Journal of Mathematics Education at Teachers College

Spring – Summer 2011

A Century of Leadership in Mathematics and its Teaching

TABLE OF CONTENTS

Foreword

Preface

Editorial Point-Counterpoint

Articles

TABLE OF CONTENTS

The *Journal of Mathematics Education at Teachers College* is a publication of the Program in Mathematics and Education at Teachers College Columbia University in the City of New York.

This issue honors Clifford B Upton who was a senior member of the Teachers College faculty from 1907 until his retirement in 1942. Professor Upton was among the Nation's most prolific mathematics authors. He served on the Board of Directors of the American Book Company enabling him to endow the Clifford Brewster Chair of Mathematics Education. The first professor to hold the Upton Chair was Dr. Myron Rosskopf.

Bruce R. Vogeli has completed 47 years as a member of the faculty of the Program in Mathematics, forty-five as a Full Professor. He assumed the Clifford Brewster Chair in 1975 upon the death of Myron Rosskopf. Like Professor Upton, Dr. Vogeli is a prolific author who has written, co-authored or edited more than two hundred texts and reference books, many of which have been translated into other languages.

This issue's cover and those of future issues will honor past and current contributors to the Teachers College Program in Mathematics. Photographs are drawn from the Teachers College archives and personal collections.

Aims and Scope

The *JMETC* is a re-creation of an earlier publication by the Teachers College Columbia University Program in Mathematics. As a peer-reviewed, semi-annual journal, it is intended to provide dissemination opportunities for writers of practice-based or research contributions to the general field of mathematics education. Each issue of the *JMETC* will focus upon an educational theme. The theme planned for the 2011 Fall-Winter issue is: *Technology.*

JMETC readers are educators from pre K-12 through college and university levels, and from many different disciplines and job positions—teachers, principals, superintendents, professors of education, and other leaders in education. Articles to appear in the *JMETC* include research reports, commentaries on practice, historical analyses and responses to issues and recommendations of professional interest.

Manuscript Submission

JMETC seeks conversational manuscripts (2,500-3,000 words in length) that are insightful and helpful to mathematics educators. Articles should contain fresh information, possibly research-based, that gives practical guidance readers can use to improve practice. Examples from classroom experience are encouraged. Articles must not have been accepted for publication elsewhere. To keep the submission and review process as efficient as possible, all manuscripts may be submitted electronically at www.tc.edu/jmetc.

Abstract and keywords. All manuscripts must include an abstract with keywords. Abstracts describing the essence of the manuscript should not exceed 150 words. Authors should select keywords from the menu on the manuscript submission system so that readers can search for the article after it is published. All inquiries and materials should be submitted to Ms. Krystle Hecker at P.O. Box 210, Teachers College Columbia University, 525 W. 120th St., New York, NY 10027 or at JMETC@tc.columbia.edu

Copyrights and Permissions

Library of Congress Cataloging-in-Publication Data

Journal of mathematics education at Teachers College
p. cm.
Includes bibliographical references.
ISSN 2156-1397
EISSN 2156-1400
1. Mathematics—Study and teaching—United States—Periodicals
QA11.A1 J963

More Information is available online: www.tc.edu/jmetc

Journal of Mathematics Education at Teachers College

Call for Papers

The "theme" of the fall issue of the *Journal of Mathematics Education at Teachers College* will be *Technology*. This "call for papers" is an invitation to mathematics education professionals, especially Teachers College students, alumni and friends, to submit articles of approximately 2500-3000 words describing research, experiments, projects, innovations, or practices related to technology in mathematics education. Articles should be submitted to Ms. Krystle Hecker at JMETC@tc.columbia.edu by September 1, 2011. The fall issue's guest editor, Ms. Diane Murray, will send contributed articles to editorial panels for "blind review." Reviews will be completed by October 1, 2011, and final drafts of selected papers are to be submitted by November 1, 2011. Publication is expected in late November, 2011.

Call for Volunteers

This *Call for Volunteers* is an invitation to mathematics educators with experience in reading/writing professional papers to join the editorial/review panels for the fall 2011 and subsequent issues of *JMETC*. Reviewers are expected to complete assigned reviews no later than 3 weeks from receipt of the manuscripts in order to expedite the publication process. Reviewers are responsible for editorial suggestions, fact and citations review, and identification of similar works that may be helpful to contributors whose submissions seem appropriate for publication. Neither authors' nor reviewers' names and affiliations will be shared; however, editors'/reviewers' comments may be sent to contributors of manuscripts to guide further submissions without identifying the editor/reviewer.

If you wish to be considered for review assignments, please request a *Reviewer Information Form*. Return the completed form to Ms. Krystle Hecker at hecker@tc.edu or Teachers College Columbia University, 525 W 120th St., Box 210, New York, NY 10027.

