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The Structural and Conceptual Interweaving of
Mathematics Methods Coursework and Field Practica
in an Era of Mathematics Reform

Abstract

This paper describes a study of observed relationships between the design of a preservice mathematics methods course with accompanying field practicum and changes in the extent to which participating preservice teachers identified themselves with the mathematics reform movement after becoming inservice teachers. The curriculum of the course with its embedded field practicum experiences was designed to support preservice teachers in interweaving methods coursework and pedagogical instruction with classroom practice. University and public school structures were interwoven by conducting weekly mathematics methods course sessions held at a public school site followed immediately by related classroom practicum experiences. The interweaving of conceptualizations about mathematics teaching and learning was facilitated by the methods instructor providing professional development for classroom teachers simultaneously with the methods course, encouraging the teachers to create “reform-friendly” classroom environments. Survey data from 68 preservice teachers were analysed to identify relationships between course/practicum experiences and the degree to which the teachers identified with a reform mathematics perspective, as well as to examine factors influencing those relationships.

Keywords:

Mathematics Teacher Education

Teacher Education

Field Experiences

Preservice Teacher Education

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in an Era of Mathematics Education Reform

Curriculum guides from around the globe promote a broad view of mathematical literacy. As an example, Australian frameworks suggest that numeracy not only includes the ability to perform basic calculations, but also the possession of a thorough, connected understanding of number and operation (Leonelli & Schmitt, 2001). Additionally, the Association of Teachers of Mathematics (ATM, 2006) in Britain, in its response to the British framework for teaching mathematics, emphasized the role of sustained thinking between teacher and learner. A similar perspective is promoted in the U.S.A. by such documents as *Principles and Standards for School Mathematics* (NCTM, 2000) and *Adding it Up* (Kilpatrick, Swafford, & Findell, 2001), of which the following description is typical.

Imagine a classroom, a school, or a school district where all students have access to high-quality, engaging mathematics instruction. There are ambitious expectations for all, with accommodation for those who need it. . . . The curriculum is mathematically rich, offering students opportunities to learn important mathematical concepts and procedures with understanding. . . . Teachers help students make, refine, and explore conjectures on the basis of evidence and use a variety of reasoning and proof techniques to confirm or disprove those conjectures. . . . Alone or in groups and with access to technology, they work productively and reflectively, with the skilled guidance of their teachers. (NCTM, 2000, p. 3)

The authors have sought to design an elementary mathematics methods course curriculum that supports preservice teachers in connecting methods coursework with actual classroom practice in ways that would encourage them to identify with current reforms. The purpose of this paper is to describe our course/practicum curriculum, its theoretical underpinnings, and our examination of the relationships between the enactment of that curriculum and the extent to which participating preservice teachers subsequently viewed themselves as engaging in reform-based practices as inservice teachers.

Theoretical Framework

In her groundbreaking work *Knowing and Teaching Elementary Mathematics*, Liping Ma (1999) places responsibility for reform in mathematics classrooms on those who educate preservice teachers. “In the vicious circle formed by low-quality mathematics education and low-quality teacher knowledge of school mathematics, a third party—teacher preparation—may serve as the force to break the circle” (p. 149) We agree with Ma, and we think about her depiction of the responsibility of teacher preparation programs in light of two glaring realities.

1. The mathematics education reform movement has been around a long time. Many would label 1989 as a watermark year in the movement, at least in the United States, because of the publication of the predecessor of the current NCTM *Principles and Standards* (NCTM, 2000), namely, the *Curriculum and Evaluation Standards* (NCTM, 1989) Some would argue that it has been around even longer (see NCTM, 1980, Davis, 1990)
2. In our experience, observations based on the TIMSS 1995 and 1999 Video Studies (Jacobs et al., 2006) still accurately describe the state of mathematics teaching

and learning today. “The nature of classroom mathematics teaching observed in the videotapes reflects the kind of traditional teaching that has been documented during most of the past century, . . . the nature of mathematical thinking and reasoning, and the conceptual mathematical work, remain unaligned with the intent of *Principles and Standards*.” (pp. 28, 30)

The proposition of Fullan, Galluzzo, Morris, and Watson (1998) has very real meaning in the context of the mathematics reform movement. “We are dealing with a reform proposition so profound that the teaching profession itself, along with the culture of schools and schools of education, will have to undergo total transformation in order for substantial progress to be made” (p. 68) Implicit in this proposition is the need to reform the “clinical side of teacher education” (Darling-Hammond, 2009, p. 11), a place of intersection between schooling and teacher education. Thus, we situate the mathematics education reform movement within overall teacher education reform, and in so doing, draw upon the perspectives of these and other internationally recognized leaders in teacher education.

Darling-Hammond (2009) continues, “Often, the clinical side of teacher education has been fairly haphazard, depending on the idiosyncrasies of loosely selected placements with little guidance about what happens in them and little connection to university work” (p. 11) Zeichner (2010) adds, “. . . one of the central problems that has plagued college- and university-based preservice teacher education for many years (is the) disconnect between the campus and school-based components of programs” (p. 89)

With Darling-Hammond, we believe a different sort of clinical experience holds great promise for increasing the value and impact of teacher education. She (2000) states, “Recent evidence . . . indicates that reforms of teacher education creating more tightly

integrated programs with extended clinical preparation *interwoven* (emphasis added) with coursework on learning and teaching produce teachers who are . . . more effective” (pp. 166-177) For this very reason, the NCATE Blue Ribbon Panel (2011) has proposed that teacher education be “turned upside down by revamping programs to place clinical practice at the center of teacher preparation” (p. 1)

Two Types of Interweaving

We assert that mathematics methods course curricula incorporate two types of coursework-clinical interweaving—*structural* interweaving and *conceptual* interweaving—to prepare preservice teachers to create the kind of classrooms envisioned by the reform movement. First, university-public school partnering structures should be established to support preservice teachers in connecting course and field experiences. Second, a conceptual synchrony between university faculty and clinical faculty, including public school teachers who serve as mentors, ought to be encouraged.

Structural Interweaving

In seeking structures that have the potential to facilitate the interweaving of methods coursework and clinical practice in ways that enhance teacher preparation, we find the arguments for the immediate application of methods in clinical settings to be quite compelling. We also find arguments for four additional structures to be compelling—(1) the gradual increase of teaching responsibility in clinical work, (2) methods instructor supervision of clinical work, (3) inservice-preservice teacher relationships that enhance mentoring, and (4) preservice teachers partnering with one another in shared clinical placements. We discuss each of these structures in the following paragraphs.

