DOCUMENT RESUME

ED 468 485 TM 034 395

AUTHOR	Cwikla, Julie
TITLE	The Importance of Setting Teacher Learning Goals To Investigate the Effectiveness of Teacher Professional Development.
PUB DATE	2002-04-00
NOTE	26p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 1-5, 2002).
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC02 Plus Postage.
DESCRIPTORS	Educational Environment; *Educational Objectives; Elementary Secondary Education; *Faculty Development; *Learning; Teacher Effectiveness; *Teachers

ABSTRACT

Professional development activities are learning environments for teachers just as classroom activities are a learning environment for students. Research on effective teaching is guided by learning goals for students and how these goals can best be achieved. It follows that research on effective professional development should be guided by the learning goals for teachers and how these goals can best be achieved. This paper argues that systematic data documenting effective teacher learning environments have not accumulated because what it means to become an effective teacher has not been made sufficiently clear. Obstacles that have discouraged the development of learning goals for teachers are also discussed. Once teachers' learning goals are made explicit, the types of learning environments that encourage the achievement of those goals could be investigated systematically. (Contains 1 table and 64 references.) (Author/SLD)

RUNNING HEAD: Learning Goals to Investigate P.D.

The Importance of Setting Teacher Learning Goals to Investigate the Effectiveness of Teacher Professional Development

Julie Cwikla, Ph.D.

University of Southern Mississippi

Paper presented at the annual meeting of the American Educational Research Association in New Orleans, April 2002.

Abstract

Professional development activities are learning environments for teachers just as classroom activities are a learning environment for students. Research on effective teaching is guided by the learning goals for students, and how these goals can best be achieved. It follows that research on effective professional development should be guided by the learning goals for teachers, and how these goals can best be achieved. This paper argues that systematic data documenting effective teacher learning environments have not accumulated because what it means to become an effective teacher has not been made sufficiently clear. Obstacles that have discouraged the development of learning goals for teachers are also discussed. Once teachers' learning goals are made explicit, the types of learning environments that encourage the achievement of those goals could be investigated systematically.

Introduction

The National Council of Teachers of Mathematics (NCTM) has established detailed academic standards to guide K-12 learning goals for students. However, it is unlikely that many K-12 teachers have learned to adjust their teaching with these new learning goals and Standards as the product. Teachers are expected to teach more content in a deep and meaningful manner without sufficient support (Lampert & Ball, 1999). To compound the situation once teachers are in the field, the U.S. education system has no proven mechanism to systematically improve teaching in our classrooms (Stigler & Hiebert, 1999). Research in the area of professional development for mathematics teachers must become more rigorous and attend to the specific learning environments that benefit teachers' development. Yet, the research will not become more systematic until the learning goals for teachers and teacher development programs are more clearly defined.

Purpose

The purpose of this review is to draw lessons from the research on learning environments for students to aid in thinking about learning environments for teachers. The classroom is a learning environment for students just as professional development activities are learning environments for teachers. Research on effective teaching is guided by the learning goals for students, and how these goals can best be achieved. It follows that research on effective professional development should be guided by the learning goals for teachers, and how these goals can best be achieved.

The thesis of this paper is that research on professional development lags behind research on mathematics classroom teaching because in part the learning goals for teachers have not yet

been made explicit. Systematic data documenting effective professional development learning environments have not accumulated because what it means to become an effective teacher has not been made sufficiently clear. It will be argued that, although setting specific learning goals for teachers that are linked with particular student outcomes is now within reach, there are multiple reasons that learning goals for teachers have not yet been fully developed. And it will be asserted further that once there is consensus for mathematics teachers' professional learning goals, researchers will be able to analyze the specific nature of the learning environments that achieve those desired goals or standards.

Learning Environments

Students and teachers as learners present different cognitive profiles, but their learning environments are similar in a number of ways. A deep understanding of the mathematical content is a goal for both students and teachers as learners. Ideally, teachers enter the field with a deep mathematical understanding, but for many, this is not the case (Silver & Stein, 1996). Pre-service teacher training programs have not provided teachers the time necessary to understand the mathematical and pedagogical content (Post, Cramer, Harel, Kieren, & Lesh; 1998). As a result, prospective teachers entering the field have a narrow understanding of the content that is centered about procedures (Ball, 1990). It is obvious that when teachers do not possess a deep understanding themselves they are not prepared to help students learn mathematics in a meaningful way. Therefore, the learning environments for teachers or for students should support the development of conceptual and procedural understanding, the connections between them, and the opportunity to make sense of mathematics.

