Teacher Motivation and Professional Development: A Guide to Resources

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Abstract

Teacher Motivation and Professional Development: A Guide to Resources provides information on teacher motivation for those planning, conducting, and evaluating PD in math and science. Over 250 resources relevant to teacher motivation and PD were identified and categorized. Categories are described with representative citations, commentaries, and examples to facilitate the search for relevant information. General trends in the literature are noted, including the importance of teacher self-efficacy, the need for collaboration, intrinsic rewards, teacher autonomy, administrative support, and education policy. Given limitations in the existing literature, it was concluded that more research is needed to understand how reforms in curriculum and instruction affect teacher motivation for PD. In addition to the document, a searchable database is available at mspmap.org.
Introduction

Teacher professional development (PD) interventions are designed to increase teacher content knowledge and pedagogical content knowledge. There is considerable consensus (although not necessarily empirical support; see Weiss, 2009) for the features of PD programs that are necessary and sufficient for their success (Darling-Hammond et al., 2009; Guskey, 2003; Hassel, 1999; Hawley & Valli, 1998; Loucks-Horsley et al., 2003; National Commission on Teaching and America’s Future, 1996; Weiss & Pasley, 2009). In addition to the focus on teacher knowledge and practices, there are urgent calls to examine the role of teacher motivation in PD. Goldsmith and Schifter (1997), for example, suggested that descriptions of teacher development need to account of individual motivational and dispositional factors.

Similarly, in his more contemporary review, Tittle (2006) concluded that while “[t]here are references [in the literature] to motivation and affective (or dispositional) characteristics as important to teacher learning...[f]ew studies address these areas, areas that are likely to be important for assessments of long-term professional learning and development” (p. 976). Boyd et al. (2003) highlighted the critical role of teacher motivation in PD as one of their four key recommendations: “A primary challenge for large-scale PD projects lies in attracting teachers and sustaining their involvement so that they can receive the full dose of PD” (p. 112). And yet, a recent work on PD in math and science (Weiss & Pasley, 2009) does not explicitly include motivation. Motivational concerns, while often alluded to in passing (e.g., with regard to participation incentives or teacher confidence), remain a critical yet understudied component of teacher PD interventions.

Here we focus specifically on teachers’ motivation to (a) participate in PD and (b) to apply the knowledge and skills acquired to their instructional practices. As stated in the study of Local Systemic Change, “You have to make every effort to get the teachers there and once you get them there, you have to make sure you have something of high quality that will encourage them to come back” (Boyd et al., 2003, p. 47), which is particularly important for higher education faculty (Zhang et al., 2008). Even for teachers who participate, their degree of engagement can both vary and moderate whether they profit from that experience. PD can influence motivation for teaching math and science in particular (Alexander, 2008; Tittle, 2006) and in general for attempting new instructional practices (e.g., reform math and problem-based science) that incur costs and risks as well as benefits and challenges (De Corte, Greer, & Verschaffel, 1996; Gregoire, 2003; Hargreaves, 1998; Richardson & Placier, 2001; Smith, 2000).

Fortunately, the recognized importance of teacher motivation in the PD process arises at a time of renewed interest in teacher motivation in general (Watt & Richardson, 2008), thus providing expanded opportunity to apply contemporary motivation theory and research to current and future PD interventions. These approaches include expectancy-value (Watt & Richardson, 2008), achievement goals (Butler & Shibaz, 2008), interest theories (Hidi & Renninger, 2006), self-determination theory (Assor, Kaplan, Feinberg, & Tal, 2009) and new ways to think about emotion and affect (Pekrun, Frenzel, Goetz, & Perry, 2007). Such conceptual frameworks offer a range of constructs and assessment, which are particularly relevant for understanding the role of motivation for PD in math and science.

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To date, however, there has been no systematic focus on the factors that influence teachers’ motivation for participating in PD, their level of engagement during PD activities, and the degree to which teachers’ motivation and engagement in PD influences their classroom instruction. Such research is essential to clarify the connection between teacher and student learning (Kelleher, 2003), to identify the necessary components of comprehensive school reform, and ultimately to facilitate student achievement (Blazer, 2005).

The present document is designed to provide information for those planning, conducting and evaluating PD in math and science about the role of motivation. Resources included (e.g., published journal articles, technical reports, conference proceedings) are those at the intersection of teacher motivation and PD. Examples of the topics identified are: teacher education (Wayne, 2008); education policy (Barrett, 2009); mid-career programs (Berl, 2005); components of teacher motivation (Camilia, 2001); content-specific references (Desimone, Smith, & Phillips, 2007); student achievement outcomes (Blank & de las Alas, 2009; Flecknoe, 2002); effectiveness of programs and enduring change (Guskey, 2002); teacher styles (Kyriakides, Creemers, & Antoniou, 2009); motivation theories (Martin & Dowson, 2009); and addressing the “whole teacher” with regard to attitudes, skills, knowledge, practices, and proficiency within a wide range of domains (Chen, J. & Chang, C., 2006). The information extracted from these and other resources was categorized, indexed and is searchable.
Methodology

Search Process

The following databases were searched to identify resources related to teacher motivation for PD: ERIC CSA, Psych Info, EBSCO, Google Scholar and ISI Web of Science. The search was initiated with the broad terms “teacher motivation” and “professional development” and then restricted by including terms associated with motivational theories such as teacher efficacy, achievement goals, expectancy-value, interest, self-determination, and cost-benefit analysis. There were significantly fewer results from this more limited search. As expected, while there was considerable information about the evaluation and assessment of PD programs during and following teacher participation, fewer resources were found that addressed teachers’ perceptions and motivation prior to their participation in PD. For example, the search of teacher efficacy and PD in mathematics education yielded extensive information on mathematics education and the assessment of specific PD programs, but little on teachers’ perceptions and motivation related to their participation or engagement in these programs. It was difficult to identify resources that assessed PD programs regarding participants’ reasons for attending PD, their level of participation, or how these factors influence student achievement outcomes.

There also were few articles that dealt with teachers’ own mastery (a focus on learning and understanding) or performance achievement goals (an emphasis on ability, interpersonal comparisons) but rather those that focused on students or on teachers’ classroom practices. Instead, there was information on teacher characteristics related to their motivation for attending PD, and teacher engagement and participation with a particular PD program. For example, the search terms “expectancy value” and “PD” yielded few relevant resources, and fewer still when combined with “motivation.” Google Scholar identified more articles using “motivation theory” and “PD” than did other databases. If the journal article did not directly focus on math and science, a resource was included if it was judged to contribute to an understanding of motivation and PD across content areas, such as “costs and benefits” and “PD” and related search terms. For example, an article on literacy achievement and PD entitled Reading Recovery and Evidence-Based Practice was included since it “provided an excellent model for demonstrating how to plan, promote and implement an intervention across an educational system” (Schwartz, Hobsbaum, Briggs, & Scull, 2009, p. 1), which included a PD program that built teacher trust and motivation to seek out other effective PD interventions.

