesson, (2) a video segment of the teacher explaining the task to the class, and (3) a video segment of the teacher describing the plans for the lesson and the focal students' strengths and weaknesses.

We also gained valuable insight into how the learning experiences needed to be facilitated and how to structure workshop participants' interactions with the case materials. We found that without guidance, participants tended to focus on criticizing the teachers in the video segments rather than observing the focal student. We therefore developed special instructions to redirect course and workshop participants' focus on observing students. Participants also raised a number of questions about the larger context of the lesson (e.g., when it took place, what came before and what came after, what students were asked to accomplish, as well as the students in the classroom (number, grade level, range of abilities and disabilities). Participants' questions helped us to refine what kinds of contextual information we need to provide in conjunction with specific learning experiences. We also found that opportunities for course and workshop participants to directly

interact with the video materials helped to deepen their learning experience. Opportunities for direct interaction with the video materials were provided by making computers available to individual or small groups of participants, allowing them to control viewing and play back of the video on their own. Alternatively, we also had participants use QuickTime Pro to isolate video clips and incorporate them in a Microsoft Word or PowerPoint document to annotate them.

Impact on Preservice and In-Service Teachers and Teacher Educators

Overall, the response of users of our materials, both faculty and participants in courses and workshops, has been very positive. They clearly value the materials and learning activities and indicated that they resulted in significant learning.

Faculty. The pilot tests allowed faculty to recognize the value of using the video and other case materials in their courses, and helped them refine how they are using the case materials in their courses.

> *"Watching video also [allowed] us to work backwards from practice to determine what teachers need to know. The study of practice is important because it respects the central importance of the classroom in our attempts to improve education. No attempt to improve education can succeed unless it affects the quality of teaching and learning inside the classroom; the classroom is like a bottleneck, through which all reforms must pass."*
>
> *Linda Metnetsky, Mathematics Education Faculty*

> *"At this point I believe I would like to fold these cases into my course throughout the 14 sessions. Certainly we should use it much earlier than the last two sessions. Before I thought special needs work should come well after the issues of so-called 'regular ed' math teaching are well established in the minds of the students. I have a different view now because I see the power of asking our teachers to step into the struggle of helping the child who has difficulty understanding …to understand."*
>
> *Harold Melnick, Mathematics Education Faculty*

Course and Workshop Participants (In-service and Preservice Teachers). The response to the materials and learning activities by participants in the courses and workshops has been enthusiastic. Participants valued the ability to closely observe individual students and to share their interpretations about the student's thinking with other participants in the course or workshop. They felt that the video provided a focal point for their collective analyses and observations. It also allowed them to step back and examine teaching and learning and to notice new things from an outside perspective. Participants especially liked the ability to play back the video.

> *"It is great to look at what children are doing under a microscopic lens and discuss what is seen-particularly in a large class with various perspectives. Each person brings some valuable interpretation of what is seen."*

"I think it is wonderful-especially as a new teacher-to have the opportunity to really study a student who might be having a learning difficulty. It's great to be able to watch the video again."

"It is great to watch children in action-when you are not in the midst of the class itself in action. Helps you see from an outside perspective, notice new things."

The learning experiences helped to make participants more aware of the need to observe carefully in order to understand more deeply what a student is thinking. Participants indicated that our materials contributed to their understanding of the complexities of teaching and learning in classrooms that include learners with diverse abilities and disabilities. It also helped them to develop a deeper understanding of particular learning disabilities.

"What I learned from the video was the multiple ways children strategize to complete tasks and how teachers often ignore these strategies because they don't have the time to look at the student work."

"It helped me to put things into perspective…to gain a deeper understanding of how inclusive teaching works and what some learning disabilities look like."

Participants got to appreciate the multiple entry points and opportunities that a given learning activity might afford to different students, but also learned that some children need additional strategies to help them succeed.

"I could see how the lesson was open enough for different kids to get it at different levels."

"I saw that some children need certain strategies or additional methods to help them grasp concepts, etc."

The learning experience made some participants think about specific adaptations that might be useful for particular students, for instance:

"Break down instructions into smaller chunks."

"I thought about how it might have helped to have visual directions, on the table, for Luis Carlos to follow—also, perhaps a place to write down how much he had counted."