Both learning environments should grow out of the prior knowledge the learner brings to the task or learning situation (Cobb, Wood, & Yackel, 1990; Shulman, 1986; Steffe, 1990).

Collaboration and group tasks have become significant components of students' classroom learning as well as teachers' professional development (Sparks & Loucks-Horsley, 1989). Finally, feedback and verbal assessment are components of both student and teacher learning environments that might guide the learners' mathematical trajectories toward the learning goals (Wiggins, 1998). These similarities suggest that research on student learning and classroom teaching might inform research on teacher learning and professional development.

Trends in Research in Mathematics Teaching & Learning

Looking back briefly at the general trends in the past century of research on students' mathematical learning might help to shape our thinking about the next steps for research in teachers' professional development and teacher learning. The beginning of the 20th century was characterized by psychological studies of students' mathematical learning (e.g. Brownell (1935), Bruekner (1939), Judd (1928), Smith (1926), and Thorndike (1922, 1949)). The research was primarily centered around knowledge acquisition, focused on student learning and the psychology of mathematical understanding. Although Dewey (1910) also published significant work at the turn of the century about learning communities and collaboration, his writings were not fully appreciated at the time. In the 1960s, the work of Piaget and his followers permeated educational and psychological research. Educators turned their attention to student-constructed understandings, investigations of the appropriate stages to introduce mathematical concepts, and student discovery and knowledge construction (e.g. Ausubel, 1968; Bruner, 1971; Piaget, 1964). During this time, most mathematics education research focused on student learning and developmentally appropriate curriculum materials.

In the later part of the century the overall research trend in mathematics education expanded to include teaching and learning. Studies began to examine the context of students'

learning, the classroom environment, teaching and its many facets (e.g. Cobb, 1988; Good, Grouws, & Ebmeier, 1983; Hansen, McCann, & Myers, 1985; Lampert, 1991; Schoenfeld, 1989; Shulman, 1986). Research on students' learning was guided by specific learning goals and desired outcomes from specific pedagogical methods in students' learning environments. I have chosen three studies to illustrate the use of learning goals for students and implications for research design. Each study investigated different facets of the students' learning environment.

Three Studies with Increasingly Specific Learning Goals

It is worthwhile to review mathematics education research on students' learning environments to help envision research on professional development and teachers' learning environments. The reviews of the three studies that follow show different levels of specificity with which classroom learning environments have been investigated. These studies were chosen based on their research focus and because they each build upon the findings of the previous study.

What is of interest for this argument is that the more specific the learning goals for the students in each study and the more specific the components of the learning environment that are investigated, the more specific the claims that are made about the nature of an effective learning environment. It was in this research climate of detailed studies about teaching and learning that eventually led the development of the NCTM Standards for K-12 mathematics classrooms. The Standards have led the national movement in mathematics reform and made explicit the learning goals for students. The parallel situation does not exist yet in professional development, but these studies offer not only useful empirical evidence about classrooms, but the research design each study employed might guide research efforts in teacher learning environments.

Each study provides systematic data about the effectiveness of different aspects of learning environments as measured by students' learning goals. The three studies provide empirically supported guidelines for (a) the use of classroom time: developmental vs. practice, (b) the behaviors of more and less effective teachers, and (c) the order of mathematical task presentation. These three studies vary in specificity of learning goals and the feature of the learning environment investigated. Although all the studies investigate links between teaching and learning, they do so in increasingly specific ways (See Table 1).

Insert Table 1 Here

Zahn (1966) examined how student learning was impacted by separating class time into various combinations of "developmental activities" and "practice work" (e.g. 67% developmental, 33% practice; 45% developmental, 55% practice). Students' learning was measured by performance on a three-part posttest following 18 weeks of mathematics instruction. Zahn's study evaluated four different learning environments based on students' learning goals defined by standardized achievement scores. The data showed that the student groups that experienced more development activities than practice work scored significantly better than the groups with more practice work. In Zahn's study the learning goals were relatively general, increased achievement on a standardized assessment. The treatment was also broad, partitioning class time into two types of activities based on learning theories. Zahn provided data to support developmental activities and their positive effect on student achievement, but the exact nature of the developmental activities that support students' learning are not revealed and cannot be reconstructed from the data. In this study the goal for student

learning was to increase achievement on a standardized assessment and the feature of the learning environment investigated was the use of classroom time: developmental vs. practice activities.

