Investigating Rural Teachers' Professional Development, Instructional Knowledge, and Classroom Practice

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Teachers Speak was a national survey study designed to investigate the characteristics of rural elementary school teachers' existing professional development; differences in professional development practices between rural and non-rural settings; and the potential influence of professional development characteristics on rural teachers' knowledge, perceptions, and instructional practice. The respondents included 268 rural and 327 non-rural (city, suburban, town) teachers whose schools were selected via stratified random sampling. Key findings indicate that professional development experiences, perceptions, and classroom practices were similar for rural and non-rural teachers. Rural teachers did not appear to be comparatively disadvantaged, at least not in terms of their best professional development experiences. They reported comparable characteristics for professional development (e.g., providers, hours, practice and feedback opportunities, collaboration opportunities). An emphasis on topics during professional development was found to be related to increased (a) positive perceptions of the utility of the topics, (b) perceptions of knowledge gained pertaining to those topics, and (c) increased focus on those topics during classroom instruction. Perceived utility of instructional topics was a significant predictor of reported practice. When including both rural and non-rural teachers, time in professional development was found to be a significant predictor of their pedagogical content knowledge.

Rural schools face significant challenges in providing effective professional development (PD) opportunities for teachers, including geographic isolation, limited availability of PD resources, and the lack of available staff to support PD efforts (e.g., coaches, consultants, substitute teachers for teacher released time). Physical distance has been identified as a major deterrent for rural schools to provide PD to teachers (Hansen, 2009; Rude & Brewer, 2003; Weitzenkamp, Howe, Steckelberg, & Radcliffe, 2003). In addition to being geographically isolated, rural teachers may have to deal with a lack of teaching resources, as well as out-of-date classrooms and labs (Lynch, 2000; Marlow & Cooper, 2008). They often teach multiple grades and multiple subjects and wear many hats within the school, including coach, bus driver, and director for multiple extracurricular activities (Minner, Berns, Century, & Hiles,

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2003). In general, their salaries are less than their non-rural counterparts (Strange, Johnson, Showalter, & Klein, 2012).

While research has documented the challenges associated with PD in rural areas, and underscored the need to consider the rural context (Howley & Howley, 2004; Oliver, 2007), studies of teacher PD are not well represented in the rural education research literature. Although the focus in this area is growing, a 2011 review of rural educational research found that the percentage of studies dealing with teacher preparation was around 20% (Cicchinelli, 2011). Since this review, several investigations have explored the influence of systematically introducing pre-service teachers to the rural context and place-based pedagogy (e.g., Azano, & Stewart, 2015). Other studies have explored the impact of specific PD approaches used in rural schools (e.g., Barrett, Cowen, Toma, & Troske, 2015; Vernon-Feagans, Kainz, Hedrick, Ginsberg, & Amendum, 2013). Although this work is encouraging, very little is known about specific characteristics of existing PD activities in rural schools, particularly in comparison with non-rural teachers, and which aspects of these activities are crucial for bolstering teacher perceptions, knowledge, and practice.

Effective Professional Development Characteristics

Although little is known about characteristics of PD approaches in rural schools, there is a growing consensus within the research literature of features that are necessary for effective PD. A comprehensive set of investigations by Garet, Desimone, and their colleagues (e.g., Desimone, 2009; Desimone, Smith, & Phillips, 2013; Desimone & Stuckey, 2014; Porter, Garet, Desimone, & Birman, 2003) have identified key characteristics, including a focus on deepening teachers' content knowledge (e.g., in reading, science, and mathematics) and active teacher engagement in learning opportunities. PD is also more effective if it is sustained over time and involves a substantial number of contact hours. Furthermore, activities that are linked to teachers' other experiences and encourage professional communication among teachers appear to support change in teaching practice, even after the effects of enhanced knowledge and skills are taken into account (Burbank & Kauchak, 2003; Vanderburg & Stephens, 2010). Graduated experiences, including instruction, modeling, practice, feedback, and opportunities to adapt newly acquired skills into natural classroom contexts (e.g., through coaching or consultation), are also necessary to achieve desired experiential and learning outcomes (Cooper, 2003; Denton & Hasbrouck, 2009; Mangin & Dunsmore, 2014; Neuman & Cunningham, 2009). Research has also shown that focusing on specific teaching practices within PD increases the use of those practices in the classroom (Desimone, 2009; Desimone et al., 2013; Gamse, Jacob, Horst, Boulay, & Unlu, 2008). Regardless of geographic context, staff development experiences should be delivered in a highly accessible way to encourage collective participation and collaboration among teachers, be of sufficient duration, and promote continuity to other in- and out-of-school experiences (Desimone, 2009; Desimone & Stuckey, 2014; Desimone et al., 2013; Loucks-Horsley, Love, Stiles, Mundry, & Hewson, 2003).

The interaction of such PD characteristics and their relationship to teacher practice has been demonstrated in a formal causal model (Desimone, 2009; Desimone & Stuckey, 2014; Porter et al., 2003). Results documented characteristics that led to increases in teachers' self-reported knowledge and skills and changes in teaching practice: (a) training duration (both total number of contact hours and span of time over which the activity takes place); (b) coherence between the PD and standards, assessments, and teacher's goals; (c) collective participation; (d) use of active learning; and (e) focus on content knowledge. Significant relationships were found between the contact hours and content focus; PD of longer duration led to deepening of content knowledge. Content focus, in turn, was significantly related to enhanced knowledge and skills, which was significantly related to change in teaching practice.

Locale-Specific Professional Development

Some insight into PD similarities and differences between rural, urban, and suburban schools comes from a report sponsored by the National Staff Development Council and funded by the Gates Foundation (Wei, Darling-Hammond, & Adamson, 2010). Drawing on large-scale datasets including the Schools and Staffing Survey from the U. S. Department of Education and the MetLife Survey of the American Teacher series, the report found some differences, but more similarities, when comparing across the rural-urban continuum. When differences were found, they were most likely between rural and urban. For example, urban teachers participated in significantly more hours of PD than rural teachers, were more likely to participate in reading PD than rural, and perceived content-focused PD as more of a priority than rural teachers. Other insight into rural vs. non-rural differences comes from the National Center for Education Statistics (NCES) teacher PD study (Choy, Chen, & Burgarin, 2006). Although data were not analyzed specifically for differences between rural and non-rural schools, analyses by school size are instructive. Results showed that schools with fewer than 150 students were significantly less likely than teachers in larger schools to participate in mentoring and coaching, to collaborate regularly with other teachers, and to take college courses.