Looking Ahead

Anticipated themes for future issues are:

Fall 2011	Technology
Spring 2012	Evaluation
Fall 2012	Equity
Spring 2013	Leadership
Fall 2013	Modeling
Spring 2014	Teaching Aids

TO OBTAIN COPIES OF *JMETC*

To obtain additional copies of *JMETC*, please visit the *Journal*'s website www.tc.edu/jmetc. The cost per copy delivered nationally by first class mail is $5.00. Payment should be sent by check to *JMETC*, Teachers College Columbia University, 525 W 120th St., Box 210, New York, NY 10027.

Journal of Mathematics Education at Teachers College
Spring–Summer 2011, Volume 2

From Curriculum Guides to Classroom Enactment: Examining Early Career Elementary Teachers' Orientations Toward Standards-Based Mathematics Curriculum Implementation

Joan Gujarati
Manhattanville College

This article examines three early career elementary teachers' orientations toward standards-based mathematics curriculum implementation in New York City public schools. It is important to have a greater understanding of teachers who are responsible for enacting standards-based curriculum in authentic teaching situations in order to learn more about what may facilitate or hinder student learning. Findings from this study reveal that all three teachers had varied orientations toward mathematics curriculum implementation due to their particular school contexts, expectations from their respective school administrators, and their personal beliefs about mathematics teaching and learning. Implications from this study include the need for school administrators to allow teachers greater flexibility and autonomy to tailor their district's formal curriculum to greater suit their classroom needs, which could potentially lead to higher student mathematics achievement.

Introduction

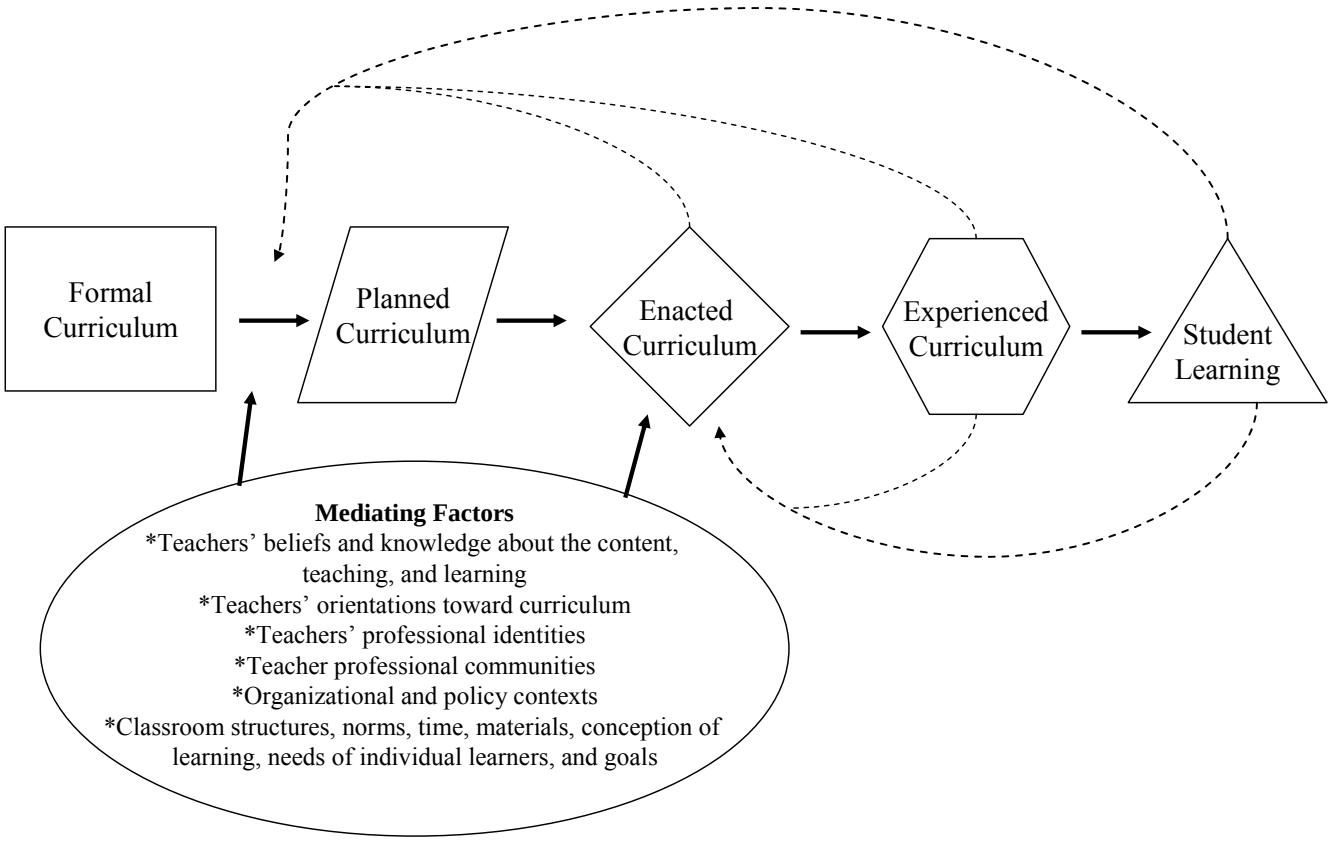
The publication of the *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989) marked a historically important first step by a professional organization toward articulating extensive goals for teachers and policymakers in a school discipline in the United States. It sparked the contemporary mathematics reform movement where mathematics began to shift from a traditional orientation that focuses on skill efficiency and fixed answers to a constructivist nature that emphasizes process and doing. This shift resulted in the development of standards-based mathematics curricula [e.g., *Everyday Mathematics* (UCSMP, 2007) and *Investigations in Number, Data, and Space* (TERC, 2008)] which have permeated many school systems and have altered the approach to teaching mathematics in many classrooms across the United States; the results are heightened expectations for teachers. Teachers are now expected to model problem-solving, explore real-world mathematical contexts, value multiple solution strategies, and give students the time to create, discuss, hypothesize, and investigate (Frykholm, 2004).

