Preparing Teachers to Teach Mathematics in Inclusion Classrooms:

A Multimedia Case Based Approach

PREPARED BY:

Ellen B. Meier, Ed.D.
Kathy Powell, Ed.D.
Fiona Hollands, Ph.D.
Teachers College, Columbia University

Babette Moeller, Ph.D.
Education Development Center

Barbara Dubitsky, Ed.D.
Bank Street College of Education

EDC Learning transforms lives.

Education Development Center
Learning and Teaching Divsion
Center for Children and Technology

Preparing Teachers to Teach Mathematics in Inclusion Classrooms: A Multimedia Case Based Approach [1, 2]

Abstract

In today's world of high standards for all elementary students in mathematics, there is an urgent need to prepare teachers to meet the needs of students with a wide range of abilities and disabilities. Teachers need to be highly knowledgeable about identifying the strengths and needs of their students, about analyzing what mathematical understandings reside at the heart of a particular lesson, and they need to be comfortable with their own skills in identifying appropriate inclusion practices to address diverse student needs. Elementary teachers are typically unprepared to implement standards-based mathematics education in inclusion classrooms. This research reports findings from evaluation of a National Science Foundation project, Mathematics for All (MFA) which was designed to address these needs. This research describes the fourth year results for two pilot sites in a four year NSF funded project, which uses multimedia case studies as the centerpiece of a five-day professional development effort to prepare teachers to meet the mathematical needs of their inclusion students. The findings of the pilot studies have important implications for those interested in promoting a deeper understanding of inclusion students in the area of elementary mathematics.

1. Objectives or purposes

Teaching mathematics in elementary classrooms is more challenging than ever for teachers who are trying to introduce standards-based reforms and address the needs of a range of students in their classroom. At the same time, the *No Child Left Behind* legislation ("NCLB," 2001) has increased the pressure on schools to ensure that all children have the opportunity to obtain a high-quality education and that they reach proficiency on challenging achievement standards. Teachers of students with disabilities and a wide range of abilities are particularly challenged by these new mandates. Elementary teachers in inclusion classrooms are often poorly prepared to implement standards-based mathematics education for students with disabilities (Karp, 2000). Moreover, teachers frequently receive minimal preparation in understanding the strengths and needs of children with learning disabilities. In a nationally representative sample of public school teachers by the National Center for Education Statistics (1999), for instance, only 21% of the teachers who serve students with disabilities reported feeling very well prepared to address the needs of these students.

---

[1] Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL, April 2007.

[2] The work reported in this report was supported by a grant from the National Science Foundation (Grant No. ESI-0243527). Any opinions, findings, conclusions, or recommendations expressed here are those of the authors and do not necessarily reflect the views of the National Science Foundation.

In recognition of this problem, the National Science Foundation funded a four year developmental effort to develop multimedia case studies to address the pressing professional development concerns of elementary teachers of mathematics in inclusion classrooms. Using a case-based approach which incorporates video of actual classroom teachers and students and lesson study features (Lewis, 2000), this project is now midway through its fourth year in a four year funding cycle. Ten multi-media case studies are the focus of a five-part workshop series that also includes the presentation of a neuro-developmental framework (to guide teachers in their observation and description of individual students), a process for analyzing mathematical "demands" of particular lessons, and collaborative lesson development with an emphasis on the identification of instructional strategies, accommodations, and modifications for students. The project was developed for general and special education teachers in K-5 classrooms.

The question which framed the research is: In what ways does the Math for All case-based professional development impact teachers' understanding of inclusion students and teachers' ability to adapt math lessons to meet the needs of the range of students found in their classrooms?

2. **Perspective(s) or theoretical framework**

The new math standards and the related high stakes tests present enormous challenges for teachers. For teachers of inclusion classrooms, the challenges are even greater; teachers must address an even broader range of learning needs. Inclusion research has identified how important it is to help students with disabilities by analyzing their needs and strengths, using a variety of instructional strategies, and learning how to adapt curricula and design effective lessons, among other critical activities (see Giangreco, Cloninger, & Iverson, 1998; Karp, 2000; Mastropieri & Scruggs, 1992; Wade & Zone, 2000). The challenge has been to bring this knowledge to teachers in ways that help them grow professionally.