Examples of articles not in math or science were those focused on teachers’ attitudes toward the arts in education (Oreck, 2004), professional development initiatives focusing on digital age literacy skills (Richardson et al., 2007), factors that influence how teachers change (Smith, Hofer, Gillespie, Solomon, & Rowe, 2003), improvement of school environments and leadership (Basom & Frase, 2004) and positive effects of professional teacher collaboration (Shepard, 2009). Articles in a journal dedicated to PD, Professional Development in Education, were only included if deemed relevant to teacher motivation and PD. Finally, articles on math or science were more likely to be included by virtue of the domains themselves. Articles beginning in the 1990s, other than a “classic” or major publication in the field, were included if they were judged potentially relevant to the study of a PD program and the various perceptions that might contribute to that, including personal interest, content knowledge improvement, cultural background, overlap of subject areas, and school level details. Selection of resources also included PD in international contexts, the connection between PD and student outcomes, and school leadership. Using these criteria yielded approximately 250 relevant resources.

Categories and Database Organization

Resources identified as relevant were categorized according to their relation to teacher motivation for PD. Categories are described in the following section, with representative citations, commentaries, and examples to capture the scope of the information contained therein. Descriptions also highlight salient issues and provide information to help ascertain whether topics are relevant. It should be noted that the categories are not mutually exclusive—resources may be assigned to multiple categories. Appendices provide a searchable database of the identified resources. Appendix A provides a list of the categories, a brief description of the resources in each category, and category keys. These keys can be used to search the resources that are provided in Appendix B. The searchable database is also available online at www.mspmap.org.
Motivation and Teacher PD Resource Categories

Achievement and Related Outcomes

Resources in this category focus on the design of PD programs that can influence teacher motivation to participate and be engaged in PD. They target the effectiveness of PD in demonstrating sustained gains in student performance, along with cost-benefit considerations (Schwartz, Hobsbaum, Briggs, & Scull, 2009). Also included are discussions of the difficulties and possibilities of providing evidence of the impact of PD programs in schools (Flecknoe, 2002), and studies that address concerns about an overreliance on self-report measures and the need to examine alternatives (Fulmer & Frijters, 2009). Authors cite the necessity for increased empirical evidence about what works in PD for mathematics and science education, and the reasons why this knowledge is so limited (Yager, 2005).

Articles also explore the benefits of providing teacher self-assessment tools along with clear standards of teaching as a strategy for improving the effectiveness of PD (Ross & Bruce, 2007), and examine the structural and process features of PD on teachers’ practices in Australia and their impact through the assessment of follow-up knowledge and student learning outcomes (Ingvarson, Meiers, & Beavis, 2005). Studies included here draw comparisons between mathematics teachers from low and high-performing school districts who participated in PD, focusing on their subsequent use of mathematics problem solving in their classrooms (Zambo, R. & Zambo, D., 2008). They also investigate relations between students’ interest in mathematics and their mathematics performance during the transition to elementary school (Aunola, Leskinen, & Nurmi, 2006) and explore how evidence-based, collaborative PD increases student engagement and learning (Shepard, 2009). Finally, this section offers examples of ways that achievement can be motivated by teachers’ and students’ desire for increased competence.

Beliefs

This category provides information for a more thorough understanding of teachers' beliefs that are relevant to the design of PD programs and successful educational reform in general. Topics include an analysis of how teachers' subject-matter beliefs may create obstacles to the acceptance and implementation of reform practices that conflict with those beliefs (Greig, 2003), a survey that explores the characteristics and variables that best describe teachers who integrate computers into their classrooms and those who do not, with teachers' beliefs playing a large role (Mueller, Wood, Willoughby, Ross, & Specht, 2008), and an investigation of how teachers’ participation in PD activities promotes changes in their beliefs about the implementation of reforms (Meirinka, Meijerb, Verloopa, & Bergenc, 2009).

Classroom Characteristics

Several studies provide information about the primary influences on the motivation of teachers in the classroom and their participation in PD. Articles reveal the consensus that motivating teachers to attend PD, and to effectively address their interests in a wide variety of topics, requires that programs offer a broad spectrum of classroom strategies, organizational tips, pedagogical methods, and enhanced subject-specific material. Also examined are the factors that may undermine or enhance teacher motivation. Topics include an examination of the perceptions of teachers regarding their lack of knowledge and efficacy in motivating students in the classroom, and implications for PD (Hardre & Sullivan, 2008), and the effects of different characteristics of PD on teachers’ learning and changes in their classroom practices (Garet, Porter, Desimone, Birman, & Yoon, 2001). Additionally, PD programs are examined that focus on discourse patterns in mathematics classrooms (Crockett, Chen, & Ziliwu, 2009), and the link between achievement in science and literacy when elementary school teachers are provided the time, instruction, resources and PD to successfully design and implement an inquiry-based science unit in the classroom (Fortino, Gerretson, Button, & Johnson, 2002). Numerous examples are provided for how PD can assist teachers, offering practical solutions for problem solving in the classroom for those educators who have a willingness to engage in new learning and PD opportunities as they become available.

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Collaboration

PD can address isolation by providing peer collaboration and support that enhances teacher motivation to attend PD, which is an important feature of professional learning communities (PLCs). Resources in this section include the evaluation of a collaborative effort in PD in which several themes emerged that contributed to program success. These include a shared vision of PD goals and flexibility in planning and implementation (Hanley, Maringe, & Ratcliffe, 2008), the development of trust in PD projects that build a community of mathematics education teachers and learners (Sztajn, Hackenberg, White, & Allexsaht–Snide, 2007), and an examination of a PD program in which a networked learning community was chosen as an approach to support technology integration in science education (Duran, Brunvand, & Fossum, 2009).

Included is information on the type of support gained through regular teacher engagement and collaboration as an effective means of connecting PD with the daily challenges faced by teachers, even in the most rural parts of China, when supported by educational institutions, leadership, and teacher initiatives (Sargent & Hannum, 2009). Also noted is the importance of including educators and other major stakeholders in the planning process and the setting of goals for PD, which often results in an improved ability for participants to translate their experiences more effectively in the classroom (Herner-Patnode, 2009).

PD can take many forms, and these articles describe how PLCs create the potential to increase teacher motivation by bringing together school staff in professional planning and collective actions towards improving student learning and positive outcomes for both staff and students.

Teachers’ views on PD...will significantly influence their motivation to attend PD...[and will also influence] its implementation, sustainability and success in integrating the curriculum and accompanying strategies into teachers’ regular classroom practices....

Curriculum

The introduction of revised curricula to address student learning involves a complex interaction between curriculum innovation, teacher motivation, PD, and the characteristics of the teaching, learning, and leadership environment. Articles in this category include evidence that mathematical curriculum materials can be effective without PD support but not for all teachers (Collopy, 2003) and how obstacles to the successful classroom integration of curricular-based initiatives can occur when teachers’ perceptions of the goals and motivations for PD and those of their districts are not aligned (Yamagata-Lynch & Haudenschild, 2009).

Several international studies are included, such as one in England that describes recent curriculum changes to increase “scientific literacy” in students’ daily lives, as well as science content knowledge, and different forms of PD that might be useful for this purpose (Ratcliffe & Millar, 2009). A study in Ireland examines the critical role of PD in providing a mechanism to introduce a revised national curriculum to schools and teachers (Loxley, Johnston, Murchan, Fitzgerald, & Quinn, 2007).

In general, resources here support the consensus that teachers’ views on PD and its contribution to the acceptability, feasibility, and usefulness of a particular curriculum program will significantly influence their motivation to attend PD and subsequently its implementation, sustainability and success in integrating the curriculum and accompanying strategies into teachers’ regular classroom practices towards school educational reform efforts.