Having high standards and high-quality curriculum are certainly important to foster high achievement among our nation's students, but no curriculum teaches itself, and standards do not operate independently of professionals' interpretations of them (Ball, Hill, & Bass, 2005; Tobin & Dawson, 1992). Research on curriculum and teaching has revealed that a substantial difference exists between the curriculum as represented in instructional materials and the curriculum as enacted in the classroom by teachers and students (Remillard & Bryans, 2004; Stein, Remillard, & Smith, 2007; Zumwalt, 2004). The influence of curriculum materials on student learning is not straightforward and cannot be understood without examining the curriculum as designed by teachers and enacted in the classroom (Figure 1). The relationship between the formal, planned, and enacted curriculum has been neglected in most studies of how curriculum influences student learning (Stein, Remillard, & Smith, 2007). However, it is an important relationship to study because it challenges the assumption that curriculum materials tend to be enacted uniformly across teachers, schools, and districts. But even a uniform curriculum does not ensure uniformity of competence and understanding (Howson, Keitel, & Kilpatrick, 1981).

The purpose of this article is to examine three early career elementary teachers' orientations toward mathematics curriculum implementation in New York City public schools. In today's educational climate there is a strong focus on standards and curriculum, particularly as districts attempt to align to the recent Common Core State Standards. However, there is little attention paid to teachers and their practices (Ball, Hill, & Bass, 2005; Ferrini-Mundy & Floden, 2007; Tate & Rosseau, 2007). It is important to have a greater understanding of teachers who are responsible for implementing standards-based curricula in authentic teaching situations to learn more about what may facilitate or hinder student learning.

Orientations Toward Curriculum Implementation

Snyder, Bolin, and Zumwalt (1992) posit there exist three orientations toward curriculum implementation by teachers and schools: *fidelity perspective*, *mutual adaptation*, and *curriculum enactment*. These orientations manifest themselves in the classroom as a result of a myriad of factors, notably school expectations for curriculum use, teachers' beliefs about best practices in mathematics teaching, and teachers' comfort level with the



Note. Synthesized from Stein, Remillard, & Smith (2007) and Zumwalt (2004). Reproduced with permission from Gujarati, 2010.

Figure 1. Temporal phases of curriculum use

mathematics content. From a *fidelity perspective*, teachers view curriculum materials as a direct blueprint for instruction, a plan to be faithfully implemented. According to this view, material that appears on the written page of the formal curriculum is meant for faithful execution by teachers and students. Hence, there is an assumption that curriculum knowledge is primarily created outside of the classroom by experts who develop the curriculum and teachers are curriculum transmitters of this knowledge. In *mutual adaptation*, adjustments in curriculum are made by those who actually use the curriculum in classrooms or schools. This view suggests that complete fidelity of implementation is impossible because teachers will always bring their own frames of understanding and their knowledge of the local context to bear on how they use curricular materials. In mutual adaptation, teachers take a more active role than in the fidelity perspective because they adapt existing material and topics for their classrooms. From a *curriculum enactment* perspective, curriculum is viewed as the educational experiences jointly created by student and teacher. Here, teachers take the very active role of curriculum makers (Clandinin & Connelly, 1992) or creators. Teachers assess students' needs to derive curriculum themes. In addition, they improvise and develop their own pedagogic techniques. Teachers are considered decision makers rather than mere implementers. In this view, the process of enacted curriculum is one of continual growth for both teachers and students.

Methodology

This article stems from a larger study (Gujarati, 2010) which used a qualitative multicase studies design (Bogdan & Biklen, 2007) guided by portraiture (Lawrence-Lightfoot, 1983, 2005; Lawrence-Lightfoot & Davis, 1997). The research was conducted over a six-month period from January-June 2009.