Various approaches have been tried over time to help teachers develop critical competencies for inclusion teaching. Often, however, professional development offerings reflect behaviorist approaches to learning, and emphasize subject matter learning that is not necessarily related to teachers' classroom experiences (Putnam & Borko, 2000). Findings from cognitive science have begun to inform ways we work with students. Gradually, some of this same knowledge about learning is beginning to influence the way we work with teachers. For instance, it is clear that all learners – teachers included – *construct* their knowledge. Situating and "anchoring" the learning for teachers by linking the discussion and interactions with authentic classroom activities is emerging as a more powerful model for teacher learning: it provides the opportunity for teachers to build their own knowledge in the context of their own classroom (Brown, Collins, & Duguid, 1989; Kinzer & Risko, 1998; Wilson, 1995).

The case study method provides teachers with a method of studying someone else's teaching as a means of reflecting on their own practice. Multi-media case activities are particularly well suited to providing situated and anchored instruction. Neelam (2006) claims that a cognitive apprenticeship model aligns with the use of multimedia cases because “instructors and teachers share visual images, sustained video clips of practice, and relate these to readings and educational theory” while the group explores effective decision-making and classroom interventions (p. 4-5). A number of research studies that have been conducted with case materials attest to the effectiveness of the case method in achieving various learning goals (see Schifter et al., 1999).

Of the existing research on multimedia case materials, however, searches of the literature have not identified similar multimedia programs to help teachers learn about *inclusion practices*. Little is known about how to design and use multimedia case study materials to help teachers develop the specific skills and understandings to better support students with diverse abilities and disabilities -- skills such as how to observe individual students and analyze their needs and strengths, how to make decisions about instructional resources and strategies, and how to adapt existing curricula. The project being discussed in this paper and associated case study materials under development are addressing these questions.

Project Description

In the first two years of the project, a core group of math faculty at Bank Street College and key individuals from the Center for Children and Technology at the Educational Development Center developed a series of ten video case studies that would be the centerpiece of the pre-service and professional development effort for the Math for All Project (Moeller, Dubitsky, Meier, & Kantrov, 2006). The development of the videos and trial use of completed videos in the faculty’s own pre-service classes engaged faculty in active reflection of their beliefs and practice as they identified the key elements of the Math for All project for broader dissemination (Meier, 2005).

In addition, in these early stages of program development, additional qualitative input was collected in the form of outside expert reviews of the material (national experts in math and special education), faculty reflection papers reporting on their own teaching experiences as they used the materials in graduate classes, workshop observations, meeting notes, and focus group sessions conducted with teachers and math coaches in one of the districts piloting the material.

In the third year, project staff finalized pilot versions of a workshop series for professional development purposes, identified two pilot sites and initiated a first round of workshops (Moeller et al., 2006). On the basis of feedback received from the initial pilot teachers, the workshops were revised to include more time for collaboration with school-based teacher teams.

This year, field tests were established and the revised workshops were delivered a second time with a different set of teachers from the initial two pilot sites. Two additional field test sites were added. The primary task this year was to refine the professional development as Math for All directors began to plan for scaling up the innovation for dissemination to a broader audience around the country. The five day-long workshops were revised to spend more time on understanding the needs of special needs students, using Mel Levine's (2002) neuro-developmental framework (attention, memory, language, neuro-motor function, temporal-sequential ordering, spatial ordering, higher order cognition, and social cognition), hands-on exploration of math activities, video-viewing and analysis, small and large group discussions, lesson planning, and collaborative planning in multidisciplinary teams. Two key changes made with the field tests were to establish a consistent structure between all the workshops (to make it easier for other facilitators to run the sessions) and to put more emphasis on analyzing accommodations and interventions, which also involved analyzing the video to understand the teaching practices used in the videos.