Purpose of Study and Research Questions

The purpose of this study was to examine variations in existing PD characteristics and their potential influence on rural teachers' perceived knowledge and practice. There is no comprehensive review of teacher PD characteristics and practices for rural teachers, particularly in comparison with non-rural teachers, as well as the impact of those characteristics on teacher practice. This study addresses a critical gap in research on rural PD focusing on science inquiry, mathematics, and reading by investigating (a) variations in existing rural PD practices pertaining to specified characteristics (e.g., the frequency and duration of training, amount of instructional support, level of collaborative participation, and prevalence of opportunities for practice with feedback); (b) differences in PD practices between rural, city, suburban, and town settings; and (c) the potential influence of various characteristics of PD on rural teachers' knowledge, perceptions, and instructional practice.

The study addressed two primary research questions:

1. **How do rural and non-rural teachers differ with respect to their professional development participation and their perceptions and classroom practices pertaining to training foci?** This research documents differences between rural (fringe, distant, and remote) and non-rural (city, suburban, and town) settings with respect to (a) the availability of PD opportunities; (b) teachers' appraisals of the PD approaches; (c) the characteristics of PD activities; and (d) teachers' perceptions, knowledge, and classroom practices pertaining to PD foci.

2. **What is the potential impact of professional development characteristics on rural teacher perceptions, knowledge, and practices?** The study examined the potential influence of research-based PD characteristics (i.e., factors pertaining to the frequency and duration of training, the collaborative participation of teachers, and opportunities for practice with feedback within a workshop/in-service context or within the classroom) on perceived teacher outcomes. Drawing upon the key characteristics identified in the research, this study proposed a path model (see Figure 1) that hypothesized key relationships between PD structural features (such as duration of training, collaborative participation of teachers, and use of practice/feedback) and teacher outcomes (such as their perceptions of the PD utility and knowledge enhancement). These teacher outcomes were, in turn, hypothesized as predictors of reported teacher practice.

Method

Participants

Participants included kindergarten through fifth-grade teachers from rural and non-rural schools. Teachers' schools were classified as rural or non-rural based on definitions established by NCES that take into account a school's location relative to urbanized areas and clusters identified by the U.S. Census Bureau. According to NCES, a *city* is defined as a "territory inside an urbanized area and inside a principal city" with a population of either 250,000 or more (large city), 100,000 to 249,999 (midsize city), or 99,999 or fewer (small city). A suburb is defined as a "territory outside a principal city and inside an urbanized area" with a population or either 250,000 or more (large suburb), 100,000 to 249,999 (midsize suburb), or 99,999 or fewer (small suburb). A *town* is defined as a "territory inside an urban cluster" that is either less than or equal to 10 miles from an urbanized area (fringe town), between 10 and 35 miles from an urbanized area (distant town), or more than 35 miles from an urbanized area (remote town). Rural areas are defined as: *fringe rural*, a "Census-defined rural territory that is less than or equal to 5 miles from an urbanized area, as well as rural territory that is less than or equal to 2.5 miles from an urban cluster"; *distant rural*, a "Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an urban cluster"; and *remote rural*, a "Census-defined rural territory that is more than 25 miles from an urbanized area and is also more than 10 miles from an urban cluster" (NCES, 2006).

For this study, schools designated by NCES with either rural or remote town locale codes were classified as rural. Remote towns were included in this classification, given that resources and access to services in remote towns were likely more similar to schools in rural areas than their non-rural counterparts (given their distance from population centers). For research question 1, the remaining schools were classified as city (i.e., large city, mid-size city, small city), suburban (large suburb, mid-size suburb, small suburb), or town (fringe town, distant town) according to their original NCES designation. Due to sample size constraints, city, suburban, and town schools were grouped into a single "non-rural" classification for research question 2.

Schools stratified by student population size within each locale (rural, town, city/suburban) were randomly selected from the national NCES database, which included locale designations and demographic information for each school. Schools were sent packets of surveys for kindergarten through fifth-grade teachers. Based on data from the NCES database from the previous school year, it

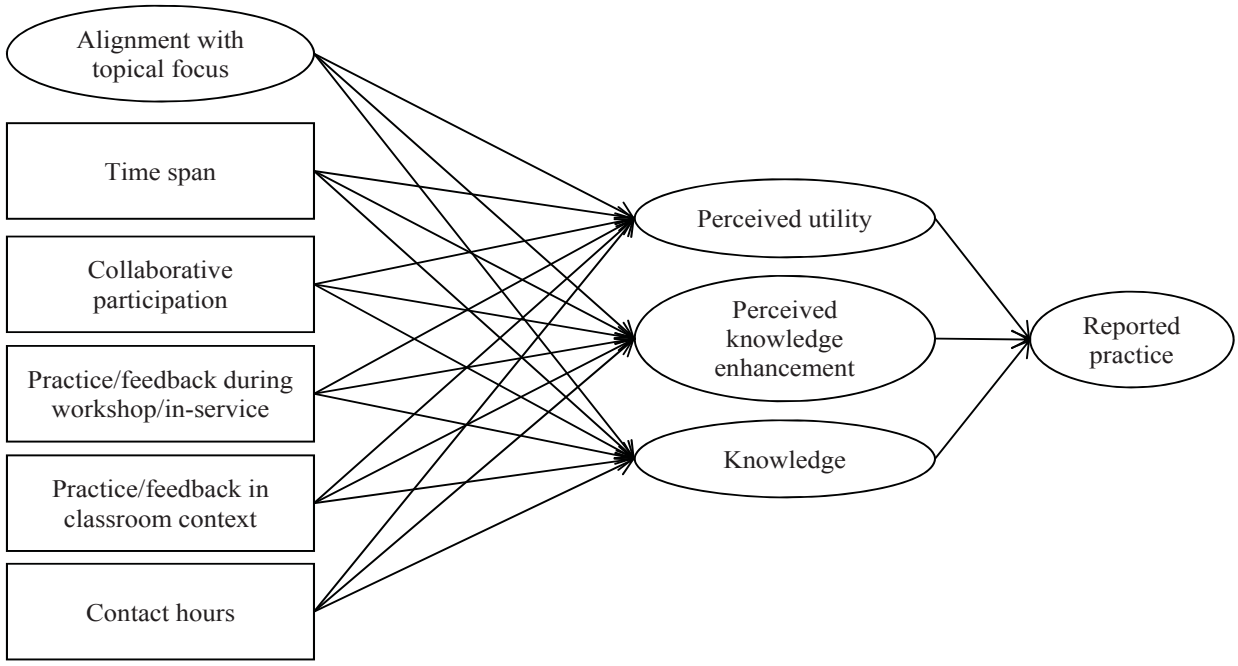

Figure 1. Model 1 (proposed model).

was estimated that approximately 845 rural, 416 town, and 432 city/suburban teachers worked in kindergarten through fifth grade at the selected schools. Respondents included 268 rural and 327 non-rural teachers from 43 U.S. states. Among these respondents, 360 teachers representing 41 U.S. states indicated that they had participated in a PD experience relevant to the survey with which they were provided. The demographic information for participants is shown in Table 1.