Participants and School Sites

Three teachers in their second year of teaching second grade in New York City public schools were purposefully chosen from an initial pool of 20 potential participants. Each potential participant filled out a Participant Recruitment Questionnaire. I then selected the three

Table 1. Teachers' Profiles

	Andrea	Lisa	Melody
Age	26	25	36
Race/Ethnicity	White	Hispanic	White
Education	Bachelor's degree in foreign service; Master's degree in elementary education	Bachelor's degree in communications and media studies; Master's degree in literacy in progress	Bachelor's degree in English; Master's degree in elementary education
Route to teaching certification	Traditional (Graduate school)	Traditional (Undergraduate)	Career changer with traditional certification (Graduate school)
Years of teaching experience	Two	Two	Two
School site	Bridge Elementary	Grand Elementary	Cobblestone Elementary
Grade taught	Second	Second	Second
Class size	21	28	19
Mathematics curriculum utilized	Everyday Mathematics	Everyday Mathematics	Investigations in Number, Data, and Space

participants who I believed yielded the most diverse sample in terms of their beliefs about mathematics (their definitions of mathematics, personal feelings about the content area, and mathematics teaching goals), school context, age, and race/ethnicity. The teacher and school profiles are highlighted in Tables 1 and 2, respectively[1].

In taking a closer look at their education, each participant was only required to take one mathematics course as part of their respective teacher education programs. As an undergraduate, Lisa took a logic course to satisfy her mathematics requirement which she felt was of little value to her once she began teaching because it was a "bizarre course" since they did not do much mathematics in it. In her graduate program, she never mentioned having to take a mathematics methods course since literacy was her concentration. As an undergraduate, Andrea completed four semesters of mandatory economics which embedded some mathematics concepts while Melody had one mathematics requirement, a course for non-mathematics majors called "Excursions in Math." In their teacher education programs, Andrea and Melody each took one elementary mathematics methods course which was met with different reviews; Melody found hers of little value because all K-5 content was lumped together and covered quickly in one semester while it affected Andrea in positive ways as she began to see that she was not nearly as bad in mathematics as she had believed since childhood.

When asked to rank their favorite subjects to teach, Lisa ranked mathematics as her second favorite subject to teach behind writing. Andrea placed mathematics third behind social studies and read-alouds while Melody ranked mathematics fourth behind social studies, reading, and writing. Although all three participants reported that they did not feel as comfortable or confident teaching mathematics as other subjects, none of them dreaded teaching it or were particularly fearful of it.

Data Collection and Analysis

Data were obtained for each participant from the following sources: 1) A mathematics autobiography was written at the onset of the study to use as an initial assessment of the three participants' beliefs about mathematics teaching and learning based on their past experiences and influences; 2) Field notes from ten classroom observations in which the participants taught mathematics; 3) Ten debriefing conversations (unstructured interviews) followed the classroom observations in which each participant conversed with the researcher regarding her perception of the mathematics lesson. Participants were asked to clarify anything that was unclear during the mini-lessons and subsequent follow-up activities; 4) Three semi-structured interviews, each with a different focus on some aspect of teachers' mathematics beliefs, occurred at the beginning, middle, and end of the study; 5) Reflective journal entries were written by participants once a month throughout the study, focusing on something particularly salient related to the mathematics lessons which occurred during that month; and 6) School and classroom artifacts were collected (e.g., mathematics lesson plans, student work samples, a class schedule, and photographs of the classroom environment). Data analysis was an ongoing process. Data for this article were analyzed both manually

[1] Pseudonyms are used for all names in this study.

Table 2. School Profiles

	Bridge Elementary	Grand Elementary	Cobblestone Elementary
School Characteristics:			
Grade span	PreK-5	K-5	PreK-5
Student enrollment	284	1166	651
Recipient of Title I funds	Yes, 79% eligibility	Yes, 78% eligibility	No
Mathematics curriculum utilized	Everyday Mathematics	Everyday Mathematics	Investigations in Number, Data, and Space
Student Composition:			
African American	70%	14%	11%
Asian	1%	8%	7%
Hispanic	28%	70%	24%
White	1%	8%	58%

Note. Data are from the 2007-2008 Quality Review Reports (New York City Department of Education, 2008).

and through the use of qualitative software based on codes which stemmed from the orientations toward curriculum implementation and the process of curriculum implementation.

Findings

Although they all taught in New York City public schools, the three participants' orientations toward curriculum implementation varied based on their particular school contexts, expectations from their respective school administrators (i.e., principals and vice-principals), and personal beliefs.