The five days of workshop activities carefully introduced and reinforced a number of key elements. The elements were, first, a close examination of video case studies as a common framework for group exploration of inclusion concerns and teacher techniques; second, use of Mel Levine's neuro-developmental framework (2002) as a means of helping teachers better identify their students' strengths and weaknesses; third, a process for "deconstructing" the math involved in a particular lesson to help teachers look closely at the "demands of the mathematical tasks and understand the goals of the case lessons;" and fourth, collaboration with fellow teachers, math coaches and specialists to discuss strengths and weaknesses of particular students with the goal of better meeting the math needs of individual students.

The results of the second round of workshops in the original two pilot sites are examined in the research presented in this paper.

3. Methods, techniques, or modes of inquiry

Throughout the design, development and piloting of the case study materials and the professional development sessions, both quantitative and qualitative approaches were used to understand the creation and impact of this intervention. This current research on the professional development effort also encompasses both approaches and thus utilizes a mixed method approach to address the overall research question about the immediate effect of the workshops.

To understand and measure the impact of the professional development delivered in the four pilot sites, data was gathered in pre-post workshop questionnaires, as well as pre and post workshop assessment "tasks" related to inclusion teaching. In addition, data was gathered in the form of interviews with key program personnel, and observations of project meetings. One entire workshop series was observed in one of the three pilot sites discussed in this research, and all related documents were analyzed to triangulate the data.

The qualitative data was analyzed in three stages following Miles and Huberman's classic Sourcebook on Qualitative Data Analysis (1994): data reduction to identify themes, data display to organize the themes, and conclusion drawing and verification by identifying patterns, configurations and propositions (p. 10).

The pre-post questionnaire data was analyzed using the Statistical Package for the Social Sciences (SPSS). A paired sample t-test was used to compare pre-post means and identify questions on which teachers showed change that was statistically significant.

This paper focuses on the most recent stage of the research: findings from the professional development delivered to field test groups of teachers. Four field test groups have been established and professional development has been delivered to three, and is in the process of being delivered to the fourth. Complete data is available from only three of the sites at this time and thus research presented focuses on the quantitative analysis of the questionnaire data from these three sites.

4. Data sources or evidence

Primary data sources for this research include the program developers themselves (who are largely math education faculty at a teacher education college), elementary classroom teachers who teach math in inclusion classrooms, special education teachers, instructional specialists, and others, such as coaches (see Chart 1).

Four pilot locations were identified on the basis of geographical distribution, variation in population demographics, and expressed interest by district-level or state-level administrators. One of the districts is in a rural area in the Midwest; the second is a large Northeast urban district, the third, a predominantly rural school district in the Midwest, and the fourth is an affluent small town in the Northeast. This geographically distributed convenience sample reflected district interest in the Math for All material. The number of teachers trained in each site is represented in the "N" column.

Chart 1. Regional Descriptive Data: Matched Pre-Post Pairs

Site	N	State	Region	SES
1	39	Midwest	Rural	Middle Class
2	11	Northeast	Urban	Lower Middle
3	19	Southeast	Predominantly Rural	Lower Middle
4*	---	Northeast	Suburban	Upper Middle

*Data from the fourth site is just being tabulated

Descriptive information about personnel from three of the four sites is presented below in Chart 2. The chart shows the range of personnel and the grades represented. The analysis and findings are based on data from the first two sites. Post-questionnaire data is in the process of being gathered on the third site. The workshops are still ongoing in the fourth site.