Immediate application of methods in clinical settings. As preservice teachers experience elementary methods instruction in “classes and classrooms simultaneously” (Snyder, 2000, p. 122), they have opportunities and encouragement for connecting coursework and practice. Chin and Russell (1995), Darling-Hammond (2006), Darling-Hammond and MacDonald (2000), Koppich (2000), Whitford, Ruscoe, and Fickel (2000), and Zeichner (2010) have made similar recommendations that involve teaching methods courses at public school sites. Such a practicum approach could accomplish what Goodlad (1994) called “immersing cohort groups in whole schools” (p. 124)

We have found the practice of teaching methods courses at public schools to be both rewarding and challenging (Author, et al., 2009), and have observed that the effectiveness of this practice does not depend on the site of the course as much as on the opportunity for immediate methods application a school site affords. Several studies have suggested that immediate methods application in classrooms changes the emphasis in teacher preparation from “learning to teach” to “learning from teaching” (Zumwalt, 1988, p. 170), similar to the aforementioned comments of Darling-Hammond (2001) These views are also consistent with Heibert et al.’s (1996) assertion, that when “learning is embedded in activity, students engage a variety of problem situations, and artificial distinctions between acquiring knowledge and applying it are eliminated” (p. 19) We argue that removing these artificial distinctions between acquiring and applying knowledge enables preservice teachers to connect coursework and practice and thus avoid having to reconcile competing images of teaching. Our argument is based on observing significant changes in preservice teachers’ beliefs about reform-based mathematics teaching when immediate methods application opportunities were provided (Author, et al., 2008, Author, et al., 2009, see also Cole, Ryan, and Tomlin, 2003,

Tchoshanov, Blake, Della-Piana, Duval, & Sanchez, 2001, Whitford, Ruscoe, & Fickel, 2000, Vacc and Bright, 1999) Thus, “application,” as we use the term, includes the perspective that “field experiences are important occasions for teacher learning rather than merely times for teacher candidates to demonstrate or apply things previously learned” (Zeichner, 2010, p. 91)

Methods instructor supervision of clinical work--debriefing. In some of our previous work (Author, et al., 2011) we observed significant belief changes among preservice teachers involved in a reform-based methods course with an associated weekly practicum that was supervised by the methods instructor. The practicum occurred in classrooms characterized by a more traditional practice. We therefore argued that the instructor’s role was an important factor in promoting those changes despite the influence of traditional classroom practice. (We will return to a discussion of the effects of the type of practice that characterizes practicum classrooms when we treat conceptual interweaving.) Tchoshanov et al. (2000) assessed the perceptions of preservice teachers involved in a school-based preparation program and found meaningful effects associated with field-based mentoring provided by methods course instructors (see also Cohn, 1981)

Gradual increase of teaching responsibility in clinical work. Our own clinical supervisory experience has evidenced the wisdom of inviting practicum students to accept a gradual increase in their responsibility for planning and teaching mathematics lessons, as well as a gradual increase in the number of students for whom they are responsible. The Association of Childhood Education International Position Paper: The Preparation of Elementary Teachers (1998) adds additional support, “Preservice teachers should have gradually increased responsibilities in the classroom” (p. 1), and teacher education programs commonly advertise characterizations of their clinical components as

including “a progressive increase of hands-on experiences” (Drexel University School of Education) Rather than assuming “complete responsibility for classroom instruction and management” “as quickly as possible” (Bullough, et al., 2003, p. 57) a gradual increase of responsibility is seen as a scaffolded response to the complexities of teaching (Snyder, 2000, Wingfield, Nath, Freeman, & Cohen, 2000)

Inservice-preservice teacher relationships that enhance mentoring. McNally, Inglis, & Stronach (1997) have demonstrated that the quality of field experiences is related to the quality of the interpersonal relationships between inservice teachers and the preservice teachers they mentor. Indeed, preservice teacher learning in practicum contexts is highly dependent upon the nature of inservice-preservice teacher interaction (Elliott, 1995) The presence of supportive mentoring inservice teachers is a hallmark of meaningful university-public school partnerships and seems to be accompanied by greater risk-taking on the part of preservice teachers and additional benefits to children (Bullough, et al., 2002)

Preservice teachers partnering with one another in shared clinical placements. Recent research has provided evidence for benefits arising from structures that allow for collaborative partnering among preservice teachers as they engage in field practica (e.g., Anderson & Speck, 1998) Howey and Zimpher (1999) conjecture that “addressing how all teachers are prepared to work with one another” (p. 294) should be a critical concern in improving teacher education. Buchberger, Campos, Kallos, & Stephenson (2000) also call for structures in teacher preparation programs that develop preservice teachers’ “collaborative problem-solving capacity” (p. 49) Bullough, et al., (2003) compared traditional single student placements and paired field placements and

observed positive impacts on children and several benefits to preservice teachers from paired placements.

Conceptual interweaving

Structural interweaving does not, however, preclude another potential source of disconnection between coursework and field experience. Tensions may result if the classroom teachers who provide practicum sites do not understand and use the methods preservice teachers are taught in methods courses. University mathematics teacher educators typically promote reform-based methodologies, while many inservice teachers use more traditional approaches (e.g., Ball, 2001) Echoing something we stated previously, we suggest the following observation by Herrera and Owens (2001) still remains true 10 years later:

While state curriculum frameworks and textbook publications show decided change directly connected to the reform movement, at the classroom level only minimal change has taken place in important areas that affect students—how mathematics is conceptualized and how it is taught. (p. 91)

Thus, preservice teachers are unable to observe reform-based methods, are often not allowed to apply those methods, or if they are, are not supported in the application if the inservice teachers' classroom practice is not reform-based.

Allsup (2006) has examined the relationships among practicum experiences in public schools and methods coursework and recommends that teacher preparation programs thoughtfully consider how their goals materialize in field practica. “Otherwise it may seem to preservice teachers that their university professors are completely unaware of the challenges they face in real . . . classrooms, and they may choose to disregard university knowledge as irrelevant” (p. 22) In a study cited previously in this paper in our

discussion of structural interweaving, Vacc & Bright (1999) examined two different cases and found commitment of preservice teachers to engage in reform-based practice depended on the level of coherence between the philosophies of preservice instruction and classroom practice. They concluded,

The framework underlying the content presented in mathematics methods courses needs to be consistent with the framework of the mathematics education program that preservice teachers observe and implement during field experiences. If the two frameworks are in conflict, the theories and concepts presented during the mathematics methods course may not seem plausible and may be rejected. (p. 91)

Hollingsworth (1989) likewise found in a study of preservice teachers that those who made the greatest professional growth were those placed with cooperating teachers who encouraged them to apply what they learned in methods courses.

Implementation

We hypothesized that if we could create a course/practicum system that facilitated structural and conceptual interweaving, the participating preservice teachers would be more likely to develop a “coherent sense of themselves as professionals” (Feiman-Nemser, 2001, p. 1029) who embrace a reform perspective. To accomplish structural interweaving, we determined to conduct our methods course in the public schools, thus allowing for immediate application. Other structures discussed previously would also accompany the immediate application—(1) the gradual increase of teaching responsibility in clinical work, (2) methods instructor supervision of clinical work, (3) inservice-preservice teacher relationships that enhance mentoring, and (4) preservice teachers partnering with one another in shared clinical placements. Conceptual interweaving could be accomplished by conducting professional development for the

classroom teachers in conjunction with the methods course at each site, encouraging the teachers to create “reform-friendly” classroom environments that would exemplify and support reform-based methods application.