The final column in Table 1 provides descriptive statistics for comparable variables obtained from the 2011-12 School and Staffing Survey (SASS). The given SASS estimates, obtained from the NCES DataLab program (NCES, n.d.), are based on teachers of public and private elementary schools with a designation of "regular" program type. This information provides a check on the representativeness of the study sample.

Measures

Participants received one of four randomly assigned versions of a scan-form questionnaire developed by the investigators. Each version of the questionnaire included common demographic questions followed by questions about their best PD experiences and their instructional knowledge, perceptions, and practice corresponding to one of four instructional content areas: reading, mathematics, science inquiry, or using data-based decision making to inform reading instruction/intervention (DBDM).

Demographic information. Participating teachers were asked to provide information about their teaching assignment, certifications, degrees obtained, gender, age, ethnicity, experience, class size, class organization, and school grade-level range.

Professional development characteristics. Participants were also instructed to answer questions characterizing their best PD experience within the past year pertaining to one of four randomly assigned content areas (reading instruction, mathematics instruction, science inquiry instruction, or the use of data-based decision making to inform reading instruction/intervention). First, they were asked whether they participated in PD within the past year in their randomly assigned topical area. If so, they were instructed to complete nine questions about their best PD experience. Participants were asked to refer to their best experience in addressing these questions, because it was anticipated that this would elicit the most vivid recollections.

In considering their best PD experience, the teachers were asked to indicate its mode (single institute, series of workshops, workshop with follow-up coaching, colleague presentation, college course, conference, work with a coach/mentor, participation in a collaborative study group); leader (school teacher/staff, district staff, regional staff, state staff, external expert, university/college faculty/staff); distance travelled; training method format (live, distance learning opportunity); time span; opportunities for interaction/collaboration with colleagues (no interaction, interaction during PD, interaction independent from PD); and

Table 1

Teacher Demographic and Educational Background

	Overall (n = 360)	City (n = 39)	Suburb (n = 43)	Town (n = 77)	Rural (n = 201)	Signif.	SASS[e] ($n \approx$ 2,185,200)
Gender							
Males	5.3%	12.8%	4.8%	3.9%	4.5%		14.3% (SE_{BRR} = 0.47)
Females	94.7% (n = 358)	87.2% (n = 39)	95.2% (n = 42)	96.1% (n = 77)	95.5% (n = 200)		85.7% (SE_{BRR} = 0.47) ($n \approx$ 2,185,200)
Age (in years)	M = 44.01 (SD = 11.38) (n = 355)	M = 46.21 (SD = 13.04) (n = 39)	M = 40.37 (SD = 12.72) (n = 43)	M = 43.95 (SD = 10.26) (n = 75)	M = 44.39 (SD = 11.04) (n = 198)		
Ethnicity		a,b		a	b	$p < .05$ $\chi^2(15) = 31.18$	
White, non-Hispanic	89.4%	69.2%	93.0%	98.7%	88.9%		81.9% (SE_{BRR} = 0.73)
Black, non-Hispanic	7.5%	25.6%	4.7%	0.0%	7.5%		6.8% (SE_{BRR} = 0.34)
Hispanic	2.0%	2.6%	2.3%	1.3%	2.0%		8.2% (SE_{BRR} = 0.54)
Asian/Pacific Islander	0.6%	2.6%	0.0%	0.0%	0.5%		1.9% (SE_{BRR} = 0.31)
American Indian/Alaskan Native	0.3%	0.0%	0.0%	0.0%	0.5%		0.4% (SE_{BRR} = 0.08)
Other	0.3% (n = 358)	0.0% (n = 39)	0.0% (n = 43)	0.0% (n = 77)	0.5% (n = 199)		0.8% (SE_{BRR} = 0.15) ($n \approx$ 2,185,200)
Years Teaching Experience							
Total	M = 15.37 (SD = 10.09) (n = 358)	M = 16.76 (SD = 11.15) (n = 38)	M = 12.58 (SD = 10.21) (n = 43)	M = 14.04 (SD = 8.01) (n = 77)	M = 16.22 (SD = 10.47) (n = 200)		M = 14.00 (SE_{BRR} = 0.16) ($n \approx$ 2,185,200)
Math	M = 13.59 (SD = 9.87) (n = 322)	M = 14.90 (SD = 10.95) (n = 31)	M = 10.11[c] (SD = 9.57) (n = 38)	M = 12.06 (SD = 8.53) (n = 69)	M = 14.66[c] (SD = 10.04) (n = 184)	$p < .05$ $F(3, 318) = 3.10$	
Science	M = 12.78 (SD = 10.31) (n = 310)	M = 16.03[d] (SD = 12.01) (n = 31)	M = 9.42[d] (SD = 9.21) (n = 38)	M = 11.09 (SD = 8.95) (n = 67)	M = 13.59 (SD = 10.49) (n = 174)	$p < .05$ $F(3, 306) = 3.41$	
Reading	M = 14.32 (SD = 10.18) (n = 324)	M = 15.74 (SD = 12.26) (n = 31)	M = 12.00 (SD = 10.09) (n = 39)	M = 12.67 (SD = 8.29) (n = 70)	M = 15.20 (SD = 10.39) (n = 184)		
Class Organization							
Self-contained	73.0%	84.2%	67.4%	77.9%	70.1%		44.6% (SE_{BRR} = 0.80)
Departmentalized	11.3%	10.5%	16.3%	6.5%	12.2%		39.2% (SE_{BRR} = 0.68)
Team Taught	9.6%	2.6%	11.6%	6.5%	11.7%		5.2% (SE_{BRR} = 0.40)
Other	6.2% (n = 355)	2.6% (n = 38)	4.7% (n = 43)	9.1% (n = 77)	6.1% (n = 197)		11.0% (SE_{BRR} = 0.51) ($n \approx$ 2,185,200)
Number of Students	M = 20.64 (SD = 16.61) (n = 308)	M = 27.70 (SD = 49.02) (n = 27)	M = 23.66 (SD = 13.41) (n = 38)	M = 19.41 (SD = 5.54) (n = 70)	M = 19.36 (SD = 8.12) (n = 173)		M = 14.80[e] (SE_{BRR} = 0.06) ($n \approx$ 2,185,200)
Degrees Held							
Bachelor's Degree	90.3%	82.1%	97.7%	90.9%	90.0%		95.8% (SE_{BRR} = 0.34)
Master's Degree	53.9% (n = 360)	56.4% (n = 39)	41.9% (n = 43)	48.1% (n = 77)	58.2% (n = 201)		53.0% (SE_{BRR} = 0.70) ($n \approx$ 2,185,200)