Chart 2. Positions and Grades of Participants

Site	Position (%)						Grades (%)					
	Gen	SpEd	Aide	Coach	Spec	Other	Pk-2	3-6	Pk-6	7-12	K-12	Other
1	33.3	28.2	33.3	2.6	0.0	2.6	41.0	5.1	48.7	0.0	2.6	2.6
2	18.2	36.4	0.0	27.3	9.1	9.1	50.0	0.0	30.0	0.0	20.0	0.0
3	36.8	26.3	0.0	10.5	5.3	21.1	5.3	47.4	15.8	5.3	26.3	0.0
4	---	---	---	---	---	---	---	---	---	---	---	---

*Data from the fourth site is just being tabulated

Key
Gen = General Education Teacher
SpEd = Special Education Teacher
Aide = Instructional Aide
Coach = Math Coach
Spec = Instructional Support Specialist
Other

5. **Results and/or conclusions/point of view**

The findings from both the qualitative and quantitative data indicated that teachers have been positively affected by the Math for All workshop series. Because the emphasis of this paper is on the quantitative data, the results below will focus on these findings.

Two sets of questions formed the heart of the questionnaire that was filled out, online, before and after the workshop. The first set of questions asked teachers how frequently they were *performing* a range of activities related to math inclusion. The second set of questions asked teachers how *comfortable* they were doing the same activities. These queries were loosely based on change principles such as those articulated by Hall and Hord (2001) who believe that new ideas embed themselves in a developmental way, and that for teachers, the use of new ideas and their concerns about the innovation are related. In other words, growing knowledge about an innovation gradually changes both the concerns teachers have about an intervention and their ability to use the ideas in their classroom.

There were significant differences in the pre-post questionnaires on several questions. (The complete findings are in Appendix 1.) First, overall, the teachers reported feeling better *prepared* to teach mathematics to students with disabilities ($t[66]=-9.117$, $p = .000$) after the workshop series. Second, overall, the teachers also reported feeling more *comfortable* teaching mathematics to students with disabilities ($t[65]=-6.104$, $p = .000$) after the workshops.

Of interest is the fact that there was a greater difference in the pre-questionnaire in the means between feeling "prepared" (M=2.97, SD=.83) and "comfortable" (M=3.21, *SD*=.92) than there was in the post-questionnaire (*M*=3.82, *SD*=.60; *M*=3.91, *SD*=.67, respectively). That is, teachers reported feeling more comfortable and more prepared in the post test, but also, the gap between the "comfort" and "preparedness" narrowed. The gap narrowed because the teachers indicated that they felt more prepared; the comfort level did not rise quite as much as the level of preparedness. Thus, although teachers still reported feeling slightly more "comfortable" than "prepared" in the post-questionnaire, the narrowing of the gap indicates that teachers' sense of preparedness grew more than their comfort through the workshop series.

The next series of questions asked teachers how often they engaged in the following activities when planning their math lessons:

- Explore the mathematical tasks hands-on
- Analyze the demands of the task
- Consider the learning goals of the lesson
- Think about how the math of the lesson connects to the math students have studied in the past and will study in the future
- Think about individual students' strengths and needs
- Collaborate with colleagues in planning the lessons
- Consult with specialists
- Use the Internet to find information and resources
- Select a variety of instructional strategies and materials to support students with diverse strengths and needs
- Write lesson plans

Of all these, there was a significant difference in the pre-post questionnaires in only two questions: considering the learning goals of the lesson, and using the Internet to find information and resources. Considering the learning goals of the lesson was a critical aspect of the Math for All training. For instance, one of the techniques Math for All used to help teachers deconstruct their lesson planning was an "Accessible Lesson Planning Chart" (see Appendix 2) to help teachers incorporate specific math standards by identifying a learning area (Levine (2002) and assessing the demands of a particular activity. In each workshop session, teachers were asked to analyze the goals of the case lesson and to state how this goal related to what students learned before and what they will learn in the future. Teachers were then asked to go through this same process for lessons they were planning for their own classrooms. It would appear that, as a result of this activity and others, the teachers reported in the post-questionnaire that they were thinking more about the learning goals of the lesson, to a significantly greater degree. The significant difference in use of the Internet seemed to be a byproduct of more inquiry and exploration of math resources in general and perhaps, a search for alternative instructional material.