The Good, Grouws, & Ebmeier (1983) studies extended the work of Zahn, looking for relationships between the teacher behaviors and student achievement. They investigated a component of the learning environment, with more specificity than Zahn (1966) but students' learning was measured in an equally general way as before on a standardized test. The researchers collected four types of information during the classroom observations: descriptions of (a) use of class time, (b) teacher-student interactions, (c) general teacher managerial style, and (d) materials and homework assignments. Classroom observations correlated with students' achievement scores provided a description of an effective teacher. Students who obtained high test scores were generally taught by active teachers with the following behaviors: Teachers (a) provided clear presentations of information, (b) were relatively non-evaluative, creating a comfortable learning environment, (c) maintained high expectations of student learning, and (d) spent most of the class time on mathematics, not socialization.

Because Good et al. (1983) investigated the components of the learning environment more explicitly and in more detail than Zahn (1966), they drew more specific conclusions about the features of the learning environment that affected students' learning. However, because they measured the students' learning goal with a general test, they were not able to make claims about the <u>specific kind of learning</u> that was influenced by these features of the learning environment. In other words, the goal for student learning was to increase achievement on a standardized assessment and the feature of the learning environment investigated was the teachers' behaviors.

Later research studies investigating the effectiveness of students' learning environments measured achievement of students' learning goals with tools other than standardized assessments (e.g. Carpenter & Moser, 1984; Collis, Romberg, & Jurdak, 1986). This paralleled the growing literature about student cognition in other fields and the increased attention to students' understanding over the acquisition of mathematical skills and procedures.

In the final study to be reviewed here, Wearne & Hiebert (1988) designed a program to develop students' conceptual understandings of decimal fractions. They developed a specific set of assessment tasks aligned with the students' learning goals of the experimental teaching program and combined them with tasks aligned with a more traditional control program. A four-process theory of cognition was developed and guided the design of the treatment and the development of the assessment tasks. This study examined students' learning with and without prior formal introduction to decimals. Their findings suggest that, if the learning goal for students is to <u>understand</u> the procedures they use, then students should be introduced to conceptual underpinnings before symbol manipulation. Unlike the previously mentioned studies, these researchers designed an assessment closely aligned with the explicit learning goals for the purpose of evaluating the impact of the teaching experiment. In this study the goal for student learning was to develop conceptual understanding of decimal fractions and the feature of the learning environment was the order of task presentation with concepts and symbol manipulation.

The lessons to be learned from these studies follow. (1) When the students' <u>learning goals</u> are clear and specific, and when the feature of the learning environment is described in detail, it is easier for investigators to analyze the specific features of the learning environment that contribute to the achievement of the goals. The more specific the learning goals and features investigated, the more specific the research claims about how to achieve the desired learning

goals. (2) The research design employed to investigate the effectiveness of a learning environment for students or for teachers must include explicit goals for the existence of the learning environment. In the case of professional development, how can researchers possibly investigate the progress of a program if the program is not designed around clear learning goals for the teachers?

Over the past two decades the mathematics educational community has been converging toward some agreement about what students' learning goals should be and, because of the handful of studies mentioned here and others, toward some agreement on how an effective learning environment might function in reference to these goals. Careful research studies investigating features of the students' learning environment amassed empirical data that created an atmosphere of accord. This provided a context in which the National Council of Teachers of Mathematics could develop a set of consensus Standards (1989, 1991, 1995, and 1999) or recommendations for K-12 mathematics curriculum, teaching, and assessment.

The field of teacher development in mathematics education has not accumulated a similar collection of empirical data indicating effective features for teachers' learning environments. Therefore, convergence or agreement about what teachers need to understand to be able to facilitate a learning environment for students that supports the NCTM Standards, is not yet within reach. However, if the field could agree on learning goals or standards for teachers both pre-service and in-service, research to achieve teacher learning goals might follow a similar path as the studies on students' learning environment.

Current Teacher Development Research

Recently, the research field in mathematics education has expanded to include an influx of research on teacher development, teacher change, and professional education (e.g. Carpenter

& Fennema, 1992; Cobb, Wood, & Yackel, 1990; Cohen & Hill, 1998; Cooney, 1994; Fennema, Carpenter, Franke, Levi, Jacobs, & Empson, 1996; Franke, Carpenter, Levi, & Fennema, 2001; Hiebert & Wearne, 1992; Hyde, Ormiston, & Hyde, 1994; Kazemi & Franke, 2000; Knapp & Peterson, 1995; Stigler & Hiebert, 1999; and Wilson & Ball, 1991). Professional development is a growing area of research in mathematics education as well as in other educational fields. Yet, the field as a whole remains unfocused. Empirical data have not systematically accumulated, so it is difficult to confirm which features of professional development programs are most critical to support teachers' ongoing learning. The mathematics education research literature is more capable of providing guidelines for effective classroom teaching than giving recommendations for developing teachers who can engage in such teaching.