Melody

Teachers at Cobblestone Elementary were expected to be wedded to the *Investigations in Number, Data, and Space* (*Investigations*) curriculum and follow it faithfully. Due to this administrative pressure, Melody exhibited a *fidelity perspective* although she was not entirely comfortable with this orientation. This comfort level was exemplified as she stated that she "feels a little restricted by what she is able to teach because we have been asked not to supplement" (Reflective Journal Entry, March 2009). Teachers were also asked not to skip or change the sequence of lessons. Melody's lessons were often dominated by mathematics games, which were fun and well received by her students, but were often "too easy" in her opinion. When asked why she could not skip some of those lessons and devote extra time to concepts she believed her students needed extra practice, such as mastery of basic addition, subtraction, and multiplication facts, or design lessons to greater challenge her students, she did not feel comfortable doing so because the school's expectation was that she follow the scope and sequence faithfully. It is as if she felt that she would get "in trouble" if she veered slightly off course.

Due to her school's expectation of faithfully adhering to *Investigations*, Melody constantly had the teacher manual on her lap or in close proximity at all times. In the midst of a lesson, she frequently glanced down at the manual to make sure to cover TERC's (the developers') "talking points." She appeared to revisit the manual most often during the discussion portion of each lesson. This dependency left her frequently confused because she did not have the freedom to tailor the lessons or change the course of a lesson to greater suit her comfort level in presenting the content and the needs of her students. Often these discussions seemed forced/stilted as if she was making sure to steer the conversations in a direction that covered what the guide expected of her rather than responding to what was happening in her classroom. Melody commented on the role the curriculum guide played in her lesson planning and implementation:

> I try to follow it carefully since that is what we've been asked to do. I read the lessons over a bunch of times and still am kind of confused often by how I am supposed to present the material and also by the sequence of lessons. Some of the lessons ask the kids to do many things in a short time. Some of the lessons don't build on the lesson that came before. The first few units were extremely repetitive. I find myself often a little confused about what this curriculum is asking me and the kids to do (Reflective Journal Entry, March 2009).

Throughout the study, Melody mentioned that she learned more about constructivist curriculum because of her adherence to *Investigations* and came to see it strengths. But, she also found the curriculum to be "too constructivist at times" and not as explicit; she would have preferred "a greater balance" between the two (Interview 2, April 2009).

Andrea

Andrea exhibited *mutual adaptation*. She was expected to utilize the *Everyday Mathematics (EM)* curriculum, keep pace with the scope and sequence as best she could, and give all assessments associated with *EM*. However, she had freedom to tailor lessons with her student population in mind as she was allowed to supplement and skip or add additional lessons to meet her students' needs. She did not have to adhere to the curriculum as faithfully as Melody did. For example, on at least two occasions that I observed, Andrea scrapped her original plans and re-taught certain concepts (e.g., subtraction with regrouping and fractions) because her students were struggling. The needs of her students seemed to dictate the pacing of her lessons more so than the curriculum pacing guide. Andrea commented on her relationship to the *EM* curriculum:

> Last year I felt like I had to do every part and then I realized that it was just impossible. So we teach like there's the main lesson and there's the independent work so we'll always do the main lesson and then independent work and then if we think the independent work is too hard we'll use like there's the readiness and then there's the enrichment we'll use those two options if we think we need to. There have been times when I do not like the way they teach the lesson at all. So sometimes I'll provide a little bit more scaffolding than the curriculum provides. There have been times when I've just looked up a new lesson online and not used the Everyday Math lesson at all to get the same concepts. Like Ball Park Estimates. I really hated the way Everyday Math taught that so I got some different ideas from different websites on what to do (Interview 2, April 2009).

Based on the aforementioned quote, Andrea appeared to adopt more of a fidelity perspective in her first year of teaching. However, realizing that it was impossible to do every lesson as written, she addressed major skills and concepts from *EM* but adapted the lessons to greater meet her students' needs in this second year. Of the three participants, Andrea was probably the most in favor of the curriculum she utilized as long as she could supplement. She commented on her views of *EM*:

> I think that as long as you approach it with the thought that you don't have to follow it to the letter and that you should adjust it as necessary for your class then I think it's great because it definitely teaches them important math skills (Interview 2, April 2009).

Lisa

Lisa's orientation toward curriculum implementation was between *a mutual adaptation* and *curriculum enactment perspective*. In approximately half the lessons I observed, she utilized *EM* but supplemented with her own materials and resources, or tailored the lessons to greater meet her students' needs. In the other half, she created lessons from scratch to address a main concept in *EM* but did not utilize their format, materials, or approach as she did not particularly care for *EM*; she felt that it "bounced around" too much and did not stay with one concept long enough.

At Grand Elementary, although *EM* was the school's primary curriculum and teachers were expected to follow it and give all related assessments, "it is not a bible" (Interview 3, June 2009). Teachers had freedom to supplement from additional resources to meet the New York State Standards. It was the state standards, and not a prescribed program, which guided their practices, and Lisa noted that message was conveyed to the teachers. Grand Elementary consistently fell short on the Problem-Solving Strand, and, therefore, a primary goal was to include extra activities to strengthen problem-solving skills. To address this goal, in addition to her formal 45 minute daily mathematics lesson, she began every morning with an additional, more informal, half-hour "Morning Math" which focused on word and other problems which she created from scratch.