When asked how comfortable they were about the same set of activities though, there was a significant difference in seven of the items:

- Exploring the mathematical task hands-on
- Analyzing the demands of the mathematical tasks

- Consider the learning goals of the lesson
- Thinking about how the math of the lesson connects to the math that students have studied in the past and will study in the future
- Thinking about individual students' strengths and needs
- Selecting a variety of instructional strategies and materials to support students with diverse strengths and needs
- Writing lesson plans

The fact that there was a significant change in the comfort level relating to seven activities after the workshop series is a strong statement about the success of the workshop in familiarizing the teachers with critical concepts related to Math for All.

There was one item in both lists in which teachers reported a significant difference in the post questionnaire in both their comfort and in their planning: "consider the learning goals of the lesson" – a key goal of the workshop series. Lesson planning is central to many other changes and the fact that teachers felt more comfortable and better prepared to think more about the learning goals is an important finding.

Taken overall though, initially, these findings may seem counter-intuitive. How is it that these teachers report feeling significantly more comfortable about the range of activities listed above, but report a significant difference in teacher practices only when they "consider the learning goals of the lesson" when planning their math lessons?

We interpret these findings in the context of a developmental approach to incorporating innovations. Getting used to new ideas – creating awareness and understanding of specific aspects of the Math for All -- such as Mel Levine's developmental framework for understanding different dimensions of learning disabilities -- is one level of engagement with an innovation. Changing practice and actually incorporating these ideas into practice is a major step however, and takes time and support. After a five day workshop, it may not be realistic to expect practice to change to a significant degree. However, the fact that participants report significant changes in their comfort level with so many concepts bodes well for the future implementation of Math for All. It indicates that the teachers feel they have a better understanding, familiarity and comfort with several key aspects of the project.

Thus, based on this questionnaire data reported for these two pilot sites, it would appear that the Math For All workshops are successful in creating more understanding and greater comfort with teachers around key approaches to inclusion teaching in mathematics

6. Educational or scientific importance of the study

Both for teachers with little or no teaching experience and for those with many years experience working with students with disabilities, the prospect of teaching or preparing teachers to teach mathematics in inclusion classrooms is daunting. Earlier focus group research with this project found that teachers do not feel prepared to assess the strengths and weaknesses of a range of students, and they do not feel fluent enough with the math content itself at different grade levels to modify specific activities to accommodate a range of learners.

While prior research has identified the key competencies that teachers need to teach successfully in inclusion classroom, the professional development available for teachers who are asked to meet the needs of a range of students is limited. This unique, multimedia project was developed to help teachers learn about the strengths as well as the needs of inclusion students and to help teachers identify instructional strategies in mathematics that can address a range of student abilities. The research presented above shows that teachers are receptive to this information and that the project succeeds in creating new understandings of inclusion students and strategies.

If policymakers and the public are genuinely committed to inclusion classrooms, better preparation and support for the teachers in these settings is needed. The emerging research from this NSF project provides significant data for those interested in using case-based materials to help elementary teachers build a deeper knowledge base that will help all students achieve a high quality education in mathematics.

Appendix 1

Math for All
Pre/Post Comparison of Sites 1, 2 and 3
Results of Paired-Samples t-Test

Question		N (pairs)	Pre-Q Mean	Pre-Q SD	Post-Q Avg	Post-Q SD	df	t	p
Q12/Q4 How well prepared do you feel to teach mathematics to students with disabilities?		67	2.97	.83	3.82	.60	66	-9.117	.000***
Q13/Q5 How comfortable to you feel with teaching mathematics to students with disabilities?		66	3.21	.92	3.91	.67	65	-6.104	.000***
When you are planning your math lessons, how often do you do the following?	Q16a/Q9a Explore the mathematical tasks hands-on	64	3.66	1.19	3.70	.97	63	-.327	.745
	Q16b/Q9b Analyze the demands of the task	63	3.67	1.12	3.78	.89	62	-.829	.410
	Q16c/Q9c Consider the learning goals of the lesson	63	4.17	1.13	4.46	.88	62	-2.184	.033*
	Q16d/Q9d Think about how the math of the lesson connects to the math students have studied in the past and will study in the future	62	3.87	1.14	4.10	.92	61	-1.627	.109
	Q16e/Q9e Think about individual student's strengths and needs	62	4.02	1.05	4.19	.87	61	-1.197	.236
	Q16f/Q9f Collaborate with colleagues in planning the lessons	64	3.28	1.12	3.23	.87	63	.323	.748
	Q16g/Q9g Consult with specialists	62	3.13	1.11	3.10	.88	61	.237	.813
	Q16h/Q9h Use the Internet to find information and resources	63	2.76	1.03	3.10	.96	62	-2.784	.007**
	Q16i/Q9i Select a variety of instructional strategies and materials to support	64	3.81	1.11	4.00	.87	63	-1.317	.193