Faculty's perceptions provide converging evidence in support of students' self assessments. For instance, Karen Marschke-Tobier, special education faculty at Bank Street, who used one of the learning experiences in her Developmental Variations course, felt that the use of the materials helped her students observe in greater detail and to connect theory to practice.

"In the Developmental Variations class I was able to present the DVD of Luis Carlos for my students to view and discuss. The class found many aspects of the two sequences compelling, some students seeing greater detail as they focused on the child's patterns and the adult's responses. Other students linked their observations of Luis Carlos with earlier readings and

experiences with Mel Levin's neuro-developmental constructs. It was particularly gratifying to me that the DVD case sequence was so stimulating for the class and led to the opportunity to link theory they had studied in another context to the actual experience they were viewing together. They were clearly engaged in the process and wanted to view the sequence again, after the discussion, to clarify their memory. "

Karen Marschke-Tobier, Special Education Faculty

Teacher Educators. Teacher educators who participated in our workshops had a very positive response as well. They found the video materials to be useful for encouraging dialog, for focusing attention on issues, for making learning less abstract for teacher candidates, and for providing a context and common basis for discussion. One teacher educator noted that he valued the focus on individual students within the classroom context that our video materials provided. This is different from other video materials that focus on the whole class and do not readily lend themselves to the observation of individual students. The teacher educators also commented on the value of the case study approach:

"I very much like the focused case study approach as it gets at lots of math content, pedagogy, and individual differences simultaneously."

Participation in our workshops helped them to become more aware of the need to address issues of learner diversity and inclusion in their courses and the need to observe the whole child rather than just to rely on verbal clues. It also helped them to appreciate the importance for teachers to understand the various demands of instructional tasks so that they can more carefully plan for individual students.

"[The workshop] reinforces that teachers often miss what students are doing and that case studies can be a way to focus on student thinking."

"The workshop made me aware of inclusion students' needs and expectations [and] helped me to plan to include more activities regarding students' abilities."

"Mathematics teacher educators cannot divorce themselves from thinking about ways of improving instruction in inclusive classrooms."

'[I learned] that I need to rethink about discourse and [verbal] communication as indicators of understanding. There are children who don't communicate verbally, but communicate knowledge in how they go about the task etc."

"[I learned] that children with disabilities have strengths and expertise to tap into—need strategies that are consistent with strengths—Help to develop skills they are deficient in."

"[I learned] different ways of interpreting a teaching/instructional task keeping in mind a diverse student population. Need to know what students bring in when they are assigned a task and how to help them learn successfully with this prior knowledge."

"[I learned] some techniques to be used with special ed teachers."

Finally, the workshops contributed to teacher educators' appreciation of the value of the case study method for teaching teachers. Many of the teacher educators who participated in our workshops indicated that they would consider using our materials in their own courses or workshops. Two faculty members from Bank Street College who are not directly participating in the project have already adopted some of our materials. We have also already received a significant number of requests from teacher educators at institutions other than Bank Street to pilot-test our materials. The purposes for which teacher educators are interested in using our materials are to facilitate discussion, to analyze student-teacher interactions, and to help dispel the myth that students with disabilities cannot participate in standards-based mathematics education. Several teacher educators indicated that they would be interested in building on our materials and extending them for their own specific purposes.

Opportunities for Training and Development

The Mathematics for All Project is offering a number of training and development opportunities for project staff and partners as detailed below.

Project Staff. The case development process is providing project staff with a multitude of learning opportunities. These include opportunities to examine current research on various topics relating to the project (e.g., teaching and learning specific mathematics concepts and skills, the inclusion of students with disabilities in standards-based mathematics classrooms, and mathematics teacher professional development) and opportunities to observe K-6 inclusion practices in action and reflect on them with the classroom teachers, colleagues and graduate students, or in-service teachers. Moreover, the development of learning experiences and background materials for the cases affords opportunities for project staff to integrate theory and research in special education and mathematics education. Pilot testing of materials and learning experiences has provided opportunities for project staff to reflect on their use of the case materials and teaching practices.

Case development teams are multidisciplinary and are composed of project staff who bring expertise in mathematics education, special education, technology, and case methodology. The cross-disciplinary collaboration within case development teams and the project team has provided opportunities for faculty to share ideas and strategies from their respective disciplines. Monthly project meetings are organized thematically and focus on different topics that reflect the areas of expertise of different team members. The collaborative process has helped project staff to develop a common language and understanding of classroom practices and has facilitated the examination of their own teaching practices.