Not wishing to be imposing, we shared our “interweaving vision” with the principals of two elementary schools, Grant, in our first year, and Sharon, in the second year, schools in which the first author had developed meaningful relationships via field experience supervision. Their interest sparked further discussion about we might approach their respective faculties. In both schools, we introduced our tentative plans in general faculty meetings, then met with grade level teams to assess the level of interest and answer questions. Without compulsion, all of the teachers at Grant and 15 of the 16 teachers at Sharon accepted the invitation to participate in a series of mathematics professional development courses over a two-year period. These inservice courses were delivered at the schools primarily after school. The single-semester, preservice methods courses were also conducted by the first author at those same schools during the school day, and the inservice teachers agreed to accept preservice teachers in their classrooms for the weekly practicum experience. Thus we were able to encourage the creation of reform-based practicum sites that enabled efforts to reform mathematics instruction school-wide (Tchoshanov et al., 2001) (The details of this professional development coursework are described in Author, et al., 2009)

Over a 3-year period, five cohorts of approximately 30 preservice teachers enrolled in the mathematics methods courses, which were held once-a-week at Grant or Sharon Elementary School. They were engaged in various course activities designed to help them understand and use key reform-based methods. Afterwards they literally walked down the school hallway to their assigned classroom to plan with their mentor

teacher lessons that incorporated the methods they had just studied, using the school curriculum materials. Most preservice teachers were assigned in groups of two or three to work with the same mentor teacher throughout the semester. The mentor and preservice teachers co-taught first few lessons, with the preservice teachers assuming increased teaching responsibility during the semester—initially assisting the inservice teacher, later teaching a small group of students, and eventually teaching the entire class. The methods course instructor supervised the preservice teachers during their classroom experiences and held a debriefing session following the experiences highlighting and discussing the methods they had used.

The preservice teachers, who were in the first semester of their senior year, were enrolled simultaneously in three other methods courses. Toward the end of the semester, all courses were dismissed for three weeks so preservice teachers could participate in an all-day intensive field practicum related to the four methods courses at a number of area schools. The classroom selections for this additional practicum were made by a university field director who did not attempt to utilize reform-friendly classrooms. However, a few of the preservice teachers participated in this 3-week experience at Grant or Sharon School.

Research Questions

We studied the first year's work at Grant School by examining some of the changes in beliefs of preservice teachers and mentor teachers, and the achievement of the children involved (Author, et al., 2009) After three years of working in the two schools, we conducted this study, hoping to assess the perspectives of former preservice teachers about school-site course-practicum integration and the value of structural and conceptual interweaving.

Five questions guided our study.

1. To what extent did the preservice teachers involved in our course/practicum identify with current reforms in mathematics teaching and learning as evidenced by their subsequent inservice teaching?
2. How influential did the teachers perceive the course/practicum to be upon their subsequent teaching?
3. What was the relationship between the teachers' perceptions of course/practicum components that facilitated structural and conceptual interweaving and the degree of the course/practicum's influence?

Addressing the third question lead to two additional questions.

4. How were the course/practicum components relating to structural interweaving perceived by the teachers?
5. To what extent did the preservice teachers' perceive that their former mentor teachers had identified with the reform movement, an issue related to conceptual interweaving?

Methods

Instrument

A survey was developed to capture data relevant to the five research questions. Discussion of the survey's development is organized around the research questions. Table 1 lists the dimensions that framed the survey and summarizes the relationship between them and our research questions. Note that research question 3 is answered by analyzing relationships between responses obtained from survey items addressing the other research questions and is therefore not addressed via instrumentation.

[Insert table 1 about here]

Research question 1: The degree of alignment between current reforms and the preservice teacher's subsequent inservice teaching. Self-report measures of classroom practice carry with them the potential for distortion. Fortunately, a survey developed by Ross, McDougall, Hogaboam-Gray, and LeSage (2003), which contains 20 selected response items organized according to nine characteristics, or dimensions, of reform-based teaching, has been shown to capture responses that correlate highly with actual observations of classroom practice. These items were incorporated into our survey. The nine characteristics constitute sub-dimensions of Dimension 1 and appear in table 2.

[Insert table 2 about here]

Research question 2: The influence of the course/practicum. We sought to assess the preservice teachers' perceptions of the influence of the course/practicum upon the extent to which their subsequent inservice teaching aligned with a reform perspective. To operationally define this construct in a manner that aligned conceptually with the Ross et al. (2003) survey, we considered rewording its items. However, concerns about survey length encouraged us to construct a shorter set of nine items based upon the nine Ross et al. (2003) organizing characteristics. These items were examined by Ross and found to represent the intent of the survey (personal communication, April 24, 2007) They constitute Dimension 2.

Research question 4: Components relating to structural interweaving. We conducted semi-open-ended interviews with two or three former preservice teachers from each of the five cohorts, for a total of twelve interviews, using as a framework the specific course/practicum components facilitating structural interweaving raised in our literature review—the immediate application of methods in clinical settings, the gradual increase of teaching responsibility in clinical work, methods instructor supervision of

clinical work, inservice-preservice teacher relationships that enhance mentoring, and preservice teachers partnering with one another in shared clinical placements. This process enabled us to flesh out issues relating to each component around which survey items could be constructed.

When asked about the relative advantages of the course/practicum in the interviews, the immediate methods application component consistently arose with little or no prompting from us, frequently embedded in statements that compared the relative utility of both types of practica experienced during the semester and/or that described the positive influence a weekly practicum had upon the methods experience. We therefore assessed perspectives regarding this structural component in an open-ended fashion, using specific interview responses to construct two different items.

Without prompting from us, the other structural components appeared less frequently in the responses we obtained from the interviews. A series of selected response items were created to assess perspectives associated with each component. As mentioned, interview responses were used to construct the specific items relating to each of them.

During the interviews, three other issues arose relating to structural interweaving—the relative utility of the practicum compared to other course activities, the degree of coherence between the practicum and those activities, and procedural issues primarily concerned with meeting off campus for the methods course—that became additional dimensions. Again, by pursuing these issues with the interviewees, aspects about them were surfaced that allowed us to craft multiple survey items addressing the additional dimensions. Survey items relating to structural interweaving constitute Dimensions 4A-4H.

Research question 5: conceptual interweaving. Seeking to assess the extent to

which the preservice teachers perceived that their mentor teachers engaged in reform-based practice, we again constructed a set of nine items based upon the nine Ross et al. (2003) organizing characteristics similar to those associated with Research Question 2. As previously stated, Ross examined these items to and found them to represent the intent of the survey (personal communication, April 24, 2007) They constitute Dimension 5.

This iterative developmental process resulted in construction of 77 survey items along the twelve dimensions. As mentioned, two of the survey items were of a constructed-response type and were used to assess Dimensions 4A-1 and 4A-2. The other dimensions were assessed by a total of 75 selected-response items, which were either unidirectional or bidirectional depending on the nature of dimension being assessed, generally with from four to six response categories. Six of these 75 items were response dependent, contingent upon responses to related items. The length of the survey precludes its inclusion in this article but survey item language is repeated in the Results section.

We invited 10 additional former preservice teachers who had been involved in the course/practicum to read and interpret the survey items aloud in order to assess the degree to which the items were interpreted according to our intentions, an issue related to validity. As a result, we revised nearly all of the 77 items. The survey was then transformed into an electronic form via SurveyMonkey (2010) to facilitate survey delivery, respondent follow-up, and data gathering.

Psychometric Considerations

Questions about the reliability of survey responses were addressed in two ways. First, because of the similarities between Dimensions 4A-1 and 4A-2 we deliberately designed the survey items associated with them in a way to assess whether respondents would respond similarly to both. As shown in the Results section, a high degree of

consistency was found between the responses associated with both items. For example, many respondents spoke favorably about immediate methods application, the opportunity to work with children, the preparation the weekly practicum provided for future teaching, and the effect it had on their willingness to adopt a reform perspective. Second, we used item-to-adjusted total correlation (Item-Total Correlation, SPSS, 2008) to examine the degree of clustering associated with the 69 selected-response items that were not response dependent according to the survey dimensions. table 3 lists the specific results. The reader will note that responses associated with only the item dealing with the utility of course reading assignments was found to possess a less than desirable coefficient.