Emotions

Education reform efforts may engender emotions that cause teacher resistance or support for changes in teachers’ classroom practices (Kelchtermans, 2005). Evidence indicates that emotions can interfere when teachers’ perceptions that their motivation and goals are not congruent with their school districts’ (Yamagata-Lynch & Haudenschild, 2009). Articles included here (e.g., Dworkin, 2001) report on teacher burnout as a predictor of teaching efficacy, how PD may improve teacher efficacy, and implications for educational quality (Madden–Szczesko, 2000). Included are approaches to PD, its scope, stakeholders, and economic perspectives that affect the return on investment when designing PD programs (VanLoo & Rocco, 2006), which address the connection between teacher motivation and emotions, PD, and student learning.
Empowerment

Interest in empowerment has triggered several initiatives to study the influences on teachers' sense of empowerment of such factors as teacher motivation for involvement in PD, self-efficacy, opportunities for professional growth, and leadership support. Resources here present a view of PD as a framework for increasing teacher efficacy and empowerment through a better understanding of the relationship between teacher motivation and active engagement in PD, recognizing the importance of collaboration with other colleagues, and the advantages of teachers' involvement in professional learning networks.

Included is an examination of a collaborative model of PD that examines the relationship between empowerment and efficacy (Henson, 2001), and a micro/macro approach to PD in Malta which takes into account the personal initiatives of the teachers within the educational system and their engagement in additional ongoing PD opportunities (Bezzina & Camilleri, 2001). In addition, a study in Israel focused on the relationship between teacher empowerment and organizational and professional commitment, with evidence that teachers' sense of empowerment is significantly related to their feelings of commitment to the organization (e.g., school and school district) and their profession (Bogler & Somech, 2004). One PD program that evaluated ways to assist teachers in implementing state content standards found that the keys to empowerment and completion of the program were the teachers' active engagement and gaining the support of the school principal (Edwards & Green, 1999).

Grade Level

Several articles provide information on PD that is specific for particular grade levels, or shared across grade levels. Grade levels reviewed range from early childcare and education through adult education programs, along with different international perspectives. Regarding early childhood education settings, articles consider such concerns as alternatives available to enhance early childhood PD opportunities (Barnett & Kelley, 2006) and the role of the state in Kenya's long history of early childhood education (Adams & Swadener, 2000). For the elementary grade levels, articles provide information that include PD efforts to support and retain experienced teachers (Holloway, 2003), success of PD programs in New Zealand in integrating classroom pedagogical tools to improve student achievement (Higgins & Parsons, 2009), and inadequate attention of state policy makers to improve the quality of PD programs (Corcoran, 1995).

Despite a relative lack of articles specific to middle school education, several are relevant to these grades. These include reports about the relationship between teachers' feelings of isolation and the development of a professional learning community (Grider, 2008), and examine teacher efficacy, learning styles and beliefs, and how these factors influence behavior to motivate and change (Kitchens & Wenta, 2007). There are also a significant number of articles that focus on high school and secondary education. These address educational issues such as teachers' attitudes regarding integrating technological tools in teaching and learning (Govender, D., & Govender, I., 2009), and the lack of occupational motivation among teachers and professional engagement and development (Jesus & Lens, 2005). One study in the Netherlands looks at the way that workplace activities such as PD contribute to changes in teachers' beliefs over time (Meirinka, Meijer, Verloopa, & Bergenc, 2009).

For higher and adult education, several articles examine the relationship between positive teacher and administrative dynamics and opportunities for PD (Ellett, Hill, Liu, Loup, & Lakshmanan, 1997) and the comparison between different models of PD and identifying the most important factors influencing teacher change (Smith, Hofer, Gillespie, Solomon, & Rowe, 2003). Generally, there are resources that examine the lack of PD programs that include many of the major factors that research has shown to be effective, such as school-wide efforts with follow-up involvement and a supportive administration (Richardson, 2003).

Identity

Implications that result from the existence of multiple identities are highlighted in this section. Recommendations are presented for the design of PD programs to incorporate the identities of teachers and other educational leaders, with due consideration for the impact of identity on teachers' motivation to further their personal and professional growth through PD, as well as to contribute to more effective learning environments for their students.

Professional development can offer teachers the opportunity to explore their identities, for example, as science teachers (Moore, 2008), and can be included in PD programs to increase teacher effectiveness when working with low-income...
and culturally diverse students (Tucker et al., 2005). Additionally, the No Child Left Behind (NCLB) legislation in the U.S. is considered by many to be a shift towards a “performance” pedagogical model that has altered the professional identities of teachers differentially depending on whether they are early or late in their careers, with implications for the design of PD opportunities (Barrett, 2009); insights have also been offered regarding the potential of “transformational” PD by examining the relation of self to other identities for urban public school leaders (Jurrow, 2009). A significant number of articles acknowledge that emotions (see category on Emotions) need to be considered in teachers’ sense of identity as they face the challenges posed by educational reform directives (Kelchtermans, 2005). The changing identities of teachers amidst education reform have been addressed, as is the potential role of PD to enhance teacher competence and personal growth during the upheaval of educational reform (Pattie, 2009).

Institution/School Features

This category reveals the intricacies of the work environment in schools and provides ways that PD can be offered to reflect the needs of school environments and contexts. The types of schools represented range from elementary through high school, and encompass urban, rural, public and private school systems, and schools with different levels of student achievement. Factors affecting schools such as organizational structures, policies, and institutional development are also considered. Topics include investigation of the characteristics of PD in high- and low-performing schools (Henry-Bell, 2007), teachers’ views about instructional reform through PD (Nielsen, Barry, & Trefz, 2008), analysis of scientifically-based evidence of the effects of PD on improving student achievement (Blank & de las Alas, 2009), engaging teachers in research experiences to enrich their classroom teaching (Klein, 2009), and how the policy environment affects teachers’ choices of PD (Desimone, Smith, & Phillips, 2007).

Additionally, regarding math and science education, articles explore teacher perception before and after PD in increasing their understanding of mathematical content (Feuerborn, Chinn, & Morlan, 2009), study the effect of PD on science teaching and achieving scientific literacy for all students (Khourey-Bowers & Simonis, 2004), and describe scientists’ views that PD should offer science teachers ways to make science fun and exciting for students (Taylor, Jones, Broadwell, & Oppewal, 2008). Further, articles consider the integrative nature of school routine and PD as complementary processes in school reform (Gorodetsky & Barak, 2009).