The project already has had a significant impact on project staff. Learning outcomes include an increased appreciation of cross-disciplinary collaboration as well as a deepened understanding of case study production and how to integrate case materials into their courses.

"I learned a great deal more about the nature of case studies and the range of video cases available. My interest in case studies, as a means of teaching teachers, was strengthened by reading about the range of research on the topic and by looking at the some of the existing video cases. I learned how much I enjoy this collaborative work and how my own perspective is enhanced by my colleagues' expertise. It also became clearer to me what my specific contribution, as I am not a math person with experience in special education, needs to be and can be. I look forward to continuing with this group."

Karen Marschke-Tobier, Special Education Faculty

Project staff also has become more aware of the needs of students with disabilities within a standards-based mathematics classroom as well as the needs of graduate students in terms of being prepared to teach mathematics to learners with diverse needs and strengths. The increased awareness of issues relating to the inclusion of students with disabilities has helped faculty to observe subtle things in the teaching and learning of mathematics in heterogeneous classrooms and thereby has enhanced their capacity to advise graduate students concerning their teaching practice.

"I am deeply appreciative of my case studies colleagues. I am learning a tremendous amount about the range of difficulties that children have in inclusive classrooms. I also am becoming more sensitive to the needs of my graduate students and want to provide them a healthy balance in this course between work with special education students and those who are not."

Harold Melnick, Mathematics Education Faculty

"In the limited way that I used the video clip we produced, I learned about what I still need to do to help my students develop note taking techniques for research. The video was a vehicle through which I could help them begin to think about the necessity of taking objective notes in a classroom setting."

Barbara Dubitsky, Mathematics Education Faculty

Given their different areas of expertise, each of the faculty members has benefited from participation in the project in different ways. Linda Metnetsky, who teaches mathematics education courses for general and special educators, reported that the project has given her a better mental model of what an inclusive mathematics classroom looks like and what role technology might play in it. For Harold Melnick, another mathematics faculty member, the project has most impacted his understanding of students with disabilities. Karen Marschke-Tobier, a member of the special education department, reported that the project has helped her to deepen her understanding of the big ideas in teaching mathematics. She is now integrating more mathematics awareness and learning experiences into her courses.

Graduate Students. Bank Street's Center for Urban Teacher Education and Technology employs six preservice teacher candidates to provide technical assistance for the technology work that goes on at the College. Two of them have been classroom teachers at the elementary level, one teaches at

the post-secondary level, one has been an educational television producer, one has worked in school administration and one is new to the education field. These graduate students are participating in a range of programs at Bank Street that include general education, middle school education, and special education. All of the technology fellows have worked on the Mathematics for All project. They have supported Mathematics for All staff with transcribing the hours of footage that result from each case. Once the footage has been edited and prepared for viewing, they have been involved in supporting the use of the footage in graduate classes through burning CDs of the footage, loading footage onto computers, and setting up rooms to facilitate the learning experiences that faculty have designed for their graduate students. Several technology fellows have supported the Mathematics for All staff in researching and exploring software that have been part of our investigations into assorted case development tools.

Their involvement with the Mathematics for All project has helped graduate students to develop strong video post-production skills and it has also afforded them the opportunity to look closely at ranges of learners as they engage in classroom work. One graduate student reported that by transcribing a segment of video footage, she was better able to understand a learning process she had read about for a language acquisition course. The nature of the technology fellows' involvement in the Mathematics for All project requires that they view and review and listen and re-listen. As the project goes on, and they see the ways in which the footage is being used by participating faculty, they are deepening their understandings of the ways that students learn, the ways they can be supported by their teachers, and the roles technology can play in education.

Intern. During the past year we have had a high school intern working with us on the project for 15-20 hours per week. She has handled a variety of activities, prime among them being work on an Endnote database of articles relating to education and students with disabilities. This database will be very useful in preparing a list of resources to include in the final product. She has also done research to locate information on various disabilities and has helped to prepare materials for workshops and conference presentations. Through this work the intern has developed research skills, has learned to use new a software tool, and has gained knowledge about students with disabilities.

Collaborating Teachers. The process of developing the multimedia case studies involves teachers whose classrooms are featured in the video. This process provides teachers opportunities to participate in a lesson study process in which they collaborate with project staff to plan and reflect on a lesson. The case materials afford the collaborating teachers further occasions to reflect on teaching and learning in their classroom. These opportunities have helped teachers to gain a different perspective on their classrooms, including a better understanding of how individual students are learning and the effectiveness of different tasks, materials and instructional strategies.