Why does professional development research lag behind its counterpart? One obvious reason is the natural developmental lag between studying students' learning, then teaching, and then learning to teach. However, another reason emerges through examining much of the current work on professional development. Much of the professional development literature is expert opinion, anecdotal evidence, or unsupported conjecture. As argued above this is in part because the literature has not yet provided a set of well-defined learning goals for teachers in the same way it has provided learning goals for K-12 students of mathematics. Without learning goals and explicit desired outcomes for teachers participating in professional development learning environments, it is difficult to determine if a program is making progress. Developing goals for teachers as ongoing learners is essential for advancing research in this field and guiding the work of professional developers, teacher educators, and researchers.

Learning Goals for Teachers

Given the similarities between the purpose of student and teacher learning environments, the lessons learned about effective classroom teaching might help to guide our future research in professional development. The NCTM defined Standards (1989, 1991, 1995, and 1999) for students of mathematics such as: learn to use mathematics flexibly, build connections between concepts, and focus learning on depth of understanding. These goals are explicit and describe expectations for students' thinking and attitudes toward the investigation of mathematical concepts. The learning goals are quite clear but are defined in cognitive rather than behavioral terms and are not easily measured by traditional standardized tests. The NCTM Standards reflect the recent attention to students' understanding and cognitively based learning theories.

The spirit of the learning goals for teachers suggested in this paper, parallel the current learning goals or NCTM Standards for students. Developing explicit learning goals for teachers that focus on a depth of understanding rather than discrete teacher behaviors will help guide the developers of professional programs, researchers of professional development, and help teachers who are focused on improving their classroom practice.

In addition to the conclusions drawn from the three studies reviewed above, the literature provides some empirical support and a good deal of conjecture about what it means to be an effective teacher. What is striking is the degree of consensus within the research community regarding a handful of characteristics that define an effective teacher. These characteristics could guide the design of learning goals for professional development learning environments.

One example is that a teacher should be attentive to students' thinking in the classroom (Fennema, Carpenter, Franke, Levi, Jacobs, & Empson, 1996; Franke, Carpenter, Fennema, Ansell, & Behrend, 1998; Shulman, 1986). An effective teacher attends to students' thinking

and considers how best to link their current thinking with intended understandings of mathematical concepts, and uses this knowledge in pedagogical decisions. Simon (1995) recommends, for example, that teachers construct and continually revise the students' "hypothetical learning trajectory," by predicting learners' paths to understanding and using this knowledge to design learning activities and adjust them according to students' understanding.

Other characteristics of effective teachers have drawn attention in the literature such as (a) provide an equitable learning culture supportive of active communication (Maturana & Varela, 1980; Cobb, Wood, & Yackel, 1990), (b) support the development of meaningful mathematical tasks (Hiebert, Carpenter, Fennema, Fuson, Human, Murray, Olivier, & Wearne, 1996), and (c) provide ongoing formative feedback and assessment (Wiggins, 1998). There is some data to support each of these recommendations for effective teachers. Why is it that characteristics such as these rarely serve as a basis to develop cognitively based learning goals for teachers?

There are a number of possible explanations why teachers' learning goals have not been made explicit and each will be discussed in more detail below. (1) The current measures of a successful professional program are usually not based directly on teachers' learning. (2) Teaching, for the most part, has remained a hidden profession making it difficult to assess teachers' learning needs. (3) Professional development has traditionally treated teachers as technicians and not as learners. (4) The social norms and expectations in teachers' learning environments are frequently not supportive of teacher inquiry, learning, and collaboration.

(1) Current Measures - The success of professional development programs often is measured either intentionally or unintentionally by teacher attitudes or concerns, student achievement, teacher attendance, facilitators' evaluations, and other equally non-rigorous

measures of teacher learning. Teacher learning, adoption, and implementation of a new instructional method, or philosophy such as the NCTM Standards, require time for teacher understanding, experimentation, shifts in attitudes and views about teaching and learning and so on (Fullan, 1991, 1996; Putnam & Borko, 1997). When measures such as those above are used to evaluate success, the intricacies of the professional development program and the features of the learning environment that might have influenced teacher learning and change often are not documented in detail. If a sequence of learning goals for teachers is made explicit, it becomes clearer how to evaluate the effectiveness of their learning environment. If "intermediate" teacher learning goals are made explicit, the measures of the professional developments' success could be based on teacher change as well as later improvements in student achievement.