International Comparisons

Articles in this category highlight the importance of taking into account the role of educational research in PD from an international perspective. There are 31 countries represented in this guide to resources. Research in Australia, for example, has focused on stability, change and the global impact on school principals, leadership and PD (Gamage & Hansson, 2006), as well as on a new curriculum that offers an engineering course in secondary schools (Williams, 2008). The success in China of teacher professional learning communities in resource-constrained schools has also been documented (Sargent & Hannum, 2009), along with the use of PD in providing a mechanism to introduce a national primary curriculum in Ireland (Loxley, Johnston, Murchan, Fitzgerald, & Quinn, 2007). In Jamaica, one study focused on a school-based intervention through PD to prevent student misbehavior (Baker-Henningham & Walker, 2009) and in Hong Kong, researchers looked at educational reform and stress on teachers as a main feature of PD programs (Pattie, 2009). A collection of articles on PD from different regions of the world is available (Day & Sachs, 2005), and researchers have provided international comparisons in mathematics education and its impact on PD (Blomeke & Paine, 2008). Included as well are articles about Israeli research efforts to determine the processes in PD that are necessary to develop teacher expertise in a specific aspect of science education (Harrison, Hofstein, Eylon, & Simon, 2008), researchers in Japan who have made comparisons between teachers’ professional status and student achievement in mathematics (Schoenfeld, 1999), and a study in Tanzania of discourse patterns as an essential feature of PD programs (Crockett, Chen, Namikawa, & Zilimu, 2009).
Motivation

Resources here directly highlight the factors that affect teachers’ decisions to attend PD programs to gain a better understanding of what matters to teachers and how best to motivate them through creating more effective PD designs and partnerships with schools. From the perspective of teachers, articles include such topics as teachers’ resistance to change in educational reform (Assor, Kaplan, Feinberg, & Tal, 2009), teachers’ motivation and styles in relationship to their progress in PD (Campoy & Hoewisch, 1998) and teachers’ ability to implement reform in areas such as mathematics (Manouchehri, 2004). There is evidence that highly motivated teachers are more likely to engage in PD and implement innovative programs to increase student learning (Cave & Mulloy, 2010).

In addition, studies focus on the educational environment, such as research that reports a strong correlation between positive teacher and administrative relationships and opportunities for PD (Ellett, Hill, Liu, Loup, & Lakshmanan, 1997), descriptions of professional learning communities and the results of collective action taken by school staff on behalf of increased learning for students (Hord, 1997), and the effect of Pakistani teachers’ feelings of being undervalued by society and working in the least sought after profession (Javaid, 2009).

Numerous studies have shown that teacher efficacy is important for improving student performance and stress the need for PD programs that incorporate this element into their designs.

From the perspective of those involved in designing PD programs, several articles explore the factors that contribute most to motivating teachers to engage in PD, the ways that teachers experience their participation, and how this enhances their learning (Scribner, 1999). Others provide an overview of PD since the 1980s, with a comparison between the US and Japan and an analysis of their similarities and differences (Collinson & Ono, 2001). With the current emphasis on accountability, several articles stress the need for an integrated approach that involves teachers, administrators, policy makers, those in leadership positions, and the designers of PD programs (Leithwood, Steinbach, & Jantzi, 2002).

Teacher self-direction and efficacy have been identified as essential factors in the success of PD. Numerous studies have shown that teacher efficacy is important for improving student performance and stress the need for PD programs to incorporate this dimension in their designs and evaluations. Among these studies, articles explore the potential relationship between teachers’ self-efficacy beliefs and the integration of computer technology in teaching and learning through PD (Govender, D. & Govender, I., 2009), examine how the level of teaching self-efficacy of highly regarded teachers influences their experiences in PD (Scribner, 1998), and study the connection between quality PD and teacher self-efficacy and its effect on student performance (Kuskovski, 2008).

Additionally, resources here consider science teaching self-efficacy as a major component in improving science teaching in elementary schools (Ramey-Gassert, Shroyer, & Staver, 1996), address the isolation of teachers by increasing teacher efficacy and successful collaboration efforts through PD (Shepard, 2009), and analyze the shift between teacher efficacy in traditional mathematics education and mathematics reform efforts (Smith, 1996). There also has been a focus on ways that teacher attitudes affect teaching skills, knowledge, and practices. Included here are such issues as the attitudes, motivations, and rewards of English teachers in Malaysia with regard to their use of computers in teaching English in their classrooms (Abdullah, Abidin, Luan, Majid, & Atan, 2006); differences between those K-12 teacher participants in a three-year PD program who persist and who drop out, through assessments of such factors as personal empowerment, satisfaction with teaching, and teacher efficacy (Edwards & Green, 1999); and the relationship between the school professional learning environment and the level of dedication and motivation among teachers (Ellett, Hill, Liu, Loup, & Lakshmanan, 1997). Additional topics include studies affirming that PD programs are most beneficial when teachers maintain input and control in the PD process and are linked to the participants’ teaching culture, curricula, and classrooms (Nir & Bogler, 2008).

Included is an examination of mathematics PD programs that focus on content knowledge or pedagogical issues, and their perceived relevance for teacher enthusiasm for participation, with examples of the incorporation of these two approaches in PD models (White, Brana, Mitchemore, & Maxon, 2004). Further, research identifies the attitudes of those participating towards their engagement in PD and offers insights about ways to take attitudes into consideration for more effective outcomes (Varga-Atkins, Qualter, O’Brien, 2009).

Perceptions

Resources here explore teachers’ perceptions of PD in mathematics and science, including those that focus on content learning and opportunities for active collective participation of teachers from the same school (Garet, Porter, Desimone, Birman, & Yoon, 2001). Additionally, a study of science teachers’ perceptions indicates that science content knowledge dominates over current science applications in their teaching, reflecting the need for PD that continues over time and of-
fers considerable support through access to teaching materials and school leadership, in order to use relevant and meaningful science applications more effectively in the classroom (Ratcliffe & Millar, 2009).

Several articles highlight the importance of teachers' perceptions of their students in creating more positive learning outcomes, such as investigating the relationship between teachers' perceptions of student motivation before and after PD and the effects of this participation on student motivation (Turner, 2008). Included is an evaluation of teachers' perceptions about a PD intervention designed to increase skills in understanding students' needs and abilities with positive and proactive strategies for improving student behavior and achievement (Baker-Henningham & Walker, 2009). Also described is the importance of teachers' perceptions of the value of PD for establishing a deeper understanding of students' needs, offering positive, proactive strategies for classroom management and teaching (Baker-Henningham & Walker, 2009). Further, there is an analysis of the influence of high school teachers' perceptions of their use of motivation strategies in the classroom, and their need for more PD opportunities that address knowledge and skills for greater teacher effectiveness in motivating students (Hardre & Sullivan, 2008).

**Policies**

Resources included here focus on ways to improve the connections between PD and early childhood policies, practices and school readiness (Zaslow & Martinez-Beck, 2005). They also focus on ways that school reform policies have contributed to teacher burnout (Dworkin, 2001), and discuss recent educational policy initiatives that emphasize retaining only the best teachers and rewarding them for outstanding performance, as essential to narrowing achievement gaps, with significant implications for PD (Whitcomb & Liston, 2009).

Studies have analyzed PD programs that integrate NCLB policies and the influence of standards in teaching and learning (Snow-Renner & Lauer, 2005). Included are the results of recent nationwide math tests showing that student achievement grew faster during the years before the NCLB law when states had more control over education policy than later when federal law became a stronger force (Dillon, 2009), and evaluated PD initiatives funded by government policymakers to address the need for improved mathematics knowledge for teaching (Hill & Ball, 2004). One report described the U.S. Department of Education establishment of the “What Works Clearinghouse” to determine which education and PD initiatives have scientific research-based evidence of effectiveness, to make this information available to educators and policymakers (Schwartz, Hobsbaum, Briggs, & Scull, 2009). With the continuing demands of NCLB and the recent federal education policies, the importance of finding the PD models most likely to improve teacher practice and student performance has become essential (Desimone, Smith, & Phillips, 2007). This climate of high stakes testing and accountability adds to the complexity of factors that may undermine motivation to attend PD, including when accountability systems are at odds with teachers’ own sense of personal responsibility for student outcomes (Lauermann & Karabenick, in press; Ryan, 2009).