Bank Street Faculty. We conducted a seminar for Bank Street faculty at which we shared samples of our materials and ways in which project staff has been using them in their graduate course. We have also shared samples of our materials and information about the project at two "Technology

Street Fairs" for Bank Street Faculty that were held in conjunction with Critical Friends visits from the Center for Technology in Urban Teacher Education at Bank Street. As a result of these presentations, several faculty members expressed an interest in using the materials. We have met with these faculty members individually to provide technical support and to help them plan to integrate the materials into their graduate courses.

CCT Staff. We conducted two meetings for CCT staff, presenting information about our project and sharing our materials and learning experiences.

EDUCATIONAL OUTREACH ACTIVITIES

Math for All Presentations and Workshops 2003-2004

Dubitsky, B., Marschke-Tobier, K., Melnick, H., Metnetsky, L. & Moeller, B. (2003). *Mathematics for All: Designing multimedia cases to prepare teachers for inclusions the mathematics classroom*. Paper presented at the annual meeting of the Society for Information Technology and Teacher Education (SITE), Albuquerque, N.M., March 24-29, 2003.

Moeller, B., Dubitsky, B., Marschke-Tobier, K., Metnetsky, L., Melnick, H. (2003). *Mathematics for All: Using multimedia case studies to teach teachers about inclusion in the mathematics classroom*. Demonstration conducted at the Technology Street Fair conducted at Bank Street College, April 28, 2003.

Dubitsky, B., Melnick, H., Metnetsky, L., Marschke-Tobier, K., Brothman, A. & Moeller, B. (2003). *Learning and teaching mathematics in inclusion classrooms*. Faculty Seminar presented at Bank Street College of Education, October 15, 2004, 12-2 pm.

Moeller, B. & Anderson, L. (2004). *Mathematics for All project: An overview*. Presented at EDC's Center for Children and Technology, January 14, 2004.

Moeller, B., Dubitsky, B., Marschke-Tobier, K., Metnetsky, L., Melnick, H. (2004). *Using multimedia case studies to help teachers learn about inclusion in elementary mathematics classrooms*. Workshop to be presented at the annual meeting of the Association of Mathematics Teacher Educators, San Diego, CA, January 22, 2004, 1:30 to 4:30 pm.

Moeller, B., Cohen, M., Dubitsky, B., Marschke-Tobier, K., Melnick, H., Metnetsky, L., Brothman, A., & Kantrov, I.,(2004). *Using multimedia case studies to help teachers learn about inclusion in the elementary mathematics classroom*. Paper presented at the annual conference of the Society for Information Technology and Teacher Education (SITE), Atlanta, GA, March 2, 2004, 2:00 pm.

Dubitsky, B., Melnick, H., Metnetsky, L., Moeller, B., Brothman, A., Cohen, M., Marschke-Tobier, K., Kantrov, I. & Anderson, L. Saturday Math Seminar at Bank Street College of Education, New York, March 6, 2004, 10 am –1 pm.

Melnick, H., Marschke-Tobier, K., Moeller, B., Dubitsky, B., Cohen, M., Brothman, A., Kantrov, I. & Anderson, L. (2004). *Teaching Math in an Inclusion Classroom: What we Can Learn From Case Studies*. Presentation at the EDC's Center for Children and Technology, New York, March 10, 2004.

Moeller, B. (2004). *Using technology to support math and science learning for all*. Invited Keynote, Workshop, and Roundtable presented at the Universal Design Conference: Reaching All Children Through Technology, Westchester Campus of Long Island University, March 19, 2004.

Dubitsky, B., Moeller, B., Melnick, H., Metnetsky, L., Marschke-Tobier, K. (2004). *Mathematics for all: A multimedia case study approach to professional development in the elementary classroom*. Workshop to be presented at the annual conference of the National Council of Supervisors of Mathematics, Philadelphia, PA, April 20, 2004, 10:10 to 11:00 am.

Metnetsky, L. & Moeller, B. (2004). *Mathematics for All: Using multimedia case studies to teach teachers about inclusion in the mathematics classroom*. Demonstration conducted at the Technology Street Fair conducted at Bank Street College, April 22, 2004.