(2) Professional Isolation - Another possible reason learning goals for teachers have remained vague and unspecified is the isolation present in the American system of education (Lortie, 1975). Teaching has been treated as a province of individual teachers and not a public activity to be examined. Teaching has remained a hidden activity practiced in isolation from the public and even concealed from peers (Ball & Cohen, 1999; CTGV, 1997). The workday experience of most teachers takes place behind closed classroom doors. The few daily collegial interactions consist of venting frustrations with students or administration, but "they don't permit serious discussion of instructional issues" (Schifter & Fosnot, 1993; p.18). If the teaching profession were made more public for peer observation and comparative analysis, teachers' learning needs would become more salient to teachers and the professional developers.

In addition to individual isolation, teachers might also be isolated from the design and creation of professional programs designed to help their own profession (Lortie, 1987). Most teacher development programs are imposed from outside the teachers' professional community

(Clark & Florio-Ruane, 2001). Professional programs are often funded by sources outside a district or state, with agendas that might or might not be in accord with what the individual teachers think they need. As a result, teachers do not have a sense of ownership in the project or the project goals and they might not be as inclined to participate in meaningful ways.

When teachers are left out of the planning process and design of their own professional learning environment and the accompanying learning goals, people other than teachers are determining teachers' needs, weaknesses, and strengths. This compounded with the isolation that teachers experience in their classroom practice and school setting makes it difficult to provide professional experiences to support teachers' needs because a forum for communication of their needs is not provided.

(3) Teachers as Technicians – Over the years, professional development has not traditionally been guided by cognitive learning goals for teachers. The traditional approach to professional development focuses on specific processes or methods that teachers should be implementing in their classroom (Richardson & Placier, 2001). Teachers have been viewed as technicians who simply implement curriculum without continually assessing and integrating their students' thinking and understandings into pedagogical decisions (Clark & Peterson, 1986).

Researchers correlated various teacher classroom behaviors and student achievement in the process-product literature (Brophy & Good, 1986; Rosenshine, 1995). This research drew attention to isolated teacher behaviors in the classroom that correlated with improvement on standardized measures. The process-product literature provides a framework to think about teacher improvement as the mastery of specific behaviors. Behavioral rules, although specific,

do not fit the definition of the learning goals proposed in this paper, which include the teacher's development of a depth of understanding and flexible use of knowledge.

Researchers have described a cognitive approach to classroom instruction and student learning, but there has been little national movement to define cognitive learning goals for teachers, other than a handful of university based programs (e.g. Cognitively Guided Instruction, Summer Math). Perhaps researchers are concerned that practitioners might misinterpret explicit learning goals as behavioral requirements and professional developers would treat teachers as technicians.

(4) Social Norms – In addition to the traditional structure of teacher learning environments there is a possible social obstacle for expressing teachers' learning goals in detailed and explicit ways. Teachers and professional developers might naturally have been socialized by their participation in professional development programs. In the past, professional development has been equated with short-term workshops and formal presentations with the focus of improving students' achievement and not continuous teacher learning and growth. These formats and goals are familiar and acceptable to teachers and administrators and shape their expectations of professional development (McDiarmid & Kelly, 1997). Therefore, in general practice the expected norms do not include long-term continuous teacher learning as the driving force behind improving student learning. For that reason, professional development can become a "series of loosely related stabs at quick-fix solutions to narrowly defined problems" as opposed to an impetus for continuous teacher learning and improvement (Clark & Florio-Ruane, 2001; p.5). Changes in expectations by both the professional developers and the teachers might be required to shift the focus to teacher learning as the primary objective of professional development.

These obstacles to articulating and assessing learning goals for teachers can be overcome. Although they are the products of tradition and beliefs, they have rarely been dealt with in a careful and systematic way. Clear learning goals for teachers could be formulated from the existing literature about effective teaching and teachers. If goals are made explicit then they can be used to evaluate the effectiveness of teachers' learning environments and the nature of the learning activities that support the achievement of the goals.

Summary & Implications

There is widespread agreement in the mathematics education community about the learning goals for students as evidenced by the NCTM Standards (1989, 1991, 1995, 1999). There is also agreement about the characteristics of an effective learning environment for students and the characteristics of an effective teacher, but learning goals for teachers remain ambiguous. The current literature is sprinkled with a variety of professional principles, guidelines, and frameworks for professional development (e.g. Guskey, 1986; Hawley & Valli, 1999; Lampert & Ball, 1999; Showers, Joyce, & Bennett, 1987; Sparks & Loucks-Horsley, 1989). Embedded in some of these lists of recommendations are the beginnings of learning goals and adult learning theories to achieve those goals. However, the literature has not yet described professional development explicitly in terms of teachers' learning goals and the learning environment to achieve those goals. Until teachers' learning goals are made explicit, empirical research on the methods to support teacher development and their learning environments will not accumulate.