Resources included support the view that teacher motivation is a critical factor in creating PD environments that respond effectively to government initiatives and policy reforms. Accordingly, the consideration of teacher motivation and PD should be a high priority in defining policies that attract and develop high quality teachers. Articles suggest ways to effectively and successfully respond to challenging educational reform policies.

With the continuing demands of NCLB and the recent federal education policies, the importance of finding the PD models most likely to improve teacher practice and student performance has become essential.

**Program Comparisons**

With increasingly diverse educational environments and rapidly changing demands, the comparative analyses of PD opportunities in this section suggest ways that PD can improve both teacher and student learning. A comparative examination and assessment of teachers' attitudes and motivation in a variety of PD programs is thus crucial to link improved teacher practices with increased student academic performance. Accordingly, articles in this category compare the features of PD models and the important characteristics of PD suggested by members of professional educational organizations. Importantly, one analysis concluded that there is considerable variation and inconsistent research findings, and emphasized the need to seek greater consensus among educators (Guskey, 2003).
Quality of Education

A variety of motivation and PD-related topics report differing paths to increase the quality of education. An example of this is an article that documents efforts that attempt to demonstrate the effectiveness of PD programs that involve science teachers with very different backgrounds, experiences and abilities, and which claim that student outcomes cannot tell the whole story when discussing the best model to advance science teacher quality (Abell, 2009). Studies here report on teacher quality as dependent upon improving teaching skills through PD that address deeper content knowledge, the ability to motivate students, communication skills, flexibility, and general knowledge about many areas of life (Keisa, 2009), and describe an example of video-based mathematics PD designed to raise the quality of mathematics education in low-performing schools (Santagata, 2009).

Additionally, there are numerous articles concerned with demands for higher student outcomes. For example, a study in Sweden reported that PD was a way to help teachers cope more effectively to maintain quality amidst higher demands in a rapidly changing educational environment, and considered the support structures necessary for successful PD (Drakenberg, 2001). Another discusses efforts to use PD to help teachers better manage the negative aspects of their practices by identifying their strengths and how to use them more effectively (Bisplinghoff, 2005). A third focuses on the motivation of school administrators and teachers to take greater ownership of their PD programs to encourage and support lifelong learning opportunities for both teachers and students (European Commission, 2005).

Reform and Innovation

Articles in this section evaluate the different combinations in which PD programs are being designed in order to most effectively direct educational reform towards improving student performance in the areas most needed. They suggest that teachers’ practices can be changed over time with considerable support from PD programs and other learning opportunities and materials, and offer potential solutions to this ongoing challenge for teachers, administrators, designers of PD, and policy makers. Resources include how learning to use technology in Rwanda through PD can serve as a model for teachers in creating change in other ways in the learning environment (Mukama & Andersson, 2008), and science education reform through PD that focuses on concrete tasks that connect teacher’s subject-matter knowledge with standards for student performance (Supovitz & Turner, 2000). Included is a study that describes the connection between the meanings that teachers in South Africa attach to a new curriculum and the success of educational reform (Bantwini, 2010), an investigation of how adult education teachers changed after being presented with different models of PD (Smith, Hofer, Gillespie, Solomon, & Rowe, 2003), and an explanation of the factors that contribute to how teachers implement new knowledge and skills gained from PD into their classrooms (Watson & Manning, 2008).

Included are articles that describe a promising preschool classroom intervention that promotes math interest and skills in young children (Arnold, Fisher, Doctoroff, & Dobb, 2002), and a review of Reading Recovery as a positive PD model for demonstrating how to implement an intervention across a large educational system (Schwartz, Hobsbaum, Briggs, & Scull, 2009). A meta-analysis at the state and local level examines the effects of teacher PD on student learning, with the goal of widely disseminating the scientifically-based evidence of the study’s findings (Blank & de las Alas, 2009), and a discussion of effective PD programs that are in partnership with universities with the goal of enhancing teacher leadership practices (Crawford, Roberts, & Hickmann, 2008).

One study in particular outlines variables that could be used by school districts to determine whether or not students could benefit from a particular innovation in their schools, such as a sufficient willingness on educators’ parts and organizational capacity (Fixsen, Blase, Horner, & Sugai, 2009). Also included is an examination of projects in Head Start classrooms to improve early literacy development and promote book reading, language, and vocabulary for young children (Dickinson & Caswell, 2007; Wasik, Bond, & Hindman, 2006). Further, there is an analysis of the impact of the Local Systematic Change Initiative, a National Science Foundation program on student achievement in science, mathematics and technology, and the importance of PD as a means of improving student outcomes in these subject areas (Banilower, 2002; Supovitz & Turner, 2000).

Authors have noted that the impact of PD on reform initiatives is strongly influenced by levels of teacher enthusiasm and motivation (Goos, Brown, & Makar, 2008). Resources here provide information that improves the understanding of ways that teacher motivation in PD may more effectively address the variety of challenges that arise through evolving research, innovation, policies, and educational philosophies that support improved student learning.
Research

New directions in PD are creating an increased demand by teachers for PD programs supported by data-driven, evidence-based approaches to reform initiatives. Articles in this category acknowledge that a strong base of research is needed to guide the design and investment in PD for present applications. They offer evidence regarding the specific features in PD that could contribute to more effective educational practices, improved student achievement, and provide possible directions for future studies. Included is a review of the most methodologically sound research on PD, delineating the relationship of teacher attitudes and behaviors towards PD and the need to discern whether or not specific PD practices are meeting the needs of teachers to engage in effective PD to improve their teaching practices and enrich student learning and performance.

Resources included highlight a variety of valued characteristics of PD, according to several professional organizations, with the need to seek consensus on criteria for the effectiveness of PD programs (Guskey, 2003) and address possible reasons why little is known about what teachers learn through their PD opportunities and why knowledge about PD is limited, especially in math and science (Yager, 2005). Additionally, articles describe the relationship between scientists’ views of teachers as professionals, with suggestions for alternatives to current practices regarding the practical role that research scientists can play in the PD of science teachers (Schuster & Carlsen, 2009). One PD program described engages high school teachers in meaningful research experiences to encourage them to take these experiences back to their science classrooms (Klein, 2009). According to several authors, there has been insufficient analysis of the professional knowledge actually acquired in PD. These authors express a need for more research on the interrelationship between teacher learning, PD, teacher knowledge, and student learning (Wilson & Berne, 1999).

School Administration/Leadership

Included here are resources that reflect the desires of those in educational leadership positions for PD training to better assist them in meeting continually evolving government mandates in measuring student achievement levels and performance. Resources include research that investigates the perceptions of the PD needs of public school principals to meet the required state and federal accountability measures (Keith, 2008) and that evaluates the consequences of poorly planned PD for teachers with little or no input or support from school leadership, which may perpetuate ineffective teaching practices (Berl, 2005). Articles also explore the responses of teachers and school administrators to government accountability initiatives, and assess which leadership practices influence those responses, implying that some forms of PD could serve as antidotes to negative teacher and administrative responses (Leithwood, Steinbach, & Jantzi, 2002). Studies show that those in educational leadership roles can support teachers in areas such as motivation, reflection, evaluation, recognition, rewards, and improving the work culture (Berl, 2005), with the increasing call for the design of PD that can actively engage and prepare teachers for assuming leadership roles in their present and future positions in schools.