[Insert table 3 about here]

Because one of the authors was also the methods instructor, we were concerned about the potential for response bias. We dealt with this potential in three ways. The surveys were completed anonymously and were completed after the preservice teachers graduated. The presence of a high degree of correlation between items relating to the same dimension also provides evidence for a lack of bias (McMillan & Schumacher, 1984)

Subjects

We located the email addresses of 113 former preservice teachers who had been involved in the course/practicum, we sent each an email inviting them to respond to the survey. Of those students, 68 responded, for a response rate of 60%, which falls within accepted response parameters (McMillan & Schumacher, 1984) There was a minor response decline related to items in the latter part of the survey. We received 14 responses from preservice teachers from the first Grant cohort, 13 from the second, 11

from the third, 11 from the first Sharon cohort, and 19 from the second. Of the 68 respondents, all but five were female, and all but one was Caucasian.

Data analysis

Two types of initial analyses were performed to enable answering research questions 1, 2, 4, and 5. First, responses to the two open-ended, constructed response survey items were categorized and tabulated in order to ascertain the frequency of responses within the categories. Comparisons were made between the responses to these two items to triangulate those data and validate interpretations. The responses that related to the other Dimensions were also compared to responses obtained from the items assessing the other Dimensions for purposes of further data triangulation and validation. Second, responses obtained from the selected-response survey items were totaled within each response category and converted to percentages. When two or more items measured the same dimension, or aspect of a dimension, overall category mean percentages were calculated. Summaries of these analyses appear in the Results sections.

Two types of analyses were conducted in relation to the third research question: examining the relationship between course/practicum components that facilitated structural and conceptual interweaving and the perceived degree of the course/practicum's influence. First, a forward linear regression analysis was performed using the REG procedures in SAS (Statistical Analysis Software, 2010) with the mean of all responses to items relating to Dimension 5 as the dependent variable. (Evidence of their homogeneity obtained via the item-to-adjusted total correlation procedures has been discussed previously.) Items relating to structural and conceptual interweaving were similarly synthesized and considered as potential factors for analysis purposes.

Second, subject responses related to these potential-factor dimensions were used

to divide subjects into two groups. This division was accomplished by totaling subject responses within a dimension, then placing those subjects whose responses averaged within the highest response category in one group and all other subjects in the second group. Thus for this analysis these varied groupings according to potential factors constituted independent variables and were used in t-test analyses with the Dimension 5 composite variable as dependent.

Results and Discussion

Results obtained from the preservice teacher survey are displayed and discussed according to the research questions and associated survey dimensions. Survey item language is included. Reported frequencies and associated percentages are means obtained by averaging response frequencies across items within a dimension. Because the third research question was not addressed directly by the survey, it will be discussed last.

Research Question 1: Degree of implementation of reform-based teaching

(Dimension 1)

To what extent do you agree that these statements characterize your approach to teaching mathematics? (six response categories)

As discussed previously, items from the Ross et al. (2003) survey were included to assess this dimension because its overall results have been shown to highly correlate with results obtained from observations of classroom practice. Table 4 lists the response percentages associated with the 20 survey items grouped according to its nine subdimensions along with response category means. Mean responses range from 4.06, “agree somewhat,” to 5.63, between “agree and strongly agree,” 59 (88%) of the responses were in the “agree somewhat,” “agree,” or “strongly agree” response categories, and the overall mean of all responses, 4.83, tends towards “agree”.

We observed a clear distinction between the responses associated with each sub-dimension, such that two groups of sub-dimensions could be formed. The responses to 4.1, 4.3, and 4.5, “Program scope,” “Discovery instruction,” and “Manipulatives and tools,” centered in the “agree somewhat” response category. Responses related to 4.2, 4.4, 4.6, 4.7, 4.8, and 4.9, “Student tasks,” “Teacher’s role,” “Student-student interaction,” “Student assessment,” “Teacher’s conception of math,” and “Student confidence,” clustered in the “agree” or “strongly agree” categories. We will discuss this distinction more fully in the Conclusion of the paper. Overall, these data suggest that most of the preservice teachers engaged in at least some degree of reform pedagogy in their subsequent inservice teaching.

Research Question 2: The influence of the course/practicum (Dimension 2) *To what extent did the weekly field experience in conjunction with your mathematics methods course affect your beliefs regarding the following statements? (five response categories)*

Table 5 lists the response percentages for the nine survey items related to this dimension, along with response category means. Sixty-seven of the responses (98%) were in the categories “positively” or “very positively.” This percentage suggests the preservice teachers perceived the course and practicum as having strongly influenced their perspectives about reform-based teaching, a conclusion validated by seventeen comments to this effect on the constructed-response survey items assessing Dimension 4A-1. These comments provide evidence the preservice teachers developed a belief that students can learn from each other and that inquiry is an effective instructional strategy. Further, the comments evidence changes in their views about the nature of mathematics teaching and learning, and in their abilities to use student thinking to inform their

instructional decisions. A possible explanation for this influence will be provided later in the paper.

[Insert table 5 about here]

As previously stated, the third research question, which concerns the relationship between perceptions of course/practicum components that facilitated structural and conceptual interweaving and the degree of the course/practicum's influence, was not directly assessed by the survey. Rather, this question was addressed by analyzing relationships between responses obtained from survey items related to the other research questions. Therefore, the third question is not discussed here.

Research question 4: Components relating to structural interweaving.

There are multiple components relating to structural interweaving, each represented by its own survey dimension or dimensions. Each component will be treated separately in the following discussion.

The immediate application of methods in clinical settings (Dimensions 4A-1 & 4A-2) *During the semester you took the mathematics methods course, you participated in two field experiences--a weekly field experience in conjunction with the course, and a 3-week field experience in November. What do you think were the advantages and disadvantages of each? Please explain your thinking.*

Interestingly, in an open-ended context, the most frequent response (43 times) specified immediate methods application as an advantage of the weekly practicum. The absence of opportunity for immediate methods application in the 3-week practicum was also frequently mentioned. The prevalence of this response validates our initial survey construction efforts. We believed that because immediate methods application was such a powerful component of structural interweaving, and that because it appeared so

frequently in our pre-survey interviewing, it would comprise a meaningful portion of the responses obtained from this item. The advantages of immediate application that were listed included its positive effect on the use and retention of methods during student teaching and inservice teaching and its ability to help problematize the process of learning to teach, the most prevalent response.

During each of your last three semesters before student teaching, you were enrolled in several methods classes, all sharing 3-week field experiences. Only one of your methods classes, the mathematics methods course at either Grant or Sharon, had an additional weekly field experience in conjunction with the course. In your opinion, how did the presence or absence of an additional weekly field experience impact the effect of your methods course experience? Please explain your thinking. The opportunity for immediate application of methods with children was a very prevalent response, similar to results in Dimension 4A-1. The immediate application opportunity, according to 16 of the responses (27%), increased learning, retention, and understanding of methods and enhanced preservice teachers' ability to connect learning across course sessions. Related to, if not synonymous with, responses about immediate methods application were 19 responses (32%) expressing satisfaction with the opportunity to work regularly with children.