Note. SASS = Schools and Staffing Survey. SASS estimates are based on the WTA000 sampling weight. SASS standard errors were computed using a balanced repeated replication method. [a]$\chi^2(3) = 24.49$, $p < .05$. [b]$\chi^2(5) = 13.74$, $p < .05$. [c]$|M_d| = 4.56$, $SE = 1.74$, $p < .05$. [d]$|M_d| = 6.61$, $SE = 2.47$, $p < .05$. [e]Estimated number of students per FTE teacher in the school.

percentage of time spent on practice/feedback opportunities within a workshop/in-service or classroom context.

The teachers were provided with a list of possible topical foci for their best teacher PD experience and were asked to rate the degree to which each topic was included in their best PD experience (not included, minor focus, significant focus, unsure). Teachers assigned to the reading content focus were provided with topical foci pertaining to the "big five" areas of reading identified by the National Reading Panel (2000): phonemic awareness, alphabetic principal, fluency, vocabulary, and comprehension. Those assigned to mathematics content were presented with topical foci related to number and operations, algebra, measurement, and geometry. Those assigned to science content were presented with topics related to skills necessary to perform scientific inquiry (e.g., discipline-specific content, engaging students in asking scientific questions, guiding students in proposing preliminary explanations/predictions, guiding students in planning and conducting a simple investigation). Finally, those who received the DBDM version of the survey were presented with topics related to administering/scoring screening, progress monitoring, or diagnostic assessments; examining screening data to identify the effectiveness of the core reading program or to identify and create instructional groups for students in need of support; examining progress monitoring data to determine the effectiveness of intervention programs to determine effectiveness of interventions for groups of students or to make instructional decisions for individual students; graphing and/or interpreting individual student progress monitoring data to make instructional decisions for students; and writing data-based goals for students.

Perceptions. To assess teacher perceptions about the utility of content-specific practices and their acquisition of knowledge, teachers were asked to appraise the importance for promoting student learning (less important, somewhat important, important, critical) for the content-specific instructional topics/practices that they had previously rated for their inclusion as part of their best PD experience. In addition, for each instructional topic/practice, they were asked to rate the degree to which they felt their knowledge improved (1 = not at all; 5 = great degree) as a result of PD participation.

Instructional content knowledge. To assess pedagogical content knowledge—knowledge pertaining to teaching specific content—teachers were instructed to complete one of four content-specific measures of instructional content knowledge. Each measure assessed best practices identified through research on content pedagogy. Teacher Knowledge of Reading and Reading Practices (Carlisle, Johnson, Phelps, & Rowan, 2008) is a 13-item multiple-choice assessment designed to measures reading pedagogical content knowledge related to early reading skills. Content Knowledge for Teaching Mathematics (Ball & Hill, 2008) is a 14-item measure designed to assess teachers' understanding of early mathematics instruction. Data-based Decision Making Knowledge for Reading (Glover et al., 2010) is a 15-item multiple choice measure assessing teachers' knowledge of practices related to the use of data to make instructional decisions for elementary students in the area of reading. Finally, Science Inquiry Instructional Knowledge (Nugent, Pedersen, Welch, & Bovaird, 2014) is a 17-item multiple-choice measure assessing teachers' content knowledge in science inquiry instruction. For each of the knowledge measures, correct items were summed to yield a total score.

Reported practice. On all survey versions, teachers were asked to rate the extent to which the previously listed content-specific instructional topics were a focus of their practice (not a focus, minor focus, significant focus, unsure).

Data Collection and Entry Procedure

Survey administration and data processing were conducted through a university survey center at the principal investigators' institution. Questionnaire packets were mailed to participating teachers' schools along with materials provided as an incentive to complete the survey (i.e., pens, tote bags, and sticky notes). Schools were mailed reminders to prompt teachers to complete unreturned surveys. Each school received approximately the same number of each of the four versions of the survey (reading, mathematics, science inquiry, or DBDM). Scannable questionnaire forms were used to complete the survey. Completed forms were returned in a pre-addressed envelope to the data processing center. Data were then scanned into a password-protected relational database, checked for errors, and recoded to create summary scores. The data were then exported via a comma-separated values file used for statistical analyses.

Data Analyses

Descriptive statistics, chi-square tests of independence, and one-way between groups ANOVAS were used to investigate whether teachers of different locales varied with respect to their demographic and educational backgrounds, PD participation, or perceptions and classroom practices pertaining to training foci. Pairwise comparisons were conducted in the presence of significant omnibus effects. Experimentwise error rate was controlled using Tukey's (1949) honestly significant difference post-hoc test with ANOVAs and a similar permutation method (Jin & Wang, 2014) with chi-square tests.

Path analysis was used to investigate relationships among PD characteristics (alignment of topical focus, time span, collaborative participation, practice/feedback

during workshop/in-service, practice/feedback in classroom context, contact hours); teacher perceptions (perceived utility, perceived knowledge); knowledge; and reported practice. Data were analyzed using a full-information maximum likelihood approach implemented via M*plus*, Version 6.1 (Muthén & Muthén, 2010). Model fit was assessed using the chi-square test of exact fit, and the fit indices CFI, SRMR, and RMSEA. The chi-square test of exact fit (χ^2) is a global model fit statistic which tests the null hypothesis of a perfect model. This test is limited in that it alone is not a sufficient measure of model fit, as it is heavily influenced by sample size. CFI (Comparative Fit Index) is a measure of comparative fit which compares the model to a more restricted model for the purpose of examining the noncentrality parameter. Values close to .95 and higher indicate acceptable model fit (Kline, 2011). SRMR (standard root mean square residual) is an index of absolute fit derived from the residual correlation matrix which describes the extent of the average discrepancy between the observed and predicted correlations. SRMR values ≤ .08 indicate acceptable model fit (Hu & Bentler, 1999). RMSEA (root mean square error of approximation) is an index of the error of approximation which provides a basis for estimating confidence intervals, with values ≤ .05 indicating acceptable model fit (Hooper, Coughlan, & Mullen, 2008).