PRODUCTS

Major Journal Publications
In preparation

Books and One-time Publications
In preparation

Web Sites or Other Internet Sites that Reflect this Project
Information about the Mathematics for All project can be found at the following web sites:
The web site of the EDC/Center for Children and Technology http://www.edc.org/cct

Other Products
By the end of Year 1, we will have drafts of 6 multimedia case studies (cd-rom and DVD based) in various stages of completion.

Powell, K. & Meier, E. (2004). *Mathematics for All: Year 1 evaluation report, July 2003-March 2004*. New York: The Center for Technology and School Change, Teachers College, Columbia University.

CONTRIBUTIONS

Within Discipline. This project is contributing resources and knowledge about effective approaches for preparing teachers to include students with disabilities in standards-based math classrooms. Through pilot and field-tests of the materials we are developing, the Mathematics for All project is having a direct impact on a large number of teachers and teacher educators. The publication of the materials and our workshops for teacher educators will facilitate the widespread availability and use of the materials. We expect that the use of the materials in teacher education programs throughout the country will contribute to improving the preparation of preservice and in-service teachers to support a wide range of learners, including students with disabilities, within standards-based mathematics classrooms. We also anticipate that the use of the materials will help teachers to become more facile users of multimedia technology.

To Other Science or Engineering Disciplines. Case studies are emerging as a tool for education in various disciplines including science and engineering education. The Mathematics for All Project will contribute to the knowledge base about the effective design and use of multimedia case studies. We will disseminate our findings broadly to share them with other disciplines.

To the Development of Human Resources. We anticipate that this project will significantly contribute to broadening the preparation of general and special education teachers, providing the knowledge, skills, and attitudes that will help them to more effectively support students with varying needs and strengths, including students with disabilities, in a standards-based mathematics curriculum. As a result of improved classroom practices, including higher expectations for all students, a rigorous curriculum, ongoing informal assessment, and teaching strategies tailored to individual students' strengths and needs, we expect that a larger number of students, including students with disabilities, will achieve high-quality, standards-based learning outcomes in mathematics. Ultimately, this will help to prepare them for the pursuit of careers in science, technology, engineering and mathematics (STEM).

To the Infrastructure for Research and Education. The professional materials that we develop will be an important resource for teacher educators and staff developers to use in their work with teachers. We will disseminate the modules broadly and use on-site and online faculty workshops to facilitate their use by professional development providers across the country. In addition to tools for educators, we expect that this project will make important contributions to the knowledge base about how to effectively prepare teachers to support students with different abilities and disabilities in a standards-based curriculum. We will use written reports and presentations to inform practitioners and policy-makers of our findings.

To Other Aspects of Public Welfare. Ultimately, we expect that our project will have a significant impact well beyond mathematics education on how teacher education is conceived and conducted, resulting in a new generation of teachers better prepared for including students with disabilities in standards-based reforms and for helping all students achieve high-quality learning outcomes.

APPENDICES

Appendix 1: Case Resources Reviewed
Appendix 2: Letters to Parents and Teachers, Consent and Release Forms
Appendix 3: Questions for Planning and Debriefing Conversations
Appendix 4: Production Guidelines
Appendix 5: Initial Draft of Context Materials for Case 1
Appendix 6: Mathematics Content and Demographic Descriptors for Cases Under Development
Appendix 7: Sample Course and Workshop Outlines
Appendix 8: Research Instruments

APPENDIX 1:
CASE RESOURCES REVIEWED

CASE RESOURCES

Research on Case Methods in Teacher Education

Andrews, L. (2002). Preparing general education preservice teachers for inclusion: Web-enhanced case-based instruction. *Journal of Special Education Technology,* 17(3), 27-35.

Barnett, C. (1999). Cases. *Journal of Staff Development*, 20(3). Available online at: http://www.nsdc.org/library/jsd/barnett203.html

Harrington, H. L. & Garrison, J. W. (1992). Cases as shared inquiry: A dialogical model of teacher preparation. *American Educational Research Journal*, 29(4), 715-735.

Kinzer, C. & Risko, V. (1998). Multimedia and enhanced learning: Transforming preservice education. In D. Reinking, M.C. McKenna, L. D. Labbo, & R. D. Kieffer (eds.): *Handbook of literacy and technology*. Mahwah, NJ: Erlbaum.