The gradual increase of teaching responsibility in clinical work (Dimension 4B) *The following questions relate to your classroom responsibilities in the weekly field experience (four response categories)* Most of the preservice teachers assumed a gradual increase in teaching responsibilities according to the pattern previously outlined. As shown in table 6, 58 (89%) affirmed that a gradual increase, and the pace of that increase, were enabling.

[Insert table 6 about here]

Methods instructor supervision of clinical work—debriefing (Dimension 4C)

The following questions relate to debriefing with your mathematics methods professor after your weekly field experience (five response categories) Most of the preservice teachers reported debriefing experiences related to both content and methods following at least some of the practicum experiences. As indicated in Table 6, 62 teachers (95%) concluded that the debriefing produced positive effects. A similar perspective about practicum debriefing and methods instructor supervision was indicated by 13 responses (22%) to the Dimension 4A-1 survey item.

Inservice-preservice teacher relationships that enhance mentoring

(Dimension 4D) *During your weekly field experience in conjunction with your mathematics methods course, to what extent did the classroom teacher support you in the following ways* (five response categories)? Table 6 lists the mean response percentages associated with the nine survey items related to this dimension. Because an average of 92% of the responses (an average of 60 respondents per item in this dimension) were in the “sometimes,” “frequently,” or “consistently” categories, we conclude that most of the mentor teachers were viewed as being at least moderately supportive. These results are validated by the low number of responses to Dimension 4A-1 that listed difficulties in working with the mentor teachers and the large number of responses specifying a number of positive aspects associated with relations with mentor teachers.

Preservice teachers partnering with one another in shared clinical placements (Dimension 4E) *The following questions relate to your relationships with other cohort students* (varied number of response categories) The items associated with this dimension addressed several issues. Most preservice teachers worked in teams of two

or three. About three-fourths viewed their partnership numbers favorably, and 58 (89%) indicated discussing their teaching with those partners. There was a decline in responses (n=40) to one of the items in this dimension, no doubt due to response dependency, i.e., “if you answered _____, skip to item ____.” Twenty-eight of those responding (67%) stated working with a partner lowered the apprehension associated with working with students. Additionally, fifty-one (78%) agreed that having a partner also helped them deal with the apprehension associated with working with their mentor teachers. Fifty-three (81%) perceived their joint lesson planning experience as being collaborative. Table 6 displays an overall satisfaction rate of 84% (55 teachers) suggesting working with peers in the practicum appears to have been a useful component of the weekly practicum experience.

The relative utility of the practicum compared to other course activities

(Dimension 4F) *How helpful was the weekly field experience compared to each of the other components of your mathematics methods course listed below (5 response categories)?* Table 6 lists the mean response percentages from the six survey items related to this dimension. Forty-two (62%) of the responses were in the “more helpful” or “much more helpful” categories, suggesting the relative influence of a weekly field practicum in relation to other methods course components. Considering the reform perspective of the mentor teachers, as demonstrated by preservice teachers’ responses to Dimension 5 (see 7) we conjecture this percentage would have been considerably lower had the mentor teachers not been engaged in reform-based professional development.

The degree of coherence between the practicum and other course activities

(Dimension 4G) *In your mathematics methods course, to what extent did each of the following course components contribute to your weekly field experience (5 response*

categories)? Table 6 lists the mean response percentages associated with the six survey items related to this dimension. Sixty-two percent of the responses (42 teachers) were in the “substantially” or “dramatically” response categories. This percentage reveals that the preservice teachers viewed the course components as contributing to their field practicum experience, providing evidence of course/practicum coherence.

Procedural issues concerned with meeting off campus for the methods course (Dimension 4H) *The following questions relate to the logistical issues associated with traveling to a school for your methods class (5 response categories)* The conducting of a methods course at a public school site brings with it procedural challenges not encountered with an on-campus course. To ascertain the preservice teachers’ perspectives about doing so, we asked them to what extent they thought other methods courses should be similarly delivered. Sixty (95%) responded positively, and 59 (93%) believed the benefits were worth the difficulties (See table 6)

Research question 5: conceptual interweaving (Dimension 5) *To what extent were the practices of the teacher in whose classroom you did your weekly mathematics experience aligned with the following statements (5 response categories)*

Table 7 lists the response percentages associated with the nine survey items related to this dimension, along with response category means. Sixty-four preservice teachers (94%) tended to respond in the “moderately,” “substantially,” or “dramatically” categories, suggesting that most of the mentor teachers were perceived as engaging in at least a moderate degree of reform-based teaching. This conclusion is validated by the responses obtained in connection with Dimension 4A-1 in two ways. First, many preservice teachers listed the congruence between the methods they were learning in the course and the methods being used by the mentor teacher as an advantage of the weekly

practicum. Second, many also considered a lack of such congruence to be a major disadvantage of the three-week practicum.

[Insert table 7 about here]

Research Question 3: Relationships between perceptions of course/practicum components that facilitated structural and conceptual interweaving and the degree of the course/practicum's influence

As mentioned previously, two separate statistical analyses were conducted in relation to the third research question, examining the relationship between course/practicum components that facilitated structural and conceptual interweaving, responses associated with Dimensions 4B-4H and 5, and the perceived degree of the course/practicum's influence, Dimension 2. First, a forward linear regression analysis using the REG procedures in SAS (Statistical Analysis Software, 2010) was performed with Dimension 2 as the dependent variable, a composite variable synthesized from the responses obtained from items 5.1 through 5.9, as displayed in table 8. Three dimensions relating to structural interweaving appeared to be factors affecting responses to Dimension 2, but only one of them to a significant degree. Dimension 4C, concerning the debriefing provided by the course instructor, explains 31.87% of the variance in Dimension 2. Dimension 4E, concerning the extent to which the preservice teachers considered that their mentor teachers identified with a reform perspective, and Dimension 4G, concerning the degree of course coherence, each accounted for less than 2% of the variance in Dimension 2.

[Insert table 8 about here]

A second analysis was performed in which subjects were divided into two groups according to their responses related to structural and conceptual interweaving. The

groupings, which constituted independent variables, were used in t-test analyses with the Dimension 2 composite variable as the dependent variable. As shown in table 9, when preservice teachers were grouped according to the degree to which they possessed a positive perspective associated with two components of structural interweaving and with conceptual interweaving (labeled “greater” and “lesser” in the table), significant differences were obtained in the degree to which those groups stated that the course and practicum affected their inservice teaching. Specifically, those who tended to perceive the course and practicum as more coherent than others (Dimension 4G) and those who had more meaningful working relationships with their preservice peers with whom they engaged in the weekly practicum (Dimension 4E) than others also perceived the course and practicum as having greater influence on their future teaching. Similarly, those who perceived their mentor teachers as being more oriented toward reform than others (Dimension 5) perceived the course/practicum to be more influential than those who perceived their mentor teachers as being less reform-oriented.

[Insert table 9 about here]

Because responses relating to immediate methods application (Dimensions 4A-1 and 4A-2) were obtained from constructed-response survey items, it was not possible to include this important structural interweaving component in these statistical analyses. However, nearly every respondent listed immediate methods application as a benefit of the course/practicum, and a large number of them indicated that it influenced their subsequent teaching.