Results

As described above, the research questions of interest focus on the experiences of teachers relative to PD. Thus, only those respondents who reported having participated in PD specific to the content area version of the survey they completed within the year prior to participation were included in analyses (n = 360; see previous description of participants).

Research question 1. How do rural and non-rural teachers differ with respect to their professional development participation and their perceptions and classroom practices pertaining to training foci?

As previously described, descriptive statistics, chi-square tests of independence, and one-way between groups ANOVAS were used to investigate whether teachers of different locales vary with respect to their demographic and educational backgrounds, PD participation, or their perceptions and classroom practices pertaining to training foci. Teacher demographic and educational background data are summarized in Table 1. As indicated in the table, demographics were statistically comparable across locales with respect to teachers' gender, age, ethnicity, total years of teaching experience and years of reading teaching experience, class organization, number of students taught, and degree obtainment. In contrast, self-reported ethnicity significantly varied across locales ($\chi^2(15) = 31.18$, $p < .05$). Specifically, there was a significant difference in the self-reported ethnicity of city and town teachers ($\chi^2(3) = 24.49$, $p < .05$), and city and rural teachers ($\chi^2(5) = 13.74$, $p < .05$), with fewer city teachers self-identifying as White, non-Hispanic and a greater number of city teachers self-identifying as Black, non-Hispanic. In addition, there was a significant omnibus mean difference across teacher locales in years of math teaching experience ($F(3, 318) = 3.10$, $p < .05$) and years of science teaching experience ($F(3, 306) = 3.41$, $p < .05$). Suburban teachers reported significantly fewer years of math teaching experience than rural teachers ($|M_d| = 4.56$, $SE = 1.74$, $p < .05$) and significantly fewer years of science teaching experience than city teachers ($|M_d| = 6.61$, $SE = 2.47$, $p < .05$).

Response frequencies and descriptive statistics for teacher PD experiences are summarized in Table 2. There were no significant mean differences across teacher locales for number of miles traveled to attend PD, number of hours devoted to PD experiences, or percentage of time spent on practice or feedback opportunities within a workshop/in-service or classroom context. Likewise, there was no significant relationship between teacher locale and PD leader, PD training method, or opportunities for interaction/collaboration with colleagues. Mode of PD, on the other hand, did significantly vary across teacher locales ($\chi^2(24) = 51.68$, $p < .05$). In comparing city and suburban teachers ($\chi^2(8) = 21.24$, $p < .05$), a greater proportion of city teachers reported participating in workshops/institutes and teacher collaborative study groups/networks, and a greater proportion of suburban teachers reported participating in presentations by colleagues, college courses, and experiences that included a mentor, coach, lead teacher, or observer. In comparing city and town teachers ($\chi^2(8) = 22.18$, $p < .05$), a greater proportion of city teachers reported participating in general workshops/institutes and workshops/institutes with follow-up coaching, and a greater proportion of town teachers reported participating in single workshops/institutes, presentations by colleagues, college courses, and experiences that included a mentor, coach, lead teacher, or observer. Number of days devoted to PD also significantly varied across teacher locales ($F(3, 356) = 4.01$, $p < .05$). City teachers devoted a significantly greater number of days to PD than town ($|M_d| = 1.41$, $SE = 0.44$, $p < .05$) and rural ($|M_d| = 1.25$, $SE = 0.39$, $p < .05$) teachers.

Means and standard deviations for teacher content knowledge, perceptions, and classroom practices are summarized in Table 3. There were no significant mean differences across teacher locales for alignment of PD experiences with content-related foci, perceived utility of content-related foci, perceived enhancement of content knowledge as a result of PD, or teacher practices. Content knowledge did significantly vary across teacher locales

Table 2

Response Frequencies and Descriptive Statistics for Teacher Professional Development Experiences

	Overall (n = 360)	City (n = 39)	Suburb (n = 43)	Town (n = 77)	Rural (n = 201)	Signif.
Primary format		a,b	a	b		$p < .05$
Single workshop/institute	20.6%	8.1%	12.8%	18.7%	25.4%	$\chi^2(24) = 51.68$
Series of workshops/institutes	25.9%	45.9%	15.4%	22.7%	25.4%	
Workshops/Institutes with follow-up coaching	22.7%	29.7%	25.6%	10.7%	25.4%	
Presentation by colleague	6.7%	2.7%	12.8%	10.7%	4.7%	
College course	5.5%	0.0%	10.3%	9.3%	4.1%	
Conference	4.7%	2.7%	2.6%	6.7%	4.7%	
Mentor, coach, lead teacher, observer	5.5%	0.0%	12.8%	10.7%	3.1%	
Teacher collaborative study group/network	6.7%	10.8%	2.6%	9.3%	5.7%	
Other	1.7%	0.0%	5.1%	1.3%	1.6%	
	(n = 344)	(n = 37)	(n = 39)	(n = 75)	(n = 193)	
Leader of Professional Development						
Teacher/Staff from school	22.8%	15.8%	31.7%	28.0%	20.3%	
District staff	13.4%	31.6%	17.1%	9.3%	10.7%	
Regional educational unit staff	11.7%	13.2%	7.3%	12.0%	12.2%	
State staff	5.1%	0.0%	2.4%	6.7%	6.1%	
External expert/consultant	36.5%	34.2%	29.3%	33.3%	39.6%	
University/College faculty/staff	7.4%	5.3%	7.3%	9.3%	7.1%	
Other	3.1%	0.0%	4.9%	1.3%	4.1%	
	(n = 351)	(n = 38)	(n = 41)	(n = 75)	(n = 197)	
Miles traveled (one way) to attend professional development	M = 77.16	M = 146.04	M = 15.77	M = 108.73	M = 64.22	
	(SD = 200.72)	(SD = 359.15)	(SD = 15.79)	(SD = 302.29)	(SD = 115.68)	
	(n = 227)	(n = 25)	(n = 22)	(n = 44)	(n = 136)	
Training Method						
Live	95.3%	100.0%	93.0%	96.1%	94.5%	
Distance Learning	2.8%	0.0%	4.7%	2.6%	3.0%	
Other	2.0%	0.0%	2.3%	1.3%	2.5%	
	(n = 358)	(n =39)	(n = 43)	(n = 77)	(n = 199)	
Span of time (in days) devoted to professional development experience	M = 1.44	M = 2.56[c,d]	M = 1.53	M = 1.16[c]	M = 1.32[d]	
	(SD = 2.24)	(SD = 4.46)	(SD = 2.56)	(SD = 1.53)	(SD = 1.63)	$p < .05$
	(n = 360)	(n = 39)	(n = 43)	(n = 77)	(n = 201)	$F(3, 356) = 4.01$
Span of time (in hours) devoted to professional development experience	M = 18.57	M = 17.87	M = 17.14	M = 19.18	M = 18.78	
	(SD = 19.13)	(SD = 21.28)	(SD = 18.48)	(SD = 19.36)	(SD = 18.87)	
	(n = 345)	(n = 38)	(n = 42)	(n = 74)	(n = 191)	
Interaction and collaboration						
Did not interact/collaborate	11.1%	13.2%	16.3%	15.6%	8.0%	
Part of professional development	61.3%	68.4%	55.8%	53.2%	64.2%	
Independent of professional development	19.8%	13.2%	20.9%	24.7%	18.9%	
Both	7.8%	5.3%	7.0%	6.5%	9.0%	
	(n = 359)	(n = 38)	(n = 43)	(n = 77)	(n = 201)	
Percentage of time spent on practice/feedback opportunities within workshop/in-service	M = 20.86	M = 17.89	M = 26.15	M = 22.74	M = 19.57	
	(SD = 34.40)	(SD = 31.90)	(SD = 38.63)	(SD = 35.86)	(SD = 33.45)	
	(n = 329)	(n = 36)	(n = 40)	(n = 70)	(n = 183)	
Percentage of time spent on practice/feedback opportunities within classroom context	M = 46.07	M = 37.73	M = 54.76	M = 43.31	M = 46.69	
	(SD = 42.32)	(SD = 41.23)	(SD = 42.11)	(SD = 42.50)	(SD = 42.45)	
	(n = 314)	(n = 33)	(n = 41)	(n = 68)	(n = 172)	