Student Behavior

There has been little focus on student behavior and PD. Articles included here examine PD interventions that expand teachers’ knowledge and understanding of students’ needs and abilities, offer practical strategies to improve student conduct, and find that teachers’ views of the usefulness and feasibility of these types of programs significantly influence successful implementation into their regular practice (Baker-Henningham & Walker, 2009). Additionally, these articles examine the role of interpersonal relationships in students’ academic behavior and motivation, establishing a framework that guides specific actions at the student, teacher, classroom, and school levels, with implications for the design of PD (Martin & Dowson, 2009). They also provide information about the benefits that teachers have experienced from participating in PD and curriculum programs that explicitly target the improvement of students’ improved social and emotional skills.

Student Characteristics

This section presents conceptual, organizational and planning ideas needed to create PD opportunities for teachers with the objective of increased inclusion of all students’ diverse needs, with the concurrent goals of greater teacher efficacy and improved student achievement outcomes. Included are resources that examine the characteristics of PD programs in high-performing and low-performing schools as possibly contributing to the persistence of the achievement gap between underserved students and their higher performing peers in different schools (Henry-Bell, 2007). Others document how
teachers who participated in PD programs that focused on understanding the development of different students’ mathematical thinking continue to implement the program long afterwards, signifying meaningful and sustained changes in their teaching practices through this form of PD (Franke, 2001). Teaching practices are also described within the context of gifted students and the role of PD with regard to improving teachers’ abilities to differentiate curriculum and instruction for gifted students (Sharfman, 2007). Further, teacher and administrator discussion of issues of inclusion often leads to rethinking and restructuring school programs, which may include PD, to improve the education of all students (Kraayenoord, 2003).

Subject Domains

Among the most important factors that increase teacher motivation for PD are content knowledge and alignment with state or district curriculum developments and standards. With a focus on how teacher knowledge and practice relates to teacher motivation and PD, resources in this category describe research in mathematics education and how the policy environment affects teacher participation in PD (Desimone, Porter, Garet, Yoon, & Birman, 2002), teachers’ subject-matter beliefs and educational reform (Gregoire, 2003), and the value and design of video-based PD (Koc, Peker, & Osmanoglu, 2009; Santagata, 2009). Also featured are teachers’ experiences in PD as they shift from traditional practices to reform efforts (Smith, 1996; Cohen, 2004), the technique of student-centered learning in math class discussions (Dixon, Egendoerfer, & Clements, 2009), and the evaluation of the effects of PD programs on teacher and classroom problem-solving abilities (Zambo, R. & Zambo, D., 2008).

Specific resources in science education PD examine the instructional practices that show improved effectiveness in the classroom (Lydon & King, 2009), the range of reasons for science teachers to attend or avoid science-related PD (Schibeci & Hickey, 2004), and the reform of traditional teachers’ practices to refocus science education on the more applied learning needs (Ratcliffe & Millar, 2009).

Whereas math and science education represent the vast majority of articles, ten other domains are included as well, which focus on the ways that teacher motivation and PD influence student achievement. These domains include the use of creativity and the arts in general education (Oreck, 2004), similarities in reasons for participating in PD programs for business and general education teachers (Shumack, 2008), and cross-disciplinary collaboration and PD projects (Nelson & Slavit, 2007). Studies also describe the impact of curricular reforms on physical education programs (McCaughtry, Martin, Hodges Kulinna, & Cothran, 2006), and PD program evaluation and literacy achievement (Schwartz, Hobsbaum, Briggs, & Scull, 2009).

Teacher Characteristics

Here we focus on teacher factors that contribute to their participation in PD. Topics include teacher persistence in PD (Edwards & Green, 1999), entrance and exit motivations in the teaching profession (Watt & Richardson, 2007), self-reported positive effects of PD (Garet, Porter, Desimone, Birman, & Yoon, 2001), and teachers’ inclusion of information technology in the classroom (Wu, Chang, & Guo, 2008; Mushayikwa & Lubben, 2009). Included as well are issues such as teachers’ strengths as a positive force to counteract negatives in the teaching climate (Bisplinghoff, 2005), organizational and professional commitment and the feeling of empowerment (Bogler & Somech, 2004), best and worst incentives for PD (Chaney, 2004), and teacher reform (Boyd, Banilower, Pasley, & Weiss, 2003). A more thorough understanding of the association between teacher motivation and participation in PD can guide educators and policy makers in seeking effective ways to encourage teachers to enthusiastically engage in PD activities. In general, the articles are relevant for a wide variety of issues that affect teachers, administrators, policy makers, and designers of teacher PD programs in formulating PD that leads to quality teaching and learning at the school level.

Technology

There is increased attention to the perceptions of teachers’ competence with computers and their corresponding attitudes toward technology application in the classroom, with implications for how PD can best address these learning and teaching challenges (Govender, D. & Govender, I., 2009). Research has also studied variables that may distinguish between high and low computer integration in the classroom, such as positive expectations, comfort level, beliefs, training, and support (Mueller, Wood, Willoughby, Ross, & Specht, 2008). Especially relevant are studies that have examined the factors that influence teachers’ decisions to participate in PD focused on digital age literacy skills and the level of implementation of...
the ideas gained through their participation (Richardson et al., 2007). Others have focused on the need for alternative PD models that offer teachers opportunities to communicate with each other and have access to quality resources, with an example of an online mathematics support network (Dalgarno & Colgan, 2007), as well as the participation of mathematics teachers in an online content-based mentoring program and the value of this type of active engagement for professional growth and development (McAleer, 2009). Indicated is that the demand for PD in the use of technology may outpace the abilities of school districts to meet this need, which will require new methods to provide satisfactory technical training to teachers.

Testing and Standards

School districts are increasingly compelled to provide more effective PD to meet the demand from teacher accountability in meeting standards (Kelleher, 2003). To meet this need the National Science Education Standards (NSES) lists the best professional opportunities for science teachers in staff development programs (Coskie & Place, 2008). With the increased expectations for student learning outcomes, these resources highlight the challenge and importance of understanding how best to motivate teachers to engage in PD, and hold promise for improving teacher practice to help students learn.

Thus, there is relevance for studies that assess the quality of PD and standards-based reform efforts in relation to what students learn as a result of changed teaching practices (Fishman, Marx, Besta, & Talb, 2003). For example, teachers in experimental preschool classrooms used math-relevant activities in their daily routines that significantly increased students’ standardized math test scores compared to students in regular classrooms (Arnold, Fisher, Doctoroff, & Dobb, 2002). There is also the acknowledgement that the emphasis being placed on high-stakes testing, with its rewards and punishments, can be informative but also come with unintended negative consequences with implications for PD programs (Ryan & Weinstein, 2009), and a thorough examination of formal PD and other professional learning opportunities that may increase teachers’ knowledge and change classroom practices to better meet federal requirements regarding student performance in the U.S. (Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009).

Theories

Motivational theories provide important guides and perspectives on teachers’ and other educators’ motivation and engagement in PD and the design of optimal PD programs. Included here are achievement goal theory, expectancy-value theory, and self-determination theory.