Lisa admitted that she rarely looked at the teacher's manual because she was familiar enough with the content and comfortable enough with it that she used *EM* as a guide, but made the lessons her own. Of the three teachers, Lisa probably put the most of herself into her lessons by finding resources to assist her in teaching the concepts or teaching students some strategies, notably visual strategies, which she learned as a child which greatly helped her to succeed in mathematics. She felt strongly about passing on strategies which helped her in her formative years to a new generation of students.

Discussion

This study examines three early career elementary teachers' orientations toward mathematics curriculum implementation in New York City public schools. It appears that even within the same school district, different messages are being conveyed to teachers about how to approach curriculum. These varied orientations can have advantages and disadvantages for early career teachers. From this study, it appears as if being asked to adopt a

fidelity perspective can be a double-edged sword. On one hand, if a teacher is not as secure in her vision for what mathematics should be like in the classroom, as Melody mentioned during the course of the study, then having a curriculum with all the materials seemingly laid out might seem like an appropriate route. Additionally, it would take some pressure off the teacher of having to supplement or find additional resources, particularly early career teachers who are still acclimating to all their other responsibilities in this profession. Furthermore, it might also expose a teacher to a curriculum she might not otherwise be exposed to. In Melody's case, the exposure to *Investigations* and its philosophy shaped her beliefs about mathematics toward a seemingly more constructivist perspective from her initial, more traditional, bent at the onset of the study.

On the other hand, following a curriculum almost blindly which a teacher does not always believe in could be problematic as it could lead to greater confusion in mathematics teaching as Melody experienced. Meeting student needs could pose more challenging if a teacher is not free to utilize additional resources (Remillard & Bryans, 2004). Of the three participants, Melody felt the most constrained by her school context as she was unable to supplement with additional resources or change the direction of a lesson as she mentioned she would have preferred.

One advantage of being able to take a *mutual adaptation* approach or *curriculum enactment* perspective seems to give teachers more flexibility and autonomy in meeting students' needs, with the latter giving the greatest flexibility and autonomy as those needs are the driving force behind creating the lessons. Although mathematics was a lower priority than English Language Arts and, thus, they did not receive the support from the administration or mathematics coaches that they may have wanted in their schools, Andrea and Lisa had greater freedom to teach mathematics in their respective schools because they were able to supplement with different resources to address student needs, with Lisa appearing to have the greatest freedom as she was driven more by the New York State Standards than the prescribed curriculum. Accordingly, they were much less dependent on the curriculum manual. Both Lisa and Andrea were able to minimize some of their confusion of teaching mathematics by looking for additional resources they believed would be better suited to teach certain lessons for their particular students, and which would be more comfortable for them. Those quests allowed them to take greater ownership of the lessons because they were active participants in designing them instead of implementing something almost blindly.

One of the disadvantages of curriculum enactment, and to a lesser extent mutual adaptation, is that it can turn a district's formal curriculum into something vastly different than intended as teachers can frequently supplement, skip lessons or create new lessons altogether. Therefore, there exists the potential for less curricular unity in schools and districts. In this study, however, because both Lisa and Andrea were expected to give all assessments associated with *EM*, they did not stray completely from the formal curriculum; they just approached the content in a different manner at times.

From this study, it also appears that the mutual adaptation and curriculum enactment orientations might be more tailored for certain types of teachers as well. Due to the more active role in those orientations, with teachers needing to take the most active role with the curriculum enactment perspective, teachers need to be willing to often take greater risks and put a lot more of themselves personally into the curriculum. Melody appeared to take a more passive approach to the curriculum than either Andrea or Lisa by accepting the status quo at her school. She was accepting of the fidelity orientation although she did not necessarily believe in it as she had mentioned. Both Andrea and Lisa did not appear to be as passive in their attitudes toward curriculum implementation. Though beyond the scope of this study, it would be interesting to see how all three participants might fare in their respective schools should the expectations for curriculum implementation ever change in the future. A further examination of the impact of school culture on teachers' orientations toward curriculum implementation could be an important further line of inquiry.

Implications for Practice

Findings from this study about the orientations of three early career elementary teachers toward standards-based mathematics curriculum implementation have implications for practice. These findings suggest that school administrators need to allow teachers greater flexibility and autonomy to tailor their district's formal curriculum to greater suit their classroom needs and own personal styles of teaching. In this study, Melody appeared to be the most constrained by her school context because the clear message by school administrators was for teachers to be wedded to *Investigations* and follow it faithfully, essentially letting the publishers dictate the content and pace and not the classroom teachers. As such, she followed the scope and sequence although she often felt that many of her students were not being challenged enough by the content. However, she did not feel comfortable going against those expectations likely since she was an untenured second year teacher. Andrea and Lisa appeared to have greater freedom to make informed curricular choices. Although they used *EM*, they were allowed to address student needs through alternative resources, with Lisa having the greatest freedom. Since none of the three early career teachers fully adopted a curriculum enactment orientation, findings from this study suggest that beginning teachers do like and need to have some curricular structure with materials to guide them instead of having to create most lessons from scratch.