Kleinfeld, J. (1990). The case method in teacher education: Alaskan Models. *ERIC Digest*, ED321965. Available online at: http://www.ed.gov/databases/ERIC_Digests/ed321965.html

Merseth, K. (1996). Cases and case methods in teacher education. In J. Sikula (ed.), *Handbook of research on teacher education* (pp. 722-744). New York: Macmillan.

Mostert, M. P. & Sudzina, M. R. (1996). Undergraduate case method teaching: Pedagogical assumptions vs. the real world. Paper presented at the *Annual Meeting of the Association of Teacher Educators,* St. Louis, MO.

Seago, N. & Mumme, J. (2000). *Videocases for mathematics teacher development: What we are learning*. San Diego, CA: San Diego State University Foundation.

Inclusion in Mathematics

Hiebert, J . (1990). The role of routine procedures in the development of mathematical competence. In T.J. Cooney and C.R. Hirsch (Eds.), *Teaching and learning mathematics in the 1990s*. (1990 Yearbook of the National Council of Teachers of Mathematics, pp31-40). Reston, VA: NCTM

Karp. K. (2000). Weaving lessons: Strategies for teaching mathematics and science in inclusive settings. In S. E. Wade (Ed.), *Inclusive education*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

ERIC/OSEP Special Project (2002). Strengthening the third R: Helping students with disabilities achieve in mathematics. *Research connections in special education*. (number 11). Arlington, VA: ERIC Clearinghouse on Disabilities and Gifted Education. Available online at: www.ericcec.org.

Lesson Study

Lewis, C. C. & Tsuchida, I. (1998). A lesson is like a swiftly flowing river. *American Educator*, Winter 1998.

Case Resources for Teacher Education in Mathematics, Inclusion, and Diversity

Mathematics

All kinds of Minds
Author: Levine, M. et al
Grade level: 3rd-12th grade
Content/topics addressed: Math and other content areas, and various learning disabilities
Materials: Case descriptions focusing on individual students on the web
http://www.allkindsofminds.org/navframe/navlibFS.asp
Video clips of Mel Levine lecturing and transcripts on the web:
http://www.allkindsofminds.org/navframe/navlibFS.asp
Website with simulations, information, and resources on learning difficulties in math
http://www.pbs.org/wgbh/misunderstoodminds/
Developing minds multimedia resources (video and print)

Developing Mathematical Ideas

Developed at EDC in collaboration with TERC and Summer Math for Teachers
Authors: Schifter, D., Bastable, V. & Russell, S. J. Grade level: K-6
Math topics addressed:

- Number and Operations, Part 1: Building a System of Tens
- Number and Operations, Part 2: Making Meaning for Operations
- Geometry 1 (in preparation)
- Geometry 2 (in preparation)
- Data Analysis (in preparation) Materials: Includes a video, a print casebook, and a print facilitator's guide for each topic. Publisher: Dale Seymour Publications

Lambert and Ball Videos

Developed at Michigan State University
Authors: Lambert, M. & Ball, D.
Grade level: 5th Grade
Lambert, M., Heaton, R. & Ball, D. (1994). Using technology to support a new pedagogy of mathematics teacher education. *Journal of Special Education Technology*, 12(3), 276-289.

Lenses on Learning
Developed at EDC
Authors: Scott Nelson, B. et al
Grade level: K-6
Math topics addressed:
Materials: Classroom Videos and print materials (in press)
Publisher: Pearson Learning

Mathematics Case Method Project
Developed at WestED
Authors: Barnett, C., Goldstein, D., & Jackson, B. (eds.)
Grade level: K-6
Math topics addressed: Fractions, decimals, ratios, and percent
Materials: Cases and facilitator guide in print
Publisher: Heinemann

Barnett, C., Goldstein, D., & Jackson, B. (eds.) (1994). *Mathematics teaching cases: Fractions, decimals, ratios, and percents*. Portsmouth, NH: Heinemann.

Barnett, C., Goldstein, D., & Jackson, B. (eds.) (1994). *Mathematics teaching cases: Fractions, decimals, ratios, and percents: Facilitator's Discussion Guide*. Portsmouth, NH: Heinemann.