	students with diverse strengths and needs								
	Q16j/Q9j Write lesson plans	64	3.64	1.36	3.75	1.27	63	-.961	.340
How comfortable are you with the following aspects of planning mathematics lessons?	**Q17a/Q10a Exploring the mathematical task hands-on**	62	3.74	1.17	4.19	.94	61	-3.199	.002**
	Q17b/Q10b Analyzing the demands of the mathematical tasks	63	3.35	1.11	3.89	.86	62	-4.163	.000***
	Q17c/Q10c Considering the learning goals of the lesson	63	3.68	1.06	4.27	.87	62	-4.410	.000***
	Q17d/Q10d Thinking about how the math of the lesson connects to the math students have studied in the past and will study in the future	63	3.59	1.17	3.94	.93	62	-2.179	.033*
	Q17e/Q10e Thinking about individual student's strengths and needs	61	3.82	1.09	4.18	.83	60	-2.438	.018*
	Q17f/Q10f Collaborate with colleagues in planning the lessons	63	3.67	1.19	3.95	.99	62	-1.611	.112
	Q17g/Q10g Consulting with specialists	63	3.73	1.22	3.94	1.09	62	-1.147	.256
	Q17h/Q10h Using the Internet to find information and resources	63	3.33	1.18	3.63	1.17	62	-2.491	.015*
	Q17i/Q10i Selecting a variety of instructional strategies and materials to support students with diverse strengths and needs	62	3.66	1.14	4.21	.83	61	-3.786	.000***
	Q17j/Q10j Writing lesson plans	62	3.60	1.26	4.03	1.10	61	-3.316	.002**

$^{*}p < 0.05$ $^{**}p < .01$ $^{***}p < .001$

Appendix 2

Accessible Lesson Planning Chart: Supporting Higher Order Thinking

Your Name: ______________________________ **Focal Student(s):** ______________________

Name of Activity or Lesson Explored: ____

Learning Areas (derived from Levine, 2002)	What are the demands of the activity or lesson?	Focal Student(s)' Strengths and Weaknesses	Interventions and accommodations that will make the activity or lesson more accessible.
Higher Order Thinking • ***Thinking with concepts*** (A concept may be abstract, concrete, a process, verbal or non-verbal.)	Pattern recognition (knowing shapes and names) Sorting into two groups	Kept saying guess my rule 8 times—had the concept of rule, and attributes Guessed partner's rule based on color Never mentioned shape names referred to circle as "box"	Clarify that objects either fit the rule or do not fit the rule. Use fewer attributes. Limited number of attribute blocks.
• ***Problem Solving*** (Involves knowing it's a problem, previewing outcomes, assessing feasibility, mobilizing resources, logical thinking, strategies, starting and pacing, self-monitoring, dealing with impasses, and reflecting.)	Challenging one's partner (thinking about what the partner knows e.g. "not" rule) and oneself	Was not able to guess his partner's first 2-attribute rule. Didn't re-evaluate when he made an incorrect guess.	Use think aloud to model rule making and how it changes based on evidence.
• ***Critical Thinking*** (Involves knowing: the facts, the creator's point of view, your point of view, errors and exaggerations and getting outside help, weighing the evidence, communicating.)	What breaks a rule and what doesn't; considering evidence Challenging one's partner (thinking about what the partner knows e.g. "not" rule) and oneself Knowing how partner is feeling	Gave clues to the partner (e.g., in a frame, it's an animal). Didn't re-evaluate when he made an incorrect guess.	Find misconceptions.