Articles on achievement goal theory include how teachers’ mastery, ability-approach, ability-avoidance, and work avoidance goals are related their help-seeking orientations (Butler, 2007) and thus their likelihood of PD participation. Included as well is the relationship between teachers’ and students’ achievement goals (Robustelli, 2007), and an analysis of achievement motivation and competence as an organizing framework (Elliot & Dweck, 2005), which is relevant for PD program design. Expectancy-value theory provides a framework for understanding teachers’ motivation for choosing teaching as a career, with implications for PD, academic institutions, and policy decisions (Watt & Richardson, 2007), and a study of the extent to which the expectancy-value model can explain teacher beliefs and practices related to computer technology (Wozney, Venkatesh, & Abrami, 2006), and thus participation in technology-related PD.

Articles discuss such topics as the usefulness of self-determination theory as a factor in promoting educational reform (Assor, Kaplan, Feinberg, & Tal, 2009), an investigation of how self-determination theory can be used to better understand why teachers attend PD and how school administration can contribute to the likelihood that teachers will implement PD content (Grove, Dixon, & Pop, 2009), and the role of self-determination theory in supplying an explanation of unintended negative consequences from high-stakes testing such as the potential for undermining both students and teachers (Ryan & Weinstein, 2009). The literature makes clear how incorporating resources that address possible theoretical approaches to teacher motivation and PD can be useful as guides to the design of PD programs and interventions as a means of attaining improved educational quality and student academic achievement.
General Trends

Several themes in the literature that are especially relevant to motivation and PD deserve mention. These include:

- **Teacher Self-efficacy** — Numerous articles report that teachers’ self-efficacy (i.e., beliefs they are capable of achieving instructional goals) influences student performance, and they stress the importance of PD programs that attend to teacher self-efficacy in their PD designs and evaluations.

- **Teacher Isolation** — The feeling of isolation that many teachers experience has motivational implications, and suggests that PD programs be designed to address such concerns.

- **Collaboration** — The call from teachers for PD opportunities to be offered in a variety of ways is being answered through the creation of alliances between teachers, administrators, and researchers in developing innovative initiatives such as collaborative professional learning communities, teacher support groups and improved traditional PD programs.

- **Intrinsic Rewards** — PD should attend to expected intrinsic rewards, such as the impact of teachers’ sense of self-worth and accomplishment in developing positive attitudes and motivation toward their participation in and anticipation of successful implementation of PD promoted practices.

- **Autonomy** — There is considerable consensus that PD programs are most beneficial when teachers maintain input and control over the PD process, for which self-determination theory is especially relevant. The inclusion of educators in the design, planning process, setting of goals, and implementation of PD has often been shown to improve the ability for participants to translate their experiences more effectively into the classroom.

- **Supportive Administrative Context** — There is a strong correlation between positive teacher-administrative relationships and opportunities for PD. Studies demonstrate that those in educational leadership positions can improve the work culture by supporting teacher motivation as well as teacher reflection, evaluation, and recognition.

- **Existing Beliefs, Practices and Change** — Evidence indicates that the acknowledgment of teachers’ existing beliefs and practices is a major factor in their motivation to participate and be engaged in PD, and that it plays a critical role in facilitating change. It is vital that PD programs recognize that while change can be important and enlightening, it can also be threatening.

- **Education Policy** — There is increasing recognition that understanding teacher motivation for PD must take the broader educational policy climate into consideration, in particular the current educational environment with its emphasis on education standards, high-stakes testing, and student achievement, which has resulted in the need for school districts to offer more effective PD for teachers in ways that promote teacher participation and engagement.

A Look Ahead

Recent comprehensive reviews of PD in the U.S. (Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009) provide new insights and evidence regarding the kinds of professional learning opportunities that are more likely to improve teacher knowledge and student achievement. This includes the need for PD to be intensive, embedded in teachers’ daily work in schools and directly related to their work with students. It is also essential that PD provides teachers with active engagement in learning how to teach content, and offers structured methods to regularly participate in collaborative solutions in local professional learning communities to improve teaching practices.

The evidence included here is consistent with the new definition of effective development, which according to Wei, et al. (2009), involves a “cycle of continuous improvement” in which teams of educators analyze data and determine student and adult learning goals, and develop strategies with coaches who support improved classroom instruction and provide assessments of how the teamwork has affected student achievement. The new model mandates professional learning as a regular part of every workday.

Clearly, the cycle of improvement approach to PD, which shares features in common with such approaches as Japanese Lesson Study (Fernandez, 2002) that was introduced in the U.S. in the 1980s, and professional learning communities, has implications for the role of motivation. Such approaches suggest the need to construe PD more generally by incorporat-
ing teachers' overall motivation for teaching into consideration in addition to focusing on PD as a discrete activity that is relatively discontinuous with other aspects of teachers' role-related activities.

Such recommendations are consistent with the evidence provided in this guide to resources. Despite new research on professional learning opportunities for teaching practice and outcomes, however, there has been virtually no mention of teacher motivation and teachers' decisions to attend or to engage in PD, only that more effective teachers may positively affect the motivation and effort of less effective teachers.

Although there is a growing body of literature to date, it is thus evident that the systematic examination of teacher motivation and PD has only begun, and that more research is needed to understand how education reforms affect teacher motivation in general, and motivation for PD in particular. Studies with an increased focus on the assessment of factors such as teacher autonomy and teacher efficacy, for example, would better enable researchers to identify the differences in participants who continue with or drop out of PD programs. Finally, there is a critical need for studies that examine teachers' beliefs about their responsibility for student outcomes (Lauermann & Karabenick, in press) that may have important consequences for their motivation to engage in PD in the pursuit of those goals.

The future of research on teacher motivation and PD, and the ability of teachers and schools to successfully bridge the demands of policy requirements and improved student learning experiences and outcomes, will be determined by the extent to which these programs weave together ideas from a wide array of fields of study, practices and theory that have previously existed separately from each other. The present guide to resources was designed with that goal in mind.
References