Summarizing, we found evidence that five course/practicum components concerning conceptual interweaving and structural interweaving are related to Dimension 2, the possible influence of the weekly field experience upon future reform-based,

inservice teaching. From factor analysis we found relationships between the nature of future inservice teaching and three components of structural interweaving, Dimensions 4C, 4E, and 4G--methods instructor supervision/debriefing, preservice teacher partnering, and course/practicum coherence. By grouping preservice teachers according to their perceptions of course/practicum components relating to conceptual and structural interweaving, we found additional evidence through comparing mean responses to Dimension 2 that responses to Dimensions 4G and 4E, preservice teacher partnering and course/practicum coherence are related to responses to Dimension 2. Constructed responses relating to Dimensions 4A-1 and 4A-2 provided evidence of an additional relationship between immediate methods application and Dimension 2. The grouping analysis process also uncovered relationships between Dimension 5, responses concerning conceptual interweaving, and Dimension 2.

Conclusions

In this paper, we have described the design of a preservice elementary mathematics methods course and accompanying field practicum that we hoped would support preservice teachers in connecting methods coursework with actual classroom practice in ways that would encourage them to identify with current reforms. We have also described the results of our investigation of the course/practicum variables associated with that hoped-for identification. We now turn to a specific treatment of the research questions that guided this study.

We first gathered data about the extent to which the preservice teachers involved in our course/practicum identified with current reforms in mathematics teaching and learning as evidenced by their subsequent inservice teaching. Results obtained from survey items measuring nine characteristics, or sub-dimensions, of reform-based teaching

indicate that the future teaching of preservice participants was indeed reform-based to varying degrees. We observed sufficient distinction between the survey responses associated with each of the sub-dimensions that two groups of sub-dimensions could be formed. Some characteristics of reform-based practice were highly involved: perception of the teacher's role as facilitator, presentation of complex, open-ended tasks, focus on student-student interaction, use of authentic student assessment, the teacher's conception of mathematics, and emphasis on student confidence. Other aspects were present to a lesser degree: traits of a curriculum program reflecting five mathematics content strands, the use of discovery or inquiry, and the availability and use of manipulatives and tools. We gained additional insight about this distinction in addressing our next research question concerning the influence of the course/practicum upon the extent to which the preservice teachers identified with a reform perspective.

Responses obtained from the teachers suggested that the course with the associated weekly practicum was highly influential on the degree to which participants later reported to engage in reform-based inservice teaching. The same nine traits of reform-based practice that framed their characterizations of their inservice teaching were used to frame their perspectives about the degree of influence of the course and practicum. That influence was consistently high across all nine reform-based teaching characteristics, which differs from their ratings of their own practice. Thus, we wondered why there was a disparity between the nature of the influence of the course/practicum and the nature of their subsequent inservice teaching. For example, why would they indicate that the course/practicum highly influenced their perspectives on discovery or inquiry teaching and yet indicate their inservice teaching was only moderately inquiry-based? We conjecture this disparity results from the influence of other teacher educators who shared

the responsibility for the mathematical preparation of these teachers with us. These educators included supervisors of their 3-week practicum and subsequent student teaching, cooperating teachers in whose classrooms these field experiences occurred, and mentors of various kinds in their first few years of inservice teaching. We believe these additional teacher educators influence the development of novice teachers' perspectives about and engagement in reform-based practice, an issue we are currently investigating.

In order to investigate the relationship between the preservice teachers' perceptions of course/practicum components that facilitated structural and conceptual interweaving and the degree of the course/practicum's influence, we addressed two additional questions.

1. How were the course/practicum components relating to structural interweaving perceived by the preservice teachers?
2. To what extent did the preservice teachers' perceive that their mentor teachers had identified with the reform movement, an issue related to conceptual interweaving?

As suggested by the research cited previously, (e.g., Author, et al., 2008, Author, et al., 2009, Whitford, Ruscoe, & Fickel, 2000), the components of structural interweaving in our course/practicum were favorably viewed. The preservice teachers perceived the weekly practicum as being more valuable than any other course component and a 3-week released-time practicum occurring towards the end of the course, despite the curricular continuity the latter provided. Indeed, the benefits of coordination and proximity between the course and the weekly field practicum outweighed the

inconveniences of traveling to the school site leading to the view that the practicum and other course components were a coherent methods learning system.

Additional evidence for this favorable view of structural interweaving was found in participants' responses to the survey items relating to immediate methods application in "reform-friendly" classrooms, which appears to increase methods learning and the long-term retention of that learning because of the opportunity it provides for methods experimentation. The preservice teachers' views support the conclusions of Snyder (2000) and Wingfield, Nath, Freeman, and Cohen (2000) about the value of a gradual assumption of classroom responsibility in methods-related practica as the methods course proceeds, although the gradual assumption of responsibility is not unique to weekly practica. Opportunities for the methods instructor to supervise the practicum (see Tchoshanov et al., 2001) and conduct a regular debriefing with the preservice teachers was an added benefit of the weekly practicum. Engaging in the weekly practicum with the support of preservice peers in the same classroom was also viewed positively (see Nokes, Bullough, Egan, Birrell, & Hansen, 2008) The mentor teachers in these classrooms were also perceived as being highly supportive of the preservice teachers.

Most of the mentor teachers who were involved in reform-based professional development simultaneous to the course/practicum were perceived as engaging in at least a moderate degree of reform-based teaching thus providing evidence of conceptual interweaving. This conclusion is evidenced by perceptions relating to the same nine characteristics of reform-based teaching that framed two other survey dimensions in responding to selected-response survey items. Also, while responding to the constructed-response survey items, many preservice teachers listed the congruence between the methods they were learning in the course and the methods being used by the mentor

teacher as an advantage of the weekly practicum. Many also considered a lack of such congruence to be a major disadvantage of the three-week practicum. Referring once again to our study of the influence of other teacher educators in the development of novice teachers, we are engaged in work examining the effects of a teacher preparation system in which all the individuals who contribute to a novice teacher's mathematical development are of a similar conceptual mind regarding reform perspectives. We conjecture that teacher education would be anything but a "weak intervention" if such a conceptual synchrony characterized those who contributed to that education.

Substantial evidence is provided in this study that the strong influence of the course/practicum was related to the opportunity for immediate methods application in reform-friendly classrooms and that the course and practicum were viewed as one coherent experience, thus corroborating the utility of structural and conceptual interweaving. That is to say, both the course and the practicum influenced the development of a coherent identity reflective of mathematics reform. In addition, the opportunities to work with preservice peers and to receive support from the methods instructor in the practicum were also influential. We have written about the influence of the methods course instructor while supporting methods-based field practica elsewhere (Author, et al., 2011)

Three other highly valued components of the course/practicum were not related to the influence of the course/practicum--the gradual assumption of teaching responsibility, the preservice teachers' attitudes toward meeting off campus, and the degree of support provided by the mentor inservice teachers. The latter result was especially interesting because the extent to which the preservice teachers viewed their inservice mentors as being oriented to reform was related to the observed degree of influence.

We wish to emphasize that although this program included teaching a methods course at public school sites, we do not believe that that the on-site course delivery is the reason for the results. The school site location is significant because of the opportunities provided for structural interweaving--particularly in reform-friendly classrooms. Other practicum structures may facilitate these characteristics.