Table 1: Comparison of three studies

Study	Learning Goals	Feature Studied
Zahn (1966)	General Standardized Assessment	General Class Time
Good, Grouws, & Ebmeier (1983)	General Standardized Assessment	Specific Teachers' Behaviors
Wearne & Hiebert (1988)	Specific Assessment Designed for Study	Specific Task Presentation

References

Ausubel, D.P. (1968). Educational psychology: A cognitive view. New York: Holt, Rinehart, and Winston, Inc.

Ball, D.L. (1990). The mathematical understanding that prospective teachers bring to teacher education. Elementary School Journal, 90 449-466.

Ball, D.L., & Cohen, D. (1999). Developing practitioners: Toward a practice-based theory of professional development. In L. Darling-Hammond & G. Sykes (Eds.), Teaching as the learning profession: Handbook of policy and practice (pp. 3-32). San Francisco, CA: Jossey-Bass.

Brophy, J., & Good, T.L. (1986). Teacher behavior and student achievement. In M.C. Wittrock (Ed.), Handbook of research on teaching (3rd ed., pp. 328-375). New York: Macmillian.

Brownell, W.A. (1935). Psychological considerations in the learning and the teaching of arithmetic. In W.D. Reeve (Ed.) The teaching of arithmetic, (The tenth yearbook of the National Council of Teachers of Mathematics) (pp. 1-31). New York: Columbia University, Teachers College.

Bruekner, L.J. (1939). The development of ability in arithmetic. In C.M. Whippe (Ed.), Child development and the curriculum. (The 35th Yearbook of the National Society for the Study of Education). (pp. 275-298). Chicago: The University of Chicago Press.

Bruner, J. (1971). On learning mathematics. In D.B. Aichele and R.E. Rayes (Eds.) Readings in secondary school mathematics. (pp. 166-177). Boston: Prindle, Weber, & Schmidt, Inc.

Carpenter, T.P., & Fennema, E. (1992). Cognitively guided instruction: Building on the knowledge of students and teachers. International Journal of Research in Education 17, 457-470.

Carpenter, T.P., & Moser, J.M. (1984). The acquisition of addition and subtraction concepts in grades one through three. Journal for Research in Mathematics Education, 13, 179-202.

Clark, C.M., & Florio-Ruane, S. (2001). Conversations as support for teaching in new ways. In C.M. Clark (Ed.), Talking Shop (pp. 1-15). New York, NY: Teachers College Press.

Clark, C.M., & Peterson, P.L. (1986). Teachers' thought processes. In M.C. Wittrock (Ed.), Handbook of research on teaching (3rd ed., pp. 255-296). New York: Macmillian.

Cobb, P. (1988). The tension between theories of learning and instruction in mathematics education. Educational Psychologist, 23, 87-103

Cobb, P., Wood, T., & Yackel, E. (1990). Classrooms as learning environments for teachers and researchers. In R. Davis, C. Maher, & N. Noddings (Eds.), Constructivist views on the teaching and learning of mathematics. Journal for Research in Mathematics Education Monograph Series, Number 4 (pp. 125-146). Reston, VA: National Council of Teachers of Mathematics.

Cohen, D.K., & Hill, H.C. (1998). Instructional policy and classroom performance: The mathematics reform in California. University of Michigan: Ann Arbor, Michigan.

Collis, K.F., Romberg, T.A., & Murad, E.J. (1986). A technique for assessing mathematical problem-solving ability. Journal for Research in Mathematics Education, 17, 206-221.

The Cognition and Technology Groups at Vanderbilt (1997). The Jasper Project: Lessons in curriculum, instruction, assessment, and professional development. Mahwah, N.J.: Lawrence Erlbaum.

Dewey, J. (1910). How we think. Boston: D.C. Heath.

Fennema, E., Carpenter, T.P., Franke, M.L., Levi, L., Jacobs, V., & Empson, L. (1996). A longitudinal study of learning to use children's thinking in mathematics instruction. Journal for Research in Mathematics Education, 27 (4), 403-434.