## Appendix A
### Resource Category Definitions and Search Keys

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<thead>
<tr>
<th>Key</th>
<th>Description</th>
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<tbody>
<tr>
<td>AO</td>
<td><strong>Achievement and Related Outcomes</strong>&lt;br&gt;Articles in this category consider the ways in which the design and implementation of PD programs affect student achievement outcomes, offer examples in which achievement can be motivated by the desire to experience competence by both teachers and students, and gives a foundation for future research and PD opportunities.</td>
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<tr>
<td>BL</td>
<td><strong>Beliefs</strong>&lt;br&gt;This section offers information which contributes to a more thorough understanding of the influence of teachers’ beliefs, relevant to the design of PD programs and educational reform. In trying to resolve hindrances to the implementation of educational reform efforts, educators have examined how to take into account teachers’ beliefs about these reforms and how best to support them in adopting changes in their teaching practices.</td>
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<td>CC</td>
<td><strong>Classroom Characteristics</strong>&lt;br&gt;This section contains resources describing the main influences on the day-to-day motivation for teachers in the classroom and with regard to their participation in PD. Articles focus on the factors which may undermine or enhance teacher motivation in these types of situations and experiences, and offer examples of practical solutions for problem-solving in the classroom for those educators who have a willingness to engage in new learning and PD opportunities as they become available.</td>
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<td>CL</td>
<td><strong>Collaboration</strong>&lt;br&gt;Topics in this section consider teacher collaboration as an effective means of connecting PD with the daily challenges faced by teachers. Research has shown that the inclusion of educators and other major stakeholders in the planning process and setting of goals for their PD often results in an improved ability for participants to translate their experiences more effectively in the classroom.</td>
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<td>CR</td>
<td><strong>Curriculum</strong>&lt;br&gt;This is a diverse collection of articles describing new PD approaches to using curriculum in school reform efforts to increase student achievement. These resources convey a widespread agreement that teachers’ views on the acceptability and usefulness of a particular curriculum program will significantly influence its implementation and success in integrating the curriculum into regular classroom practices towards school educational reform efforts. Several international studies are included.</td>
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<td>EM</td>
<td><strong>Emotions</strong>&lt;br&gt;In studies of emotion in educational contexts, resources in this category have shown that school reform has involved a reconstruction of teachers’ professional understanding of themselves and their beliefs. School reform may lead to intense feelings that cause teacher resistance or support in changing working conditions in schools and in teachers’ classroom practices, and articles in this section address the connection between teacher emotions, PD and student learning.</td>
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<td>EP</td>
<td><strong>Empowerment</strong>&lt;br&gt;The resources in this category provide a current view of PD as a framework within which educators can develop greater efficacy and empowerment through active engagement, in collaboration with colleagues, and involving an ongoing continuum of professional learning networks, with implications for teachers, principals, education leaders, and policy makers.</td>
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<td>GL</td>
<td><strong>Grade Level</strong>&lt;br&gt;The resources in this category cover grade levels that range from early childhood education through adult education programs, along with different international perspectives. These articles provide information on teaching concerns belonging to a particular grade level, as well as those that are shared across grade levels.</td>
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<td>ID</td>
<td>Identity</td>
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<td>An individual’s or group's identity may be defined by race, ethnicity or gender, along with other criteria factors such as economic status, age, religion, and professional self-understanding and perception. Implications which result from the existence of multiple identities are highlighted in this section, with recommendations for the design of PD programs which incorporate the identity of teachers and other educational leaders in furthering their personal and professional growth as well as contributing to more effective learning environments for their students.</td>
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<th>IN</th>
<th>Institution/School Features</th>
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<td>Resources in this category suggest the many ways that PD can be offered to reflect the needs of the individual school environments and contexts. The types of schools represented range from elementary through high school, and encompass urban, rural, public and private school systems, and schools with different levels of student achievement.</td>
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<th>IS</th>
<th>International Comparisons</th>
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<td>There are 31 countries represented in this literature review. The articles in this section highlight the importance of taking into account the role of educational research in PD in many different contexts. A collection of articles from different regions of the world is available.</td>
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<th>MV</th>
<th>Motivation</th>
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<td>Articles are included from the perspective of teachers, as well as from those involved in designing PD programs, which explore the factors that contribute most to motivating teachers to engage in PD, the ways that teachers experience their participation, and how this enhances teacher and student learning.</td>
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<th>PE</th>
<th>Perceptions</th>
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<td>The resources in this section offer information regarding the ways that teachers’ perceptions of their own needs interact with the types of support that are necessary to sustain successful pedagogical implementation of new practices through the educational system and PD programs. Articles in this category address the roles that intrinsic rewards, such as a sense of self-worth and accomplishment, have in developing positive attitudes and motivation to engage in PD programs.</td>
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<th>PL</th>
<th>Policies</th>
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<td>Legislation established by government policymakers both past and present, specifically the No Child Left Behind (NCLB) legislation, has changed the way education is being discussed in the U.S. and throughout the world. The articles in this category reflect this, highlighting the importance of identifying the PD models most likely to improve teacher practice and student performance.</td>
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<th>PR</th>
<th>Program Comparisons</th>
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<td>This category offers articles that address the spectrum of PD models in a comparative manner, relating to characteristics of individual PD programs, and also from an international perspective. Comparative analyses included here evaluate the most significant characteristics of PD suggested by members of professional educational organizations as part of effective PD programs.</td>
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<th>QE</th>
<th>Quality of Education</th>
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<td>In this section, a variety of topics are covered that report differing paths taken to increase the quality of education. Additionally, there are a significant number of resources concerned with greater expectations being placed on teachers for higher student outcomes and potential solutions which demonstrate effectiveness in advancing educational quality and increasing student achievement.</td>
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<th>RI</th>
<th>Reform and Innovation</th>
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<td>The articles in this section evaluate the different combinations in which PD programs are being designed in order to most effectively direct educational reform towards improving student performance in the areas most needed. Several international studies are included. These resources highlight some specific reform programs that seem to be effective and discuss which factors may be responsible for this progress.</td>
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<td>RS</td>
<td>Research</td>
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<td>The articles in this category acknowledge that a strong base of research is needed to guide the design and investment in PD for present applications, and offer evidence regarding the specific features in PD that could contribute to more effective educational practices, improved student achievement, and possible directions for future studies.</td>
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<th>SA</th>
<th>School Administration/Leadership</th>
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<td>The articles in this section reflect the desires of those in educational leadership positions for PD training to better assist them in meeting continually evolving government mandates in measuring student achievement levels and performance. Studies show an increasing call for the design of PD that can actively engage and prepare teachers for assuming leadership roles in their present and future positions in schools.</td>
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<th>SB</th>
<th>Student Behavior</th>
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<td>Resources in this section explore teachers’ perceptions of PD interventions which deepen teachers’ knowledge and understanding of students’ needs and abilities, offer practical strategies to improve student conduct, and suggest that teachers’ views of the usefulness and feasibility of these types of PD programs significantly influence successful implementation into their regular classroom practice.</td>
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<th>Student Characteristics</th>
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<td>This category includes articles which investigate the characteristics of PD programs in high-performing and low-performing schools, and document how teachers who participated in PD programs which focused on understanding the development of students’ thinking continue to implement the programs long afterwards, signifying meaningful and sustained changes in their teaching practices through this kind of PD.</td>
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<td>Math and science education represent the vast majority of articles in this category, however ten other domains are included as well which focus on the variety of ways that teacher motivation and PD influence student achievement.</td>
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<td>This category focuses on contexts, perceptions and motivations that contribute to teachers’ participation in PD, along with the outcomes resulting from their application of what was learned and gained through this engagement. The articles are relevant for a wide variety of issues that affect teachers, administrators, policy makers and designers of teacher PD programs.</td>
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<td>Resources in this category illustrate the growing wealth of information which provides guidance in facilitating the integration of technology into the educational process. For educators who seek innovative approaches to adapting technological advances into positive educational initiatives, the research findings from the articles in this section may be used to assist in designing PD that promotes good teaching, learning and creative thinking practices.</td>
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<td>New standards require new approaches to educating students, and resources in this section evaluate several different options for improving student achievement by enhancing the capacity of teachers and schools through PD to more successfully bridge the demands of students’ learning experiences and the demands of the federally mandated standards movement.</td>
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<td>The motivational theories mentioned in these articles, such as achievement goal theory, expectancy-value theory and self-determination theory, have been looked at in the context of PD programs and their implications for educational practice in light of these theoretical perspectives. Resources that suggest possible theoretical approaches to teacher motivation and PD could be useful to educators in guiding the design of PD programs and interventions.</td>
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### Appendix B

**Resources and Category Search Keys**

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<td>The impact of professional development in mathematics on teachers’ individual and collective efficacy: The stigma of underperforming</td>
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