We also re-emphasize that when we use the term “immediate methods application” we recognize the generative cognitive construction that occurs between coursework learning and classroom practice. Because we agree with Heibert et al. (1996), that when “learning is embedded in activity, students engage a variety of problem situations, and artificial distinctions between acquiring knowledge and applying it are eliminated” (p. 19), we view the commonly-held distinction between acquiring and applying knowledge as artificial. We argue that the operationalization of this view in teacher education enables preservice teachers to connect coursework and practice and thus avoid having to reconcile competing images of teaching as explained below.

Those who would problematize learning to teach by situating that learning in school classrooms focus teacher preparation on the development of a teacher identity: that is, supporting novices in finding out who they are as teachers. We make this claim because the development of a teacher identity results at least in part from extensive interaction with students (Schram, Lappan, & Lanier, 1991), which provides novices—both preservice and new inservice teachers—with the opportunity to acquire knowledge of students that they then use to modify and reconstruct their identities as teachers (Kagan, 1992)

We draw upon Gee’s (1999, 2001) connection between the creation of identity and the discourses that characterize disciplines. Discourses act as “identity kits,”

complete with the “appropriate costume and instructions on how to act, talk, and often write, so as to take on a particular role that others will recognize” (Gee, 2001, p. 526) Developing teacher identity involves utilizing particular discourses that characterize the teacher role as novices try on different teacher costumes. Therefore, Hall (2000) viewed identity as “situational—it shifts from context to context” (p. xi), and Bullough (1991) studied a novice teacher who characterized herself as a “chameleon” (p. 47)

When mathematics teacher educators answer the challenge of mathematics teaching reform by focusing their preservice teacher preparation efforts on school classrooms, they are faced with a daunting obstacle—helping preservice teachers negotiate the conflict between the separate identities that can result from disconnected university and school experiences (Sumara & Luce-Kapler, 1996) Thus Feiman-Nemser (2001) described teacher identity development as a “complex, on-going process” in which novices “must consolidate a professional identity” as they “struggle to reconcile competing images of their role” (p. 1029)

This struggle is minimized when teacher preparation programs structurally interweave methods instruction with practical classroom experience because in these settings images of the teacher role are more likely to be congruent, thus simplifying the identification process. We posit that this rationale underlies the effectiveness of integrated teacher preparation programs. Unfortunately, as Feiman-Nemser (2001) argued, programs that situate pedagogical learning in classroom practice are rare. “Conventional programs of teacher education . . . are not designed to promote complex learning by teachers or students” (p. 1014) She described “the typical preservice program” as a “weak intervention” because it fails to adequately address the “influence of teachers’ own schooling and their on-the-job experience” (p. 1014) upon the novice’s

developing teacher identity.

However, a disparity between the methods espoused in school classrooms and those espoused in university courses often marginalizes those of the university teacher educators (Eisenhart, Borko, Underhill, Brown, Jones, & Agard, 1993, Tabachnick, Popkewitz, & Zeichner, 1979-1980) even in the presence of meaningful structural interweaving. Thus a mismatch between what they are learning in their courses and what they are seeing in classrooms may present preservice teachers with conflicting teacher identities with which to identify. Bullough and Knowles (1991) note when the novice teacher's sense of identity is not well defined, methods course knowledge is superficial and easily replaced by the practices in the practicum classroom. Hence, as previously stated, they are "chameleons" (Bullough, 1991, p. 47) or "shape-shifters" (Hallman, 2007, p. 476, see also Gee, 2004) adjusting to the varied contexts of their teacher preparation because they perceive that "university instructors may want one kind of student and those students' future employers may want a different kind of teacher" (Hallman, 2007, p. 476)

On the other hand, if a coherent image of mathematics teaching and learning is portrayed by university instructors and inservice teachers in whose classrooms preservice teachers engage in field experiences--conceptual interweaving--the "shape-shifters" or "chameleons" do not have to radically adjust their shapes or costumes to vastly differing professional contexts. Thus, the fragile preservice teacher identities favoring a reform perspective developed during university coursework can be enhanced and solidified, rather than replaced, during field experiences.

Overall, this study provides support for a mathematics methods course curriculum that facilitates regular preservice methods application in reform-based classrooms as a

strategy for promoting reform, which Ma (1999) considers a responsibility of preservice teacher preparation. Through a conceptually and structurally coherent course and practicum experience, it appears that preservice teachers can personally identify with the reform movement and think of themselves as teachers who understand and embrace reform. Simultaneous renewal of both preservice and inservice teacher education (Goodlad, 1994) yields long-term benefits to both preservice teachers, as demonstrated in this study, and to inservice teachers. We have gathered evidence for this latter assertion, which we will present in subsequent publications.

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Table 1

Research Question-Dimension Relationships

Research Question	Related Dimensions
1. To what extent did the preservice teachers involved in our course/practicum identify with current reforms in mathematics teaching and learning as evidenced by their subsequent inservice teaching?	Dimension 1. The degree of alignment between current reforms and the preservice teacher’s subsequent inservice teaching
2. How influential did the preservice teachers perceive the course/practicum to be upon the extent to which they identified with those reforms?	Dimension 2. The influence of the course/practicum
3. (addressed by analyzing responses to other survey items)	
4. How were the course/practicum components relating to structural interweaving perceived by the preservice teachers?	Dimension 4. Components relating to structural interweaving 4A-1. Relative advantages and disadvantages of the weekly field experience (immediate methods application) 4A-2. Possible influence of a weekly field experience upon a methods course (immediate methods application) 4B. Gradual increase of teaching responsibility in clinical work 4C. Methods instructor supervision of clinical work—debriefing 4D. Inservice-preservice teacher relationships that enhance mentoring 4E. Preservice teachers partnering with one another in shared clinical placements 4F. Relative utility of the practicum compared to other course activities 4G. Degree of coherence between the practicum and other course activities 4H. Procedural issues primarily concerned with meeting off campus for the methods course
5. To what extent did the preservice teachers’ perceive that their mentor teachers had identified with the reform movement, an issue related to conceptual interweaving?	Dimension 5. Conceptual interweaving

Table 2

(Sub) Dimensions of Elementary Mathematics Reform (Ross et al., 2003 Survey)

Survey Dimension Title	Dimension Description
D1: Program scope	A broader scope (e.g., multiple mathematics strands with increased attention on those less commonly taught such as probability, rather than an exclusive focus on numeration and operations) with all students having access to all forms of mathematics.
D2: Student tasks	Student tasks are complex, open-ended problems embedded in real life contexts, many of these problems do not afford a single solution. In contrast in traditional mathematics students work on routine applications of basic operations in decontextualized, single solution problems.
D3: Discovery Instruction	Instruction in reform classes focuses on the construction of mathematical ideas through student discovery contrasting with the transmission of canonical knowledge through presentation, practice, feedback, and remediation in traditional programs.
D4: Teacher's role	The teacher's role in reform settings is that of co-learner and creator of a mathematical community rather than sole knowledge expert.
D5: Manipulatives and tools	Mathematical problems are undertaken in reform classes with the aid of manipulatives and with ready access to mathematical tools (i.e., calculators and computers) In traditional programs such tools are not available or their use is restricted to teacher presentations of new ideas.
D6: Student-student interaction	In reform teaching the classroom is organized to promote student-student interaction, rather than to discourage it as an off task distraction.
D7: Student assessment	Assessment in the reform class is authentic (i.e., relevant to the lives of students), integrated with everyday instruction, and taps multiple-levels of performance. In contrast, assessment in traditional programs is characterized by end of week and unit tests of near transfer.
D8: Teacher's conceptions of math as a discipline	The teacher's conception of mathematics in the reform class is that of a dynamic subject rather than a fixed body of knowledge.
D9: Student confidence	Teachers in the reform setting strive to raise student self-confidence in mathematics rather than impede it.