• ***Rule-Guided Thinking*** (If… then kinds of thinking)	What breaks a rule and what doesn't; considering evidence Shifting gears/revising rules Generalizing	Guessed partner's rule based on color Was not able to guess his partner's first 2 attribute rule Could make rules of things he could do to the blocks but not a rule using the attributes of the shapes themselves. Made two different rules not "rule" and "not rule" Didn't re-evaluate when he made an incorrect guess.	Use visual chart to break down what different rules might look like. Use think aloud to model rule making and how it changes based on evidence.
• ***Creative Thinking*** (Involves divergent thinking, taking a fresh look, suspension of self-evaluation, and risk taking.)	Challenging one's partner (thinking about what the partner knows e.g. "not" rule) and oneself	He changed the rules; created his on game rules. Used standing up/laying down as an attribute. Animals--made it hard for partner to guess.	

Other Learning Areas: (derived from Levine, 2002)	**What are the demands of the activity or lesson?**	**Focal Student(s)' Strengths and Weaknesses**	**Interventions and accommodations that make will make the activity or lesson more accessible.**
Language • understanding mathematical language • using language to communicate with others and to clarify one's ideas			
Spatial Ordering • interpreting relationships within and between spatial patterns • organizing things in space • reasoning with images			
Sequential Ordering • organizing information in sequence • following directions • managing time			
Memory • short-term memory • active working memory • long-term memory			
Attention • controlling mental energy • maintaining focus • self-monitoring		Self monitoring?	

Psycho-Social • using and understanding social language • collaboration • conflict resolution			
Motor Coordination • gross motor functions • fine motor functions • grapho-motor functions			

References

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Giangreco, M. F., Cloninger, C., & Iverson, V. S. (1998). *Choosing outcomes and accomodations for children: A guide for educational planning for students with disabilities* (2nd ed.). Baltimore: Paul H. Brooks.

Hall, G., & Hord, S. (2001). *Implementing change: Patterns, principles, and potholes*. Boston: Allyn and Bacon.

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.

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.

Levine, M. (2002). *A mind at a time*. New York City: Simon & Schuster.

Lewis, C. C. (2000). *Lesson study: The core of Japanese professional development.* Paper presented at the American Educational Research Association, New Orleans, LA.

Mastropieri, M. A., & Scruggs, T. E. (1992). Science for students with disabilities. *Review of Educational Research, 62*, 377-411.

Meier, E. (2005). *Setting the Stage for Reflective Practice: Faculty Development of Multimedia Case Studies* Paper presented at the Society for Information Technology. Phoenix, AR

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks: Sage.

Moeller, B., Dubitsky, B., Meier, E., & Kantrov, I. (2006). *Designing and using video case studies for professional development on inclusion in elementary mathematics classroom*. Paper presented at the American Education Research Association.

National Center for Educational Statistics. (1999). *Teacher quality: A report on the preparation and qualifications of public school teachers*. Washington, D.C.: U.S. Department of Education.

NCLB, 1425 (2001).

Neelam, P. (2006). Examining the efficacy of multimedia case innovations. Center for Technology & School Change, Teachers College, Columbia University.

Putnam, R., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning. *Educational Researcher, 29*(1), 4-15.

Schifter, B., Bastable, V., Russell, S. J., Yaffee, L., Lester, J. B., & Cohen, S. (1999). *Developing mathematical ideas: Making meaning for operations (Casebook)*. Parsippany, NJ: Dale Seymour Publications.

Wade, S. E., & Zone, J. (2000). Creating inclusive classrooms: an overview. In S. E. Wade (Ed.), *Inclusive education*. Mahwah, NJ: Lawrence Erlbaum Associates.

Wilson, B. (1995). *Situated instructional design: Blurring the distinctions between theory and practice, design and implementation, curriculum and instruction.*