Franke, M.L., Fennema, E., Carpenter, T.P., Ansell, E., & Behrend, J. (1998). Understanding teachers' self-sustaining change in the context of professional development. Teaching and Teacher Education, 14 (1), 67-80.

Franke, M.L., Carpenter, T.P., Levi, L., & Fennema, E. (2001). Capturing teachers' generative change: A follow up study of professional development in mathematics. American Educational Research Journal, 38 (3), 653-690.

Fullan, M.G. (1991). The new meaning of educational change (2nd ed.). New York: Teachers College Press.

Fullan, M.G. (1996). Professional culture and educational change. School Psychology Review, 25 (4), 496-500.

Good, T.L., Grouws, D., & Ebmeier, H. (1983). Active mathematics teaching. New York: Longman.

Guskey, T. (1986). Staff development and the process of teacher change. Educational Researcher, 15 5-12.

Hansen, R.S., McCann, J., & Myers, J.L. (1985). Rote versus conceptual emphases in teaching elementary probability. Journal for Research in Mathematics Education, 16, 364-374.

Hawley, W.D., & Valli, L. (1999). The essentials of effective professional development: A new consensus. In L. Darling-Hammond & G. Sykes (Eds.), Teaching as the learning profession: Handbook of policy and practice (pp. 127-150). San Francisco, CA: Jossey-Bass.

Hiebert, J., Carpenter, T.P., Fennema, E., Fuson, E., Wearne, D., Murray, H.A., Olivier,

A., & Murray, H. (1996). Making Sense: Teaching and learning mathematics with understanding. Portsmouth, NH: Heinemann.

Hiebert, J., & Wearne, D. (1992). Links between teaching and learning place value with understanding in first grade. Journal for Research in Mathematics Education, 23, 98-122.

Hyde, A. Ormiston, M., & Hyde, P. (1994). Building professional development into the culture of schools. In D. Aichele & A. Coxford (Eds.). Professional development for teachers of mathematics (pp. 49-54). The 1994 Yearbook of the National Council of Teachers of Mathematics, Reston, VA.

Judd, C.H. (1928). The fallacy of treating school subjects as "tool subjects." In J.R. Clark & W.D. Reeves (Eds.), Selected topics in the teaching of mathematics. The 3rd Yearbook of the National Council of Teachers of Mathematics, New York: Columbia University Teachers College.

Kazemi, E., & Franke, M.L. (2000, April). Teacher learning in mathematics: A community of practice perspective. Paper presented at the American Educational Research Association. New Orleans, LA.

Knapp, N.F., & Peterson, P.L. (1995). Teachers' interpretation of "CGI" after four years: Meanings and practices. Journal for Research in Mathematics Education 26 (1), 40-65.

Lampert, M. (1991). Connecting mathematical teaching and learning. In E. Fennema, T.P. Carpenter, & S. Lamon. Integrating research on teaching and learning mathematics. (pp. 121-152) Albany: State University of New York Press.

Lampert, M., and Ball, D.L. (1999). Aligning teacher education with contemporary K-12 reform visions. In L. Darling-Hammond & G. Sykes (Eds.), Teaching as the learning profession: Handbook of policy and practice (pp. 33-53). San Francisco, CA: Jossey-Bass.

Lortie, D.C. (1987). Overlooked aspects in the study of school policy: The importance of

district organizations. In F. Kemmerer (Ed.), Proceedings of the New York Education Policy Seminar.

Lortie, D.C. (1975). The schoolteacher. Chicago, IL: University of Chicago Press.

Maturana, U., & Varela, F.J. (1972). Autopoiesis and cognition. Dordrecht, The Netherlands: Reidel.

McDiarmid, G.W., & Kelly, P.P. (1997, March). Teachers planning professional development in a context of reform: The case of Kentucky. Paper presented at the American Educational Research Association. San Diego, CA.

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

National Council of Teachers of Mathematics (1991). Professional standards for teaching mathematics. Reston, VA: Author.

National Council of Teachers of Mathematics (1995). Assessment standards for school mathematics. Reston, VA: Author.

National Council of Teachers of Mathematics (2000). Principles and standards for school mathematics. Reston, VA: Author.

Piaget, J. (1964). Development and Learning. Journal for Research in Science Teaching, 2, 176-186.

Post, T., Cramer, K, Harel, G., Kieren, T., & Lesh, R. (1998). Research on rational number, ratio, and proportionality. Proceedings of the Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, Vol. 1 (Raleigh, NC, 1998).