Table 3

Summary of Item-Total Correlation Coefficients

Dimension	# of items	Cronbach's Alpha	# of items below .30	Revised Alpha
1. Degree of implementation of reform-based teaching	20	n/a ^a	n/a	n/a
2. Influence of course/practicum	9	.897	0	n/a
4B. Gradual increase of teaching responsibility in clinical work	3	.787	0	n/a
4C. Methods instructor supervision of clinical work—debriefing	6	.906	0	n/a
4D. Inservice-preservice teacher relationships that enhance mentoring	6	.886	0	n/a
4E. Preservice teachers partnering with one another in shared clinical placements	2	.776	0	n/a
4F. Relative utility of the practicum compared to other course activities	6	.692	1	.878 ^b
4G. Degree of coherence between the practicum and other course activities	6	.801	0	n/a
4H. Procedural issues primarily concerned with meeting off campus for the methods course	2	.503	0	n/a
5. Conceptual interweaving	9	.952	0	n/a

Note.

^aThe psychometric characteristics of these items are available from Ross et al. (2003)

^bThe only original alpha requiring re-computing resulted in this alpha, hence the n/a's in this column.

Table 4

*Degree of Implementation of Reform-Based Teaching (Ross, et al., 2003 Survey):
Categorized Response Percentages for Survey Dimension 1 (n= 67)*

Sub-dimension	Strongly disagree	Disagree	Disagree somewhat	Agree somewhat	Agree	Strongly Agree	Sub-dimension Mean Rating
Program scope	0	1.5	23.9	46.7	22.5	6.0	4.06
Student tasks	0	0	0	17.9	50.7	24.3	4.69
Discovery Instruction	1.5	3.0	13.6	33.3	30.3	18.2	4.03
Teacher's role	0	0	1.5	10.5	44.8	43.2	5.30
Manipulatives and tools	0	0	13.4	30.0	37.3	9.0	4.00
Student-student interaction	0	0	0	9.0	43.3	47.7	5.30
Student assessment	0	1.5	0	12.0	46.2	40.3	5.21
Teacher's conceptions of math as a discipline	4.5	7.5	17.9	25.4	28.4	16.4	5.28
Student confidence	0	0	0	6.0	25.4	68.6	5.63
Response category mean percentages	0.67	1.5	7.81	21.2	36.54	30.41	4.82

Table 5

Influence of the Course/Practicum: Categorized Response Percentages for Survey Dimension 2 (n = 68)

Survey item	Very negatively	Negatively	Not at all	Positively	Very positively
Program scope	0	0	3.0	27.3	69.7
Student tasks	0	0	0	29.2	70.8
Discovery Instruction	0	0	0	36.9	63.1
Teacher's role	0	0	4.6	35.4	60.0
Manipulatives and tools	0	0	0	27.7	72.3
Student-student interaction	0	0	0	40.0	60.0
Student assessment	0	0	0	30.8	69.2
Teacher's conceptions of math as a discipline	0	0	7.7	27.7	64.6
Student confidence	0	0	0	20.0	80.0
Response category mean					
Percentages	0	0	1.7	30.56	67.74

Table 6

Summary of Structural Interweaving Responses: Categorized Response Percentages for Survey Dimensions 4B-4H

4B Gradual increase of responsibility (n = 65)	Quite hindering	Somewhat hindering	Enabling	Quite Enabling	
Mean Percentages	1.03	9.73	52.30	36.93	
4C Effects of debriefing (n = 65)	Not at all	Somewhat	Moderately	Substantially	Dramatically
Mean Percentages	2.38	2.78	14.78	37.10	44.93
4D Inservice-Preservice Teacher Relationships (n = 65)	Never	Seldom	Sometimes	Frequently	Consistently
Mean Percentages	2.03	5.63	18.20	20.50	53.60
4E Preservice Partnering (n=65)	Never	Seldom	Sometimes	Frequently	Consistently
Mean Percentages	3.63	12.27	17.07	46.27	20.73
4F Relative Utility of Practicum (n = 68)	Much less Helpful	Less helpful	About as helpful	More helpful	Much more helpful
Mean Percentages	2.28	9.13	25.73	26.48	35.78
4G Degree of Coherence (n = 68)	Not at all	Slightly	Moderately	Substantially	Dramatically
Mean Percentages	1.47	11.03	25.5	35.78	26.23
Procedural Issues (n = 63)	Quite unwilling	Unwilling	Willing	Quite willing	
Mean Percentages	3.2	1.6	28.6	66.7	

Table 7

Conceptual Interweaving: Categorized Response Percentages for Survey Dimension 5 (n = 68)

Survey item	Not at all	Slightly	Moderately	Substantially	Dramatically
Program scope	1.5	0	18.5	47.7	32.3
Student tasks	0	4.6	15.4	33.8	46.2
Discovery Instruction	1.6	4.7	18.8	34.4	40.6
Teacher's role	3.1	4.6	18.5	40.0	33.8
Manipulatives and tools	0	3.1	15.4	35.4	46.2
Student-student interaction	3.1	3.1	15.4	33.8	44.6
Student assessment	1.5	4.6	15.4	46.2	32.3
Teacher's conceptions of math as a discipline	3.1	7.7	13.8	26.2	49.2
Student confidence	1.5	3.1	12.3	26.2	56.9
Response category mean percentages	1.71	3.95	15.95	35.97	42.46

Table 8

Summary of Forward Selection

Step	Variable Entered	Partial R-Square	Model R-Square	C(p)	F Value	Pr > F
1	D10	0.3187	0.3187	-0.3000	28.54	<.0001
2	D8	0.0173	0.3360	0.2087	1.56	0.2159
3	D3	0.0142	0.3502	0.9864	1.29	0.2610

Table 9

Mean Group Comparisons by Factor

Dimension	Group	<i>n</i>	Mean Dimension 5 (range 1-5)	<i>df</i>	<i>t</i> -value	<i>p</i>
3. Course Coherence	Greater	19	4.83	63	2.442	.017
	Lesser	46	4.59			
6. Degree of reform perspective possessed by mentor teacher	Greater	38	4.82	62	4.368	.000
	Lesser	26	4.45			
7. Degree of mentor teacher support	Greater	38	4.72	63	1.530	.131
	Lesser	27	4.58			
8. Nature of preservice teachers' partnering	Greater	40	4.83	53	2.815	.007
	Lesser	15	4.41			
9. Gradual assumption of teaching responsibility	Greater	34	4.68	63	.518	.606
	Lesser	31	4.63			
10. Debriefing weekly practicum with methods instructor	Greater	34	2.69	60	1.094	.278
	Lesser	28	2.52			
12. Procedural issues related to travel	Greater	15	2.61	60	.012	.990
	Lesser	47	2.62			