Note. [a]$\chi^2(8) = 21.24$, $p < .05$. [b]$\chi^2(8) = 22.18$, $p < .05$. [c]$|M_d| = 1.41$, $SE = 0.44$, $p < .05$. [d]$|M_d| = 1.25$, $SE = 0.39$, $p < .05$.

Table 3

Means and Standard Deviations for Teacher Content Knowledge, Perceptions, and Classroom Practices

	Overall (n = 360)	City (n = 39)	Suburb (n = 43)	Town (n = 77)	Rural (n = 201)	Signif.
Content knowledge	M = 0.52 (SD = 0.19) (n = 339)	M = 0.43[a,b] (SD = 0.18) (n = 35)	M = 0.56[a] (SD = 0.18) (n = 42)	M = 0.54 (SD = 0.21) (n = 68)	M = 0.53[b] (SD = 0.19) (n = 194)	$p < .05$ $F(3, 335) = 3.04$
Alignment with topical focus	M = 1.09 (SD = 0.57) (n = 332)	M = 1.12 (SD = 0.53) (n = 36)	M = 1.03 (SD = 0.59) (n = 40)	M = 1.04 (SD = 0.61) (n = 75)	M = 1.12 (SD = 0.56) (n = 181)	
Perceived utility of topical foci	M = 2.02 (SD = 0.58) (n = 345)	M = 2.00 (SD = 0.64) (n = 36)	M = 2.08 (SD = 0.55) (n = 43)	M = 1.98 (SD = 0.58) (n = 75)	M = 2.03 (SD = 0.57) (n = 191)	
Perceived knowledge enhancement	M = 0.91 (SD = 0.71) (n = 301)	M = 0.84 (SD = 0.64) (n = 31)	M = 0.84 (SD = 0.70) (n = 37)	M = 0.81 (SD = 0.65) (n = 64)	M = 0.97 (SD = 0.75) (n = 169)	
Reported practice	M = 1.47 (SD = 0.43) (n = 347)	M = 1.41 (SD = 0.47) (n = 36)	M = 1.47 (SD = 0.48) (n = 43)	M = 1.40 (SD = 0.43) (n = 75)	M = 1.52 (SD = 0.41) (n = 193)	

Note. [a]$|M_d| = 0.12$, $SE = 0.04$, $p < .05$. [b]$|M_d| = 0.09$, $SE = 0.04$, $p < .05$.

Table 4

Standardized Regression Coefficients for Model 2 for Rural and Non-Rural Groups

	Rural		Non-Rural	
	Est.	SE	Est.	SE
Reported practice ON				
Perceived utility	0.47**	0.07	0.57**	0.07
Perceived knowledge gain	-0.03	0.11	-0.28*	0.12
Knowledge	0.01	0.08	0.01	0.08
Knowledge alignment with topical focus	0.23*	0.11	0.45**	0.11
Perceived utility ON				
Practice/feedback during workshop/in-service	0.13	0.09	0.03	0.10
Alignment with topical focus	0.18*	0.09	0.17	0.09
Perceived knowledge gain ON				
Alignment with topical focus	0.69**	0.05	0.74**	0.05
Knowledge ON				
Contact hours	0.15	0.08	0.19	0.10
Practice/feedback during workshop/in-service	-0.30**	0.08	-0.06	0.10
Perceived utility WITH				
Perceived knowledge gain	0.14	0.09	0.20*	0.10
Knowledge WITH				
Perceived utility	0.13	0.09	0.27**	0.09
Perceived knowledge gain	-0.28**	0.09	-0.03	0.11

* $p < .05$, ** $p < .01$

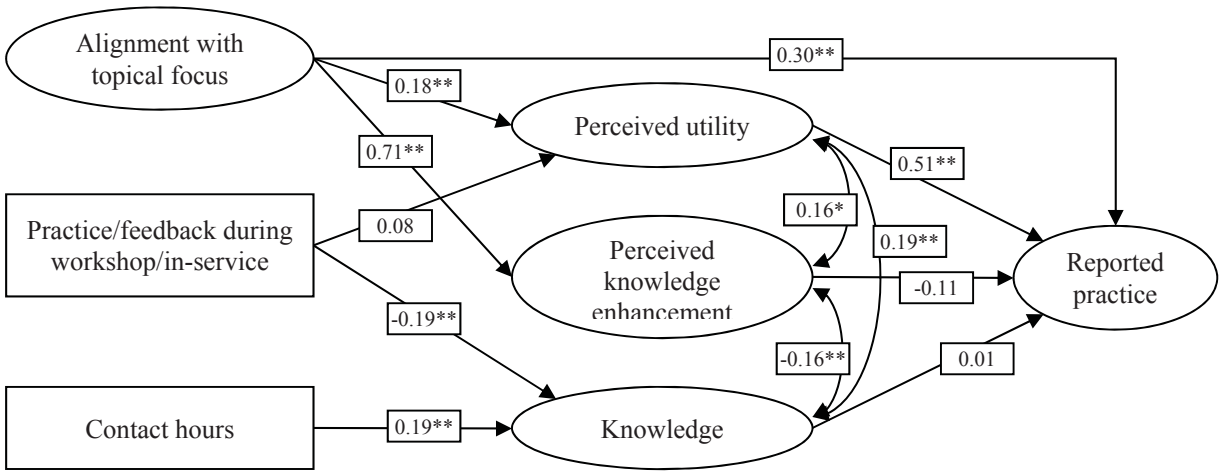

Figure 2. Model 2 (final model).

($F(3, 335) = 3.04$, $p < .05$). City teachers had significantly less content knowledge than suburban ($|M_d| = 0.12$, $SE = 0.04$, $p < .05$), and rural ($|M_d| = 0.09$, $SE = 0.04$, $p < .05$) teachers.

Research question 2. What is the potential impact of professional development characteristics on teacher perceptions, knowledge, and practices?

The path model displayed in Figure 1 (Model 1) was proposed as a foundation for the design and collection of the data presented here. Since this model was theoretically derived, it was important to evaluate the model before it could be used to investigate the potential influence of PD characteristics on rural teacher perceptions, knowledge, and practices. The model depicts aspects of PD as they relate to teacher perceptions and knowledge, which in turn relate to reported teacher practices. The goal of this evaluation was to simplify the model without omitting essential parameters to accommodate the small sample sizes inherent to the multiple subgroups within the data (i.e., by urbancentric locale or content area). Examination of model fit as well as the size and significance level (significant or not) of the proposed relationships between variables guided a systematic process by which unnecessary parameters were removed from the model. As each parameter was trimmed from the model, the new model was compared to the previous model, and fit statistics (i.e., χ^2, CFI, SRMR, RMSEA) were considered to evaluate the improvement or worsening of the model.

The final model developed for the purposes of this research is displayed in Figure 2 (Model 2). It was determined that the amount of time in days spent in PD experiences, collaborative participation as part of the PD experience, and having the opportunity to practice and receive feedback in a classroom context were not integral to this model, and these variables were omitted from Model 2. Model 2 was fit to each subgroup (rural, non-rural) of substantive interest in the data. Since the sampling method included stratification across urbancentric locale and the design of the survey incorporated four content areas, it was important to determine that the revised model was a suitable fit to each subgroup. Without this step, it would not be possible to determine whether the model fit for every group, or if some instances of ill-fit were masked my instances of good fit. The model was fit to each urbancentric locale group (rural, non-rural) and to each content area group (DBDM, reading, math, science) separately, and then to each locale × content area group (i.e., rural DBDM, non-rural DBDM, rural reading, non-rural reading, rural math, non-rural math, rural science, non-rural science). The findings for each content area model are not presented here, as that focus is outside the scope of this article. For a presentation of Model 2 for each locale × content area group, the reader is referred to other recent works (Chumney, 2012).

Figure 2 depicts Model 2 and includes the standardized regression coefficients for the overall sample for each relationship retained in the development of Model 2. As displayed in Figure 2, alignment of the PD experience with content-specific foci was found to have a significant and positive direct effect on reported practice ($\beta = 0.30$, $p < .01$). The direct effect of participants' perception of knowledge enhancement on reported classroom practices was found to be negative and non-significant ($\beta = -0.11$). The direct effects of teachers' perceptions of the utility of the content-related foci and content-specific knowledge were found to be positive on teachers' reported classroom practices ($\beta = 0.51$ and 0.01, respectively), though only the effect of perceived utility was significant ($p < .01$).

Evaluation of Model 2 for rural respondents indicated model fit for the rural group differed slightly from that of the overall group. Standardized regression coefficients for the rural and overall groups are displayed in Table 4. Of

particular interest are the ways in which the rural group was found to differ from the overall group. Specifically, having the opportunity to practice and receive feedback within the context of the PD experience was a negative predictor of content knowledge for both the rural and overall groups, but the effect was not significant for the rural group. The number of contact hours was found to be a positive predictor of content knowledge, but this relationship was significant only for the overall group.

Discussion

Prior to discussing the contribution of the present study in the context of existing and future research, it is important to highlight several key findings.

Key Findings

Comparisons between rural and non-rural teachers (research question 1). Despite obstacles and resource limitations for rural schools identified through previous research (e.g., Lynch, 2000; Marlow & Cooper,2008; Rude & Brewer, 2003; Weitzenkamp et al., 2003), rural teachers did not appear to be comparatively disadvantaged, at least in terms of their best PD experiences. Across locales (city, suburban, town, rural), teachers devoted a comparable number of hours to PD and allocated similar proportions of their time to practice and feedback opportunities and opportunities for interaction/collaboration with colleagues. The proportion of rural teachers indicating that their best experience involved workshops/institutes with follow-up coaching (25%) is comparable to those in city and suburban schools, suggesting that rural schools are not disadvantaged relative to other locales when it comes to access to personnel who can provide quality support beyond a stand-alone event or training series. The reported PD providers were also similar across locales, with the majority of PD provided by external consultants. Across locales, teachers also reported traveling comparable distances to their best PD experience, with only a very small number of teachers reporting that this PD was provided using distance technology. These latter findings are especially interesting, given recent attention to evidence-based practices for distance training (e.g., webinars, distance courses, Internet-based video training modules; see Means, Toyama, Murphy, Bakia, & Jones, 2010). It is possible that, although teachers were given access to distance opportunities, they were not their best PD experiences. In future research investigations, it would be interesting to examine the proportion of all PD experiences that were provided from a distance and which training characteristics were perceived to be most effective. This future work may yield important implications for rural schools, given their potential geographic isolation.

Despite many similarities, there were differences in PD experiences between locales. However, these differences related to the primary format of the PD were primarily between city and suburban teachers, or between city and town teachers. The number of days spent in PD was greater for city teachers than for those in town or rural areas. Since the total number of hours was comparable between locales, this finding may represent the need for PD providers to provide more condensed PD experiences when visiting town or rural areas.

Finally, on average, teachers in all locales appeared to indicate that they learned very little in their best PD experience about select instructional topics/practices and that the topical foci were only moderately important. However, further analyses conducted to address the second primary research question (see below) indicate that when topics were a focus of PD, teachers found those topical foci to be more useful and reported implementing more practices related to the foci.

The potential influence of professional development characteristics on perceptions, knowledge, and practice (research question 2). Several findings from this study also depict important relationships among PD characteristics, teachers' knowledge, teachers' perceptions, and instructional practices. First, it is important to note that an emphasis on select instructional topics during PD (i.e., alignment with topical focus) was found to be related to (a) increased perceptions of the utility of those topics, (b) increased perceptions of knowledge gained pertaining to those topics, and (c) an increased focus on those topics during classroom instruction. When taken together, such findings suggest that PD may influence teacher perceptions and practices, and that by focusing on specific instructional topics during PD, educators may be able to increase (a) perceptions about their utility and (b) their practice in the classroom. These findings are promising, given a need to move beyond an increase in teachers' knowledge to the actual implementation of practices within classrooms. Additional experimental studies, including an ongoing investigation conducted by the present authors (e.g., Glover, Ihlo, Martin, Howell Smith, Wu & Bovaird, 2014), will be useful for determining the causal mechanisms by which this may take place.

Second, the relationship between practice or feedback and teacher knowledge was of interest. Opportunities for practice or feedback within a workshop context were found to be a significant (negative) predictor of knowledge. Although it might be logical to predict that practice/feedback within a workshop context would be related to greater (rather than less) pedagogical content knowledge, it is very possible that the participating teachers received or even sought out practice/feedback in areas where they were less knowledgeable.

Third, it is also important to note that perceived utility of instructional topics/practices was found to be a significant predictor of reported practice (i.e., teachers who indicated that instructional topics/practices were more useful reported more emphasis on those topics/practices during instruction). This finding suggests that, by focusing on the utility of a topic/practice during PD, educators may be able to influence teachers' practice.

Finally, it is interesting that, when including both rural and non-rural teachers, time in PD (i.e., contact hours) was also a significant predictor of knowledge. Accordingly, teachers who spent more time on PD had greater pedagogical content knowledge. This finding is promising, as it suggests that increasing teachers' time in PD may be useful for boosting their knowledge of instructional practices. Although this relationship was positive but not statistically significant for rural teachers alone, it is very possible that increasing the sample size for rural teachers would have led to similar results. Future research with a larger sample size is needed to reexamine this relationship.

Overall, it is important to note that the PD experiences, perceptions, and practices for teachers across locales were more similar than different. Although existing research has pointed to resource limitations for rural schools (e.g., Lynch, 2000; Marlow & Cooper, 2008; Rude & Brewer, 2003; Weitzenkamp et al., 2003), compared to non-rural teachers, rural teachers were not disadvantaged when considering their best PD experiences, knowledge, and practices. This finding is important in considering misconceptions about the experiences of rural school personnel and the resources available to them.

When taken together, the findings from this study lend strong support for important relationships among PD characteristics, teachers' knowledge, teachers' perceptions, and instructional practices. Such findings have implications for the creation of PD experiences that optimize teachers' knowledge and perceptions and influence their classroom practices.

Limitations

Several potential limitations impact the generalizable of findings from this study. First, recipients who elected to participate in this study may differ from the general population. Although the scope of questions administered was useful for collecting extensive information about participants' PD experiences, perceptions, knowledge, and practice, the length of the survey may have prohibited some individuals from completing it. As a result, there may be systematic differences between those who responded and those who did not respond to this survey. Second, because some teachers had not received PD within the past year in the content area to which they were randomly assigned, they were unable to complete some information from the survey. This reduced the size of the sample for the study, which may have influenced statistical power in addressing the second primary research question. Third, although limiting inquiries about PD to teachers' *best* experiences may have been useful for eliciting more vivid recollections, it does permit inferences about PD in general. Fourth, because participants completed all survey items at a single point in time without systematic manipulation of PD by an experimenter, the observed correlations should not imply cause-and-effect relationships among the PD characteristics, teacher perceptions, teacher knowledge, and practices. Future experimental research is required to make causal claims. Fifth, this study focused on elementary teachers' PD experience. Their experiences may differ from the experiences of teachers of other grade levels. Finally, as is common in many studies, measurement error may have impacted the accuracy of the studied constructs and, in turn, impacted the research findings.

State of the Research and Future Directions

Key findings from this study are important to consider in light of existing research and the need for future work to better inform practice. First, despite existing research identifying the prevalence of short-term, workshop based training designed to increase knowledge without sufficient opportunities for integration or practice (e.g., Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Haymore-Sandholtz, 2002), it is promising that a relatively large proportion of both rural and non-rural teachers in the present study indicated that their best PD experiences included workshops that were also accompanied by coaching and opportunities to interact and collaborate with colleagues.

Although select results are consistent with previous research, the current study advances knowledge on PD for rural teachers beyond existing lines of inquiry. Similar to previous findings from a national study of teacher PD (Choy et al., 2006), both rural and non-rural teachers from the present study indicated that (a) PD providers were often individuals external to their school (e.g., external consultants, university professors), (b) the format of PD was often workshop-based, and (c) school staff often cooperated during PD. Importantly, there were more differences relating to the format of PD between city and suburban teachers, or between city and town teachers. Overall rural teachers' experiences were very similar to those from other locales.

Several key conclusions from this study are also important to consider relative to existing research by Garet, Porter, Desimone, Birman, and Yoon (2001) on the potential impact of PD characteristics on teachers' knowledge and practices. Consistent with Garet and colleagues' findings, an emphasis on select instructional topics during PD was found to be

related to (a) increased perceptions about knowledge gained pertaining to those topics and (b) an increased focus on the topics during classroom instruction. The present study also found an important additional relationship between content-focused PD and teachers' perceptions about the utility of covered content, perhaps indicating that it is this perceived utility that leads to specific practices. Also consistent with Garet and colleagues' findings, the number of hours spent in PD (i.e., contact hours) had an indirect effect on teacher practices through content knowledge, supporting the notion that increasing time in PD may increase knowledge which in turn may influence teacher practice.

Findings from the present study are important for advancing an understanding of rural teachers' PD experiences and characteristics that impact teacher knowledge and practice. Information from this study and ongoing, much-needed experimental investigations of the impact of aspects of PD on student outcomes (e.g., Glover, Ihlo, Martin, Howell Smith, & Bovaird, 2014) will be important in considering the provision of PD in rural schools.

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