Design, Validity and Reliability

Instrument Background and Design

The current national policy context demands a more nuanced understanding of the association between teaching and student learning. Federal laws such as No Child Left Behind and federal competitive incentive programs such as Race to the Top, the Teacher Incentive Fund and School Improvement Grants drive the need to identify the conditions under which teachers best contribute to student learning (Steele, Hamilton & Stecher, 2010). Additionally, research from private organizations, such as the Bill and Melinda Gates Foundation's Measuring Effective Teachers (MET) project, increase the visibility and support of efforts to explain the relationship between teaching and learning.

This brief furthers the discussion by contributing to a growing body of research that specifically describes how teaching and learning conditions theoretically and empirically link to important outcomes, including teacher retention and student learning. The purpose of this brief is to provide an overview of the research base documenting the association between teaching and learning conditions and outcomes of interest, and to summarize the design and psychometric properties of the New Teacher Center (NTC) Teaching, Empowering, Leading and Learning (TELL) survey instrument, the North Carolina Teaching Conditions Survey. The information provided in this brief serves as the technical basis for additional analyses and reporting, and will be referenced in future briefs. The intent of the teaching and learning conditions work is to inform policy and practice.

Research Base

Why do teaching and learning conditions matter? Teaching and learning conditions impact two significant areas of national interest: teacher retention and student learning. The following section summarizes the quantitative relationship between teaching and learning conditions and student learning and teacher retention. It is not intended as an exhaustive review.

Teacher Retention

Large-scale empirical studies present evidence that contextual factors matter for teachers' decisions about staying and leaving schools. In a meta-analysis of 34 studies, researchers suggest that teaching and learning conditions influence teachers' career paths more than previously documented (Borman & Dowling, 2008). Boyd et al. (2011) demonstrate that teachers' perceptions of the school administration have the greatest influence on teacher retention decisions. Other work finds similar effects (Pogodzinski et al., 2012). Studies also find statistically significant relationships between teachers' perception of school facilities and their plans to stay or leave (Loeb, Darling-Hammond & Luczak, 2005; Buckley, Schneider & Shang, 2004).

Researchers using TELL data from various states confirm that teaching and learning conditions influence teachers' plans to stay. Johnson, Kraft and Papay (2011) demonstrate that the conditions that matter most in deciding to stay include the school's culture, the principal's leadership and relationships among peers. Ladd (2009), also using TELL data, documents that teaching and learning conditions predict plans to leave a school, independent of school demographics.

Student Learning

Far fewer large-scale empirical studies explore the association between teaching and learning conditions and student achievement.

The analysis by Ladd (2009) shows that teaching and learning conditions predict student achievement in mathematics, and to a lesser degree, in reading. The Johnson, Kraft and Papay (2011) research indicates that positive conditions contribute to improved student achievement. Both of these efforts use the TELL survey data from various states to estimate the impact of teaching and learning conditions on student learning. Additional work by Kraft and Papay (2014) also uses student-teacher linked data and school-level teaching conditions as measured by the TELL survey to find that teachers who work in more supportive environments become more effective at raising student achievement on standardized tests over time than do teachers who work in less supportive environments, after controlling for student characteristics, prior test scores, and teacher and school characteristics.

In a forthcoming book featuring research from the Bill & Melinda Gates Foundation's MET project, Ferguson with Hirsch (2014) demonstrate significant connections between teaching conditions and student value-added gains. In particular, the authors find that four areas assessed by the NTC's TELL survey—student conduct management, demands on time, professional autonomy and professional development—are significant predictors of student learning gains and student perceptions of rigor and support.

TELL Background and Structure

The TELL survey originates from the Governor's Teacher Working Conditions Initiative in North Carolina (2002–2009). As part of this work, the North Carolina Professional Teaching Standards Commission (NCPTSC) conducted a literature review and analyses of state and national survey data from the National Center for Education Statistics' School and Staffing Survey to better understand the factors contributing to teacher satisfaction and employment trajectories. Based on these efforts, the NCPTSC identified the following areas as related to teachers' future employment plans: time, empowerment, leadership, decision-making, and facilities and resources. The commission created standards aligned with these areas and administered a statewide survey in 2002 to assess whether the standards were in place in schools.