However, they need the freedom to make curricular adjustments according to their students' needs.

Findings from this study also suggest that the following larger questions need to be given greater thought: What is driving instruction? Is it a prescribed curriculum, standards, both, or something additional? What should be driving instruction? These are important questions to consider, especially in lieu of the recent Common Core State Standards and the curricular changes which are sure to follow. Because Grand Elementary was driven by the standards more so than one particular program, yet utilized *EM* to help target those standards, Lisa had the greatest freedom to structure her lessons. Having that larger goal allowed her to address curriculum in a broader sense since she was not wedded to one program. Grand Elementary utilized *EM* as one means to achieve the standards that students fell short on, but teachers were free to utilize additional resources to meet the needs of their students to work toward those standards. Lisa's case could suggest that having teachers aware of the standard(s) that students particularly fall short on and making accommodations to address that goal might allow for greater flexibility and unity when there is a school-wide goal in mind. A more thorough examination of the impact of state standards on teachers' orientations toward curriculum implementation could be an important further line of inquiry. Overall, from this study, it appears that allowing early career elementary teachers multiple curricular resources and flexibility to tailor the formal curriculum seems like an appropriate route to address student needs which could potentially lead to higher student mathematics achievement.

References

Ball, D. L., Hill, H. C., & Bass, H. (2005). Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade, and how can we decide? *American Educator*, 14–46.

Bogdan, R. C., & Biklen, S. K. (2007). *Qualitative research for education: An introduction to theories and methods* (5th ed.). Boston, MA: Pearson Education, Inc.

Clandinin, D. J., & Connelly, F. M. (1992). Teacher as curriculum maker. In P. W. Jackson (Ed.), *Handbook of research on curriculum* (pp. 363–401). New York, NY: Macmillan.

Ferrini-Mundy, J., & Floden, R. E. (2007). Educational policy research and mathematics education. In F. K. Lester, Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (Vol. 2, pp. 1247–1280). Charlotte, NC: Information Age Publishing, Inc.

Frykholm, J. (2004). Teachers' tolerance for discomfort: Implications for curricular reform in mathematics. *Journal of Curriculum and Supervision, 19*(2), 125–149.

Gujarati, J. (2010). Portraits of early career elementary teachers: Examining beliefs about mathematics in the midst of classroom practices (Doctoral dissertation, Teachers College, Columbia University). Available from ProQuest Dissertations and Theses database. (UMI NO. 3424995)

Howson, G., Keitel, C., & Kilpatrick, J. (1981). *Curriculum development in mathematics*. Cambridge, United Kingdom: Cambridge University Press.

Lawrence-Lightfoot, S. (1983). *The good high school: Portraits of character and culture*. New York, NY: Basic Books, Inc.

Lawrence-Lightfoot, S. (2005). Reflections on portraiture: A dialogue between art and science. *Qualitative Inquiry, 11*(1), 3–15.

Lawrence-Lightfoot, S., & Davis, J. H. (1997). *The art and science of portraiture*. San Francisco, CA: Jossey-Bass.

National Council of Teachers of Mathematics [NCTM]. (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: The Council.

New York City Department of Education (2008). Quality review reports 2007-2008. Retrieved January 8, 2009, from http://schools.nyc.gov/default.htm

Remillard, J. T., & Bryans, M. B. (2004). Teachers' orientations toward mathematics curriculum materials: Implications for teacher learning. *Journal for Research in Mathematics Education, 35*(5), 352–388.

Snyder, J., Bolin, F., & Zumwalt, K. K. (1992). Curriculum implementation. In P. W. Jackson (Ed.), *Handbook of research on curriculum* (pp. 402–435). New York, NY: Macmillan.

Stein, M. K., Remillard, J., & Smith, M. S. (2007). How curriculum influences student learning. In F. K. Lester, Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (Vol. 1, pp. 319–369). Charlotte, NC: Information Age Publishing, Inc.

Tate, W. F., & Rousseau, C. (2007). Engineering change in mathematics education: Research, policy, and practice. In F. K. Lester, Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (Vol. 2, pp. 1209–1246). Charlotte, NC: Information Age Publishing, Inc.

Technical Education Research Center [TERC] (2008). *Investigations in number, data, and space*. Glenview, IL: Pearson Scott Foresman.

Tobin, K., & Dawson, G. (1992). Constraints to curriculum reform: Teachers and the myths of schooling. *Educational Technology, Research and Development, 40*(1), 81–92.