QUASAR Project
Developed at the University of Pittsburgh and the Learning Research and Development Center.
Authors: Stein, M. K., Schwan Smith, M., Henningsen, M.A., & Silver, E.
Grade level: middle grades
Math topics addressed: fractions, decimals, percent, multiplication of fractions, data organization and analysis, problem solving, multiplication of monomials and binomials
Materials: Cases and facilitation guidelines in print
Publisher: NCTM and Teacher College Press.
Stein, M. K., Schwan Smith, M., Henningsen, M.A., & Silver, E. (2000). *Implementing standards-based mathematics instruction: A casebook for professional development*. New York: Teachers College Press.

Ranking Data to Make Decisions
Developed at San Diego State University in collaboration with Syracuse and Vanderbilt Universities
Authors: Bowers, J., Doerr, H., Masingila, J. & McClain, K.
Grade Level: 7th & 8th grade
Topics addressed: Data Analysis
Materials: CD-ROM with videos of lessons, other resources, activities, and tools

Seeing Math Telecommunications Project

Developed by the Concord Consortium in collaboration with TeachScape and Research for Better Schools

Authors: Tinker, B. et al

Grade levels: 3-6th grade

Math topics addressed:

- Numbers and Operations: Division with Remainders
- Pre-algebra: Pan Balance Equations
- Geometry: Calculating the Area of a Triangle
- Data Analysis and Probability: Data Sets and Measures of Center
- Data Analysis and Probability: Using Data to Make Predictions

Materials: Video, text (background information, perspectives) and activities, all available online through TeachScape

A sample case on PRE-ALGEBRA: PAN BALANCE EQUATIONS can be accessed through the Seeing Math web site. For more information: http://seeingmath.concord.org/

TIMMS Videos/Lesson Lab Software

Developed by Lesson Lab, Inc.

Authors: Stigler et al.

Grade level: 8th Grade

Content/Topics addressed: Math and science lessons.

Materials: Video of lessons, Lesson Lab Software (streaming video, user discussions, supplemental materials, expert commentary, personal learning tools)

For more information: http://www.lessonlab.com

Videocases for Mathematics Teacher Development and Leadership Curriculum for Mathematics Professional Development

Developed at San Diego State University in collaboration with WestEd

Authors: Mumme, J., Seago, N. et al

Grade level: K-12

Math topics addressed: Algebraic thinking

Materials: Video, accompanied by resources such as transcripts, seating charts, copies of student work, teacher interviews, commentaries, and related reading materials

Inclusion/Diversity

Children with Special Needs

A book that includes cases of individual children with various kinds of disabilities from Birth to Age 8. Each case is accompanied by information for educators about specific disabilities, hints for success, questions for discussion, and resources for educators and parents.

Kostelnick, M.J., Onaga, E., Rohde, B. & Whiren, A. (2002). *Children with special needs.* New York: Teachers College Press.

Diversity in the Classroom

Developed at Far West Laboratory
Authors: Shulman, J. & Mesa-Bains, A.
Grade level: K-12
Content/topics: Reading, writing, ESL, interpersonal relations, social issues

Shulman, J., & Mesa-Bains, A. (eds.) (1993). *Diversity in the classroom: A casebook for teachers and teacher educators.* Hillsdale, NJ: LEA and Research for Better Schools.

Mesa-Bains, A. & Shulman, J. (1994). *Diversity in the classroom: Faciliator's Guide.* Hillsdale, NJ: LEA and Research for Better Schools.

Inclusive Education

This book presents teaching events relating to inclusion in grades K-12 in various content areas, including math, science, reading, and writing.

Wade, S. E. (ed.) (2000). *Inclusive education: A casebook and readings for prospective and practicing teachers.* Mahwah, NJ: Lawrence Erlbaum Associates.

School Reform Teaching Cases

Developed at EDC.
Authors: Miller, B. & Kantrov, I. (eds.)
Grade level: K-12
Content/topics: School reform issues as played out in different content areas including mathematics
Materials: Includes a casebook and facilitator's guide in print.
Publisher: Heinemann

Miller, B. & Kantrov, I. (eds.) (1998). *Casebook on school reform*. Portsmouth, NH: Heinemann.

Miller, B. & Kantrov, I. (eds.) (1998). *A guide to facilitating cases in education.* Portsmouth, NH: Heinemann.

Video Case Studies in Science Education

Developed by Harvard-Smithsonian Center for Astrophysics
Author: Schnepps, M. et al.
Materials: Includes a video and short facilitator guide.

Appendix 2:

Letters to Parents and Teachers, Consent and Release Forms