Putnam, R.T., & Borko, H. (1997). Teacher learning: Implications of new views of cognition. In B.J. Biddle, Good, T.L., & Goodson, I. (Eds.), International handbook of teachers and teaching (pp. 1223-1296). Dordrecht, Netherlands: Kluwer.

Richardson, V., & Placier, P. (2001). Teacher change. In V. Richardson (Ed.), Handbook of research on teaching (4th ed.), Washington, D.C.: American Educational Research Association.

Rosenshine, B. (1995). Advances in research on instruction. Journal of Educational Research, 88 (5) 262-268.

Schifter, D., & Fosnot, C.T. (1993). Reconstruction mathematics education: Stories of teachers meeting the challenge of reform. New York, NY: Teachers College Press.

Schoenfeld, A.H. (1989). Ideas in the air: Speculations on small group learning, environmental and cultural influences on cognition, and epistemology. International Journal of Educational Research, 13, 71-88.

Showers, B., Joyce, B., & Bennett, B. (1987). Synthesis of research on staff development: A framework for future study and a state-of-the-art analysis. Educational Leadership, 45, 77-87.

Shulman, L.S. (1986). Those who understand: Knowledge growth in teaching. Educational Researcher, 15, 4-14.

Silver, E.A., & Stein, M.K. (1996). The QUASAR PROJECT: The "Revolution of the possible" in mathematics instructional reform in urban schools. Urban Education, 30, 476-521.

Simon, M.A. (1995). Reconstructing mathematics pedagogy from a constructivist perspective. Journal for Research in Mathematics Education, 26, 114-145.

Smith, D.E. (1926). The 1st Yearbook, General survey of progress in the last twenty-five years. National Council of Teachers of Mathematics. Reston, VA: Author.

Sparks, D., & Loucks-Horsley, S. (1989). Five models of staff development for teachers. Journal of Staff Development, 10, 40-57.

Steffe, L.P. (1990). Mathematics curriculum design: A constructivist perspective. In L.P. Steffe & T. Wood (Eds.), Transforming children's mathematics education: International perspectives. (pp. 389-398). Hillsdale, NJ: Lawrence Erlbaum.

Stigler, J. W., & Hiebert, J. (1999). The Teaching Gap. New York, NY: The Free Press.

Thorndike, E.L. (1922). The psychology of arithmetic. In G.M. Jonich (Ed.), Psychology and the science of education L Selected writing of E.L. Thorndike. (pp. 83-90). New York, NY: Columbia University, Teachers College.

Thorndike, E.L. (1949). Selected writing from a connectionists's psychology. New York, NY: Apleton-Century-Crofts, Inc.

Wearne, D., & Hiebert, J. (1988). A cognitive approach for meaningful mathematics instruction: Testing a local theory using decimal numbers. Journal of Research in Mathematics Education, 19 371-384.

Wiggins, G. (1998). Educative assessment: Designing assessment to inform and improve student performance. San Francisco, CA: Jossey-Bass

Wilson, S.M., & Ball, D.L. (1991). Changing visions and changing practices: Patchworks in learning to teach mathematics for understanding (RR 91-2). East Lansing, MI: The National Center for Research on Teacher Education.

Zahn, K.G. (1966). Use of class time in eighth grade arithmetic. Arithmetic Teacher, 13, 113-120.

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Specific Document)

TM034395

I. DOCUMENT IDENTIFICATION:

Title: THE IMPORTANCE OF SETTING TEACHER LEARNING GOALS TO INVESTIGATE THE EFFECTIVENESS OF TEACHER PROFESSIONAL DEVELOPMENT	
Author(s): JULIE CWIKLA	
Corporate Source: AMERICAN EDUCATIONAL RESEARCH ASSOCIATION	Publication Date: APRIL 2002

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

Level 1 ☑

Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) *and* paper copy.

The sample sticker shown below will be affixed to all Level 2A documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2A

Level 2A ☐

Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only

The sample sticker shown below will be affixed to all Level 2B documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

Level 2B ☐

Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Signature:	Printed Name/Position/Title: JULIE CWIKLA / ASST. PROF	
Organization/Address: UNIV. SOUTHERN MISS. 244 LOVERS LN. OCEAN SPRINGS, MS 39564-2833	Telephone: 228-547-6547	FAX:
	E-Mail Address: julie.cwikla@usm.edu	Date: 8/02

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
4483-A Forbes Boulevard
Lanham, Maryland 20706

Telephone: 301-552-4200
Toll Free: 800-799-3742
FAX: 301-552-4700
e-mail: ericfac@inet.ed.gov
WWW: http://ericfacility.org

EFF-088 (Rev. 2/2001)