University of Chicago School Mathematics Project [UCSMP] (2007). *Everyday mathematics* (3rd ed.). New York, NY: Wright Group/McGraw-Hill.

Zumwalt, K. K. (2004). Choosing to make a difference. In A. T. Costigan & M. S. Crocco (Eds.), *Learning to teach in an age of accountability* (pp. 247–257). Mahwah, NJ: Lawrence Erlbaum Associates.

SEARCH EXTENDED

Teachers College Columbia University
Department of Mathematics, Science, and Technology

MATHEMATICS EDUCATION FACULTY VACANCY

Teachers College invites applicants for a faculty position in mathematics education. A successful candidate will have an earned doctorate in mathematics or mathematics education at the time of appointment and a demonstrated ability to pursue an active research agenda in a significant area of mathematics education. Applicants should be qualified to teach graduate-level courses in at least two areas of mathematics and in two or more areas of mathematics education. Preference will be given to candidates with prior experience teaching school mathematics. All candidates are expected to demonstrate an ability to establish a research program and a potential to obtain external funding. Candidates also are expected to establish a record of continuous, scholarly productivity and a record of leadership. Minority candidates are strongly encouraged to apply.

Rank: Open Rank, Tenure Track

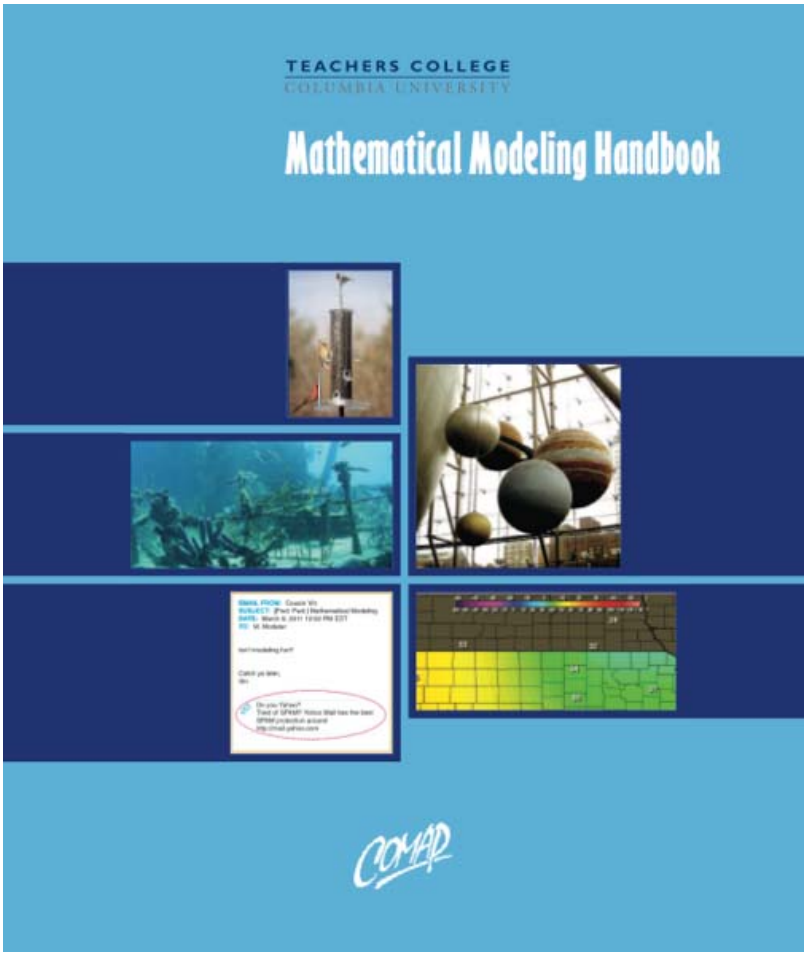
Send CV, a cover letter explaining your interest in the position, representative publications, and names of three references to Professor Bruce Vogeli, Search Committee Chair, Teachers College Columbia University, 525 West 120th Street, Box 195, New York, NY 10027.

Review of applications will begin by November 15, 2011 and continue until the search is completed. Appointment begins September 2012.

Teachers College as an institution is committed to a policy of equal opportunity in employment. In offering education, psychology, and health studies, the College is committed to providing expanding employment opportunities to persons of color, women, and persons with disabilities in its own activities and in society.

Teachers College Columbia University
525 West 120th Street, New York, NY 10027
http://www.tc.columbia.edu

COMING - SUMMER 2011



Order from:

The Consortium on Mathematics and Its Application

BY MAIL:

COMAP, Inc.
175 Middlesex Turnpike, Suite 3B
Bedford, MA 01730
USA

BY EMAIL:

info@comap.com

Download a free Handbook Sampler of five lessons
at **www.comap.com/NCTM.html**