The TELL survey incorporates these constructs and includes others logically and empirically linked to outcomes of interest, such as teacher retention and student learning. These constructs include student behavior support, community support, and instructional practices and support. Based on the NCPTSC-identified areas and an external validation study, the TELL survey currently includes the eight constructs identified in Exhibit 1.

EXHIBIT 1. TELL SURVEY CORE CONSTRUCTS

Time—Available time to plan, collaborate, provide instruction, and eliminate barriers to maximize instructional time during the school day

Facilities and Resources—Availability of instructional, technology, office, communication, and school resources to teachers

Community Support and Involvement—Community and parent/guardian communication and influence in the school

Managing Student Conduct—Policies and practices to address student conduct issues and ensure a safe school environment

Teacher Leadership—Teacher involvement in decisions that impact classroom and school practices

School Leadership—Ability of school leadership to create trusting, supportive environments and address teacher concerns

Professional Development—Availability and quality of learning opportunities for educators to enhance their teaching

Instructional Practices and Support—Data and support available to teachers to improve instruction and student learning

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On current TELL survey administrations, the NTC adds questions to these eight core constructs about general demographic information, beginning teacher support and client-specific information. Survey responses related to the eight constructs are scored using Likert-type ratings ranging from strongly disagree (1) to strongly agree (4), with a "Don't Know" option.

External Analyses of Validity and Reliability

This section describes the methods used by an external analyst to verify that the structure and items included in the TELL survey result in meaningful and useful information. This work is part of the MET project supported through the Bill and Melinda Gates Foundation (Swanlund, 2011). The Swanlund analyses use data from 286,835 educators from 11 states across the U.S. The external survey review examines both validity and reliability. These analyses identify patterns in the data that provide a clear structure for the survey and confidence for interpreting the results.

Validity
"Validity" generally refers to the process of ensuring that a survey accurately measures what it is intended to measure, in this case teaching and learning conditions. There are several approaches to testing validity. The external validity testing conducted for the TELL survey assesses the structure of the response scale and the alignment between survey items and the broader survey constructs identified in Exhibit 1. The review uses the Rasch rating scale to examine the item-measure correlations, item fit, rating scale functioning, unidimensionality and generalizability of the instrument.

Results from the external validity testing prompted several edits to increase the statistical stability of the TELL survey. For example, a four-point rating scale replaced the original six-point scale to ensure appropriate scoring for both individual-level responses and school-level responses. Based on the external study finding that some survey constructs are more stable if broken into multiple constructs, an additional construct was added, resulting in eight constructs. Additionally, the results indicate that some individual items overlap across survey constructs. For example, items found in the teacher leadership construct overlap with the school leadership construct and should be reviewed for each analysis.

Reliability
Reliability testing ensures that the survey instrument produces the same results across repeated measures, either within the same population or with a similar population. A reliable survey is generalizable and is therefore expected to reproduce similar results across settings. The external review analyzes reliability using both the Rasch model and Cronbach's alpha. The Swanlund (2011) study concludes the survey is capable of producing consistent results across participant groups.

In summary, the external analyses confirm that the TELL survey offers a robust and statistically sound approach for measuring teaching and learning conditions. For a detailed review of the methods and results from the external analyses, consult Swanlund (2011).

Internal Analyses of Validity and Reliability

In addition to the external analyses, the NTC conducts internal analyses of validity and reliability to verify the stability of the instrument across survey populations as promoted by industry standards found in Standards for Educational and Psychological Testing (American Educational Research Association, American Psychological Association and National Council on Measurement in Education, 1999). Statistical tests of validity include factor analyses and reliability tests that generate internal consistency estimates.

In early 2014, the NTC administered the anonymous survey to all the reported 105,136 school-based licensed educators in North Carolina. Over 93,000 educators (89 percent) in the state responded (Exhibit 2). Of those, 89 percent are teachers, 4 percent are administrators and 7 percent are other licensed educators, such as librarians and school psychologists. Exhibit 2 provides percentages of sampling population by participant type. These analyses are based on responses provided by the school-based licensed educators.

EXHIBIT 2. PERCENT OF POPULATION BY PARTICIPANT TYPE	
Respondents*	Percent of Population (N) 2014
Teachers	89.3% (83,208)
Administrators	3.5% (3,235)
Other Education Professionals	7.3% (6,734)

*Note. The respondent category "teachers" includes instructional coaches, department heads, literacy specialists, etc. The respondent category "administrators" includes principals and assistant principals. The respondent category "Other Education Professionals" includes school counselors, school psychologists, social workers, etc.

Validity

The validity analyses assess the degree to which the 2014 North Carolina Teacher Working Conditions Survey measures the eight theoretical constructs it is intended to capture. See Exhibit 1 for descriptions of the constructs. The NTC conducts factor analyses to group variables with similar characteristics together. The NTC also performs confirmatory factor analysis (CFA), using principal components analysis and varimax rotation procedures, to verify that the actual structure of the data reflects the structure expected from the external validation study.

Researchers suggest several empirical criteria for determining which orthogonal or correlated factors to retain in a stable instrument. These criteria are based on an eigenvalue. Eigenvalues indicate how much variation each factor or component can explain. The criteria include: scree plot, Kaiser criterion and variance explained (Cortina, 2002). Additionally, Hair et al. (2006) suggest including construct correlations. However, the final decision about which factors should be retained should be based on judgments of interpretability and consistency of the factors with sound theory (Bandalos & Boehm-Kaufman, 2009). Next, the NTC provides information about each of the recommended empirical criteria.

The scree plot graphically represents the eigenvalues in descending order and connects them with a line. Researchers suggest examining the line for where it levels off. Exhibit 3 indicates an "elbow" beginning with factor two, continuing through factors seven or nine, and then smoothing or showing that each additional factor beyond that accounts for smaller amounts of the total variance (Ledesma & Vlero-Mora, 2007). Therefore, the scree plot shown in Exhibit 3 would suggest approximately a seven- to nine-factor solution.

EXHIBIT 3. SCREE PLOT
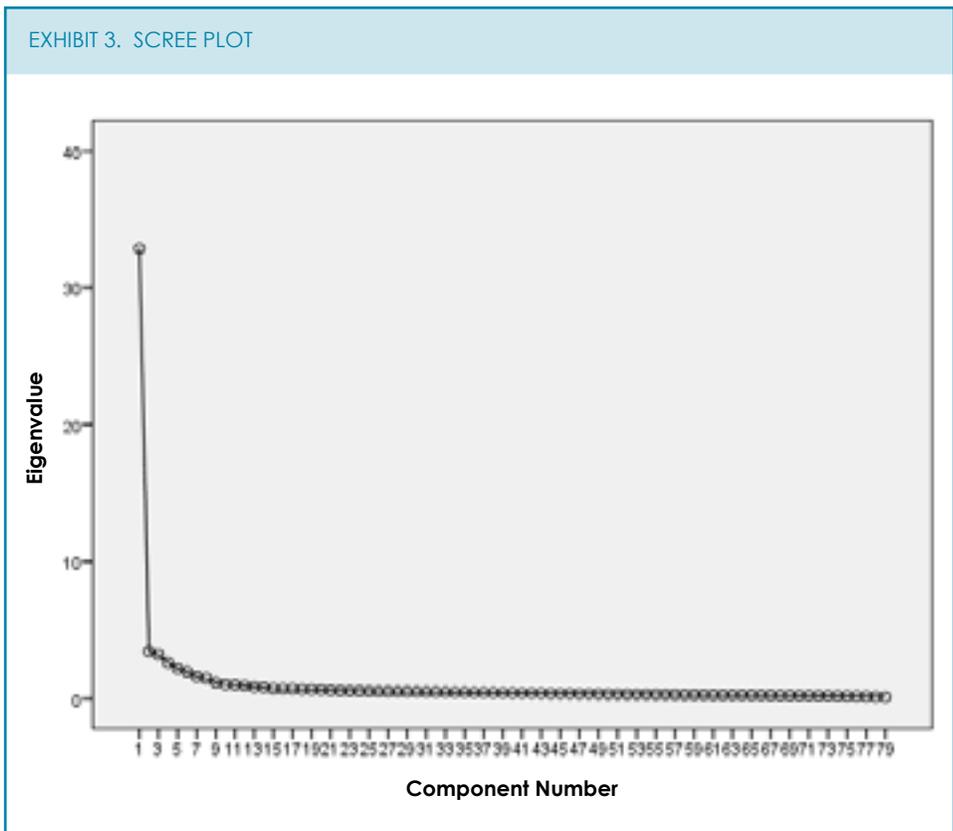
The Kaiser criterion (K1) suggests only including factors where eigenvalues are greater than one (as a theoretical lower bound). The initial eigenvalues displayed in Exhibit 4 show that at least eight factors have a value of more than one and therefore meet minimal variance-explained thresholds. Exhibit 4 shows that the eight factors explain 62 percent of the variance.

Component	Initial Eigenvalues		
	Total	Percent of Variance	Cumulative Percent
1	32.879	41.619	41.619
2	3.451	4.368	45.988
3	3.193	4.042	50.030
4	2.620	3.317	53.346
5	2.155	2.728	56.075
6	1.947	2.464	58.539
7	1.591	2.015	60.553
8	1.463	1.852	62.405

EXHIBIT 4. EIGENVALUES AND VARIANCE EXPLAINED

THE INITIAL EIGENVALUES *displayed in Exhibit 4 show that at least eight factors have a value of more than one and therefore meet minimal variance-explained thresholds. The eight factors together explain 62 percent of the variance.*

The empirical criteria reviewed together indicate at least an eight-factor solution, including a general leadership category and a general community support and involvement category with a sub-category. Due to the findings of the external validation study and the theoretical framework the TELL survey is based on, the NTC conducted further analyses.

The construct correlations are presented to examine whether factors are correlated above the professional standard of 0.70 (Hair et al., 2006). Factor correlations above 0.70 indicate that the constructs overlap and do not capture distinct areas of teaching and learning conditions. Exhibit 5 suggests that teacher leadership and school leadership are correlated at the .820 level, indicating the items overlap as found with the CFA. Managing student conduct and school leadership also overlap with a correlation of .709. These results are similar to results found in the external study and suggest that different combinations of questions would be appropriate for exploratory analysis when conducting outcome analyses.

EXHIBIT 5. COMPONENT CORRELATION MATRIX

	Time	Facilities and Resources	Community Support and Involvement	Managing Student Conduct	Teacher Leadership	School Leadership	Professional Development	Instructional Practices and Support
Time	1 92903	.583** 92763	.417** 92482	.511** 92533	.581** 92826	.572** 92721	.549** 92346	.540** 92124
Facilities and Resources	.583** 92763	1 92981	.502** 92562	.566** 92628	.575** 92905	.583** 92806	.567** 92401	.551** 92190
Community Support and Involvement	.417** 92482	.502** 92562	1 92693	.611** 92379	.580** 92635	.599** 92542	.513** 92156	.553** 91935
Managing Student Conduct	.511** 92533	.566** 92628	.611** 92379	1 92758	.660** 92697	**.709**** 92607	.554** 92202	.596** 91987
Teacher Leadership	.581** 92826	.575** 92905	.580** 92635	.660** 92697	1 93054	**.820**** 92888	.653** 92486	.639** 92263
School Leadership	.572** 92721	.583** 92806	.599** 92542	**.709**** 92607	**.820**** 92888	1 92943	.699** 92441	.684** 92228
Professional Development	.549** 92346	.567** 92401	.513** 92156	.554** 92202	.653** 92486	.699** 92441	1 92532	.705** 91989
Instructional Practices and Support	.540** 92124	.551** 92190	.553** 91935	.596** 91987	.639** 92263	.684** 92228	**.705**** 91989	1 92320

** Correlation is significant at the 0.01 level (2-tailed).

The NTC conducted an additional factor analysis that defined the variables associated with each of the eight pre-identified constructs listed in Exhibit 1. The factor loadings across these constructs indicate that the school leadership and teacher leadership constructs include items with high factor loadings (all above 0.65), do not cross load and could stand as independent constructs. However, the community support and involvement construct include items that cross load and will be explored further in outcome analyses.

Empirically and theoretically, the factor analysis for the North Carolina Teacher Working Conditions Survey supports eight factors that are similar to the external validity work. For outcome analyses using teacher retention and student performance data produced later, the NTC will use a variety of constructs and combinations to determine best model fit.

Confirmatory factor analyses of the data set suggest that the North Carolina Teacher Working Conditions Survey's eight-construct structure provides stable and generalizable measures of teaching and learning conditions, and is consistent with the theoretical framework supporting this work.

Reliability

The internal reliability testing for the North Carolina Teacher Working Conditions Survey confirms that the survey is generalizable and will produce similar results with similar populations. The reliability analyses for the North Carolina Teacher Working Conditions Survey produce Cronbach's alpha coefficients ranging from 0.86 to 0.96. Alphas normally range between 0.00 and 1.00. The closer the Cronbach's alpha coefficient is to 1.00, the greater the internal consistency of the items in the scale. Alpha coefficients above 0.70 are considered acceptable (George & Mallery, 2003).

As Exhibit 6 indicates, all eight alpha coefficients are above 0.70, confirming the internal consistency of the North Carolina Teacher Working Conditions Survey constructs.

EXHIBIT 6. RELIABILITY BY CONSTRUCT	
Construct	**Cronbach's Alpha**
Time	0.861
Facilities and Resources	0.876
Community Support and Involvement	0.893
Managing Student Conduct	0.903
Teacher Leadership	0.939
School Leadership	0.948
Professional Development	0.956
Instructional Practices and Support	0.910

AS EXHIBIT 6 INDICATES, *all eight alpha coefficients are above 0.70, confirming internal consistency of the North Carolina Teacher Working Conditions Survey constructs.*

Summary of North Carolina Teacher Working Conditions Validity and Reliability

Based on external and internal analysis of North Carolina Teacher Working Conditions Survey data, results indicate that the most appropriate structure of the survey includes eight factors consisting of 79 questions. Exhibit 7 provides questions within each construct generated from the validity and reliability analyses. These eight constructs will be the basis for other analyses investigating how outcomes of interest are associated with teaching and learning conditions, as well as other sub-factors discussed earlier.

EXHIBIT 7. NORTH CAROLINA TEACHER WORKING CONDITIONS CONSTRUCTS AND ITEMS		
Construct	**Number of Items**	**Items**
Time	7	Teachers are allowed to focus on educating students with minimal interruptions.
		The non-instructional time provided for teachers in my school is sufficient.
		Teachers are protected from duties that interfere with their essential role of educating students.
		Efforts are made to minimize the amount of routine paperwork teachers are required to do.
		Teachers have sufficient instructional time to meet the needs of all students.
		Teachers have time available to collaborate with colleagues.
		Class sizes are reasonable such that teachers have the time available to meet the needs of all students.
Facilities and Resources	9	Teachers have access to reliable communication technology, including phones, faxes and email.
		Teachers have sufficient access to instructional technology, including computers, printers, software and Internet access.
		The physical environment of classrooms in this school supports teaching and learning.
		Teachers have adequate space to work productively.
		Teachers have sufficient access to office equipment and supplies such as copy machines, paper, pens, etc.
		Teachers have sufficient access to appropriate instructional materials.
		Teachers have sufficient access to a broad range of professional support personnel.
		The reliability and speed of Internet connections in this school are sufficient to support instructional practices.
		The school environment is clean and well maintained.

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Construct	Number of Items	Items
Community Support and Involvement	8	Parents/guardians know what is going on in this school. This school does a good job of encouraging parent/guardian involvement. The community we serve is supportive of this school. This school maintains clear, two-way communication with the community. Community members support teachers, contributing to their success with students. Parents/guardians support teachers, contributing to their success with students. Teachers provide parents/guardians with useful information about student learning. Parents/guardians are influential decision-makers in this school.
Managing Student Conduct	7	School administrators consistently enforce rules for student conduct. School administrators support teachers' efforts to maintain discipline in the classroom. Policies and procedures about student conduct are clearly understood by the faculty. Students at this school understand expectations for their conduct. Students at this school follow rules of conduct. The faculty work in a school environment that is safe. Teachers consistently enforce rules for student conduct.
Teacher Leadership	7	Teachers are relied upon to make decisions about educational issues. Teachers are trusted to make sound professional decisions about instruction. Teachers are recognized as educational experts. In this school we take steps to solve problems. The faculty has an effective process for making group decisions to solve problems. Teachers are effective leaders in this school. Teachers are encouraged to participate in school leadership roles.

Construct	Number of Items	Items
School Leadership	11	The school leadership consistently supports teachers. Teacher performance is assessed objectively. Teachers receive feedback that can help them improve teaching. The procedures for teacher evaluation are consistent. Teachers feel comfortable raising issues and concerns that are important to them. There is an atmosphere of trust and mutual respect in this school. The school improvement team provides effective leadership at this school. The faculty and staff have a shared vision. The faculty are recognized for accomplishments. The school leadership facilitates using data to improve student learning. Teachers are held to high professional standards for delivering instruction.
Professional Development	13	Professional development enhances teachers' ability to implement instructional strategies that meet diverse student learning needs. Professional development provides ongoing opportunities for teachers to work with colleagues to refine teaching practices. Professional development enhances teachers' abilities to improve student learning. In this school, follow up is provided from professional development. Professional development is evaluated and results are communicated to teachers. Professional learning opportunities are aligned with the school's improvement plan. Professional development deepens teachers' content knowledge. Professional development is differentiated to meet the individual needs of teachers. Professional development offerings are data driven. An appropriate amount of time is provided for professional development. Sufficient resources are available for professional development in my school. Teachers have sufficient training to fully utilize instructional technology. Teachers are encouraged to reflect on their own practice.

Construct	Number of Items	Items
Instructional Practices and Support	17	Teachers collaborate to achieve consistency on how student work is assessed.
		Provided supports (i.e., instructional coaching, professional learning communities, etc.) translate to improvements in instructional practices by teachers.
		Teachers have knowledge of the content covered and instructional methods used by other teachers at this school.
		Teachers know what students learn in each of their classes.
		Teachers work in professional learning communities to develop and align instructional practices.
		Teachers are encouraged to try new things to improve instruction.
		Teachers use assessment data to inform their instruction.
		Teachers believe what is taught will make a difference in students' lives.
		Teachers require students to work hard.
		The curriculum taught in this school is aligned with Common Core Standards.
		Teachers believe almost every student has the potential to do well on assignments.
		Teachers are assigned classes that maximize their likelihood of success with students.
		Teachers have autonomy to make decisions about instructional delivery (i.e., pacing, materials and pedagogy).
		Local assessment data are available in time to impact instructional practices.
		State assessments accurately gauge students' understanding of standards.
		State assessment data are available in time to impact instructional practices.
		State assessments provide schools with data that can help improve teaching.

EXHIBIT 7. NORTH CAROLINA TEACHER WORKING CONDITIONS CONSTRUCTS AND ITEMS (CONTINUED)

References

American Educational Research Association, American Psychological Association, and National Council on Measurement in Education. (1999). *Standards for educational and psychological testing.* Washington, D.C.: American Educational Research Association.

Bandalos, D. & Boehm-Kaufman, M. (2009). Four common misconceptions in exploratory factor analysis. In C. Lance & R. Vandenberg (Eds.), *Statistical and methodological myths and urban legends: Doctrine, verity and fable in the organizational and social sciences.* (pp. 61–87). UK: Taylor & Francis.

Borman, G. & Dowling, N. (2008). Teacher attrition and retention: A meta-analytic and narrative review of the research. *Review of Educational Research*, 78(3).

Boyd, D., Grossman, P., Ing, M., Lankford, H., Loeb, S., & Wyckoff, J. (2011). The influence of school administrators on teacher retention decisions. *American Educational Research Journal*, 48(2).

Buckley, J., Schneider, M., & Shang, Y. (2004). *The effects of school facility quality on teacher retention in urban school districts*. Chestnut Hill, MA: National Clearinghouse for Educational Facilities.

Cortina, J. (2002). Big things have small beginnings: An assortment of "minor" methodological misunderstandings. *Journal of Management*, 28(3).

Ferguson, R. & Hirsch, E. (2013). *Using teacher and student surveys to link school context, classroom learning conditions and achievement*. Forthcoming.

George, D. & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.). Boston, MA: Allyn & Bacon.

Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). Multivariate data analysis (6th ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.

Johnson, S., Kraft, M., & Papay, J. (2012). How context matters in high-need schools: The effects of teachers' working conditions on their professional satisfaction and their students' achievement. *Teachers College Record*, 114(10).

Kraft, M.A. & Papay, J.P. (2014, Jan. 30). Do supportive professional environments promote teacher development? Explaining heterogeneity in returns to teaching experience. *Educational Evaluation and Policy Analysis*.

Ladd, H. (2009). Teachers' perceptions of their working conditions: How predictive of policy relevant outcomes? CALDER Working Paper 33. Washington, DC: National Center for Analysis of Longitudinal Data in Education.

Ledesma, R., & Valero-Mora, P. (2007). Exploratory factor analysis. *Practical Assessment, Research & Evaluation*, 12(22).

Loeb, S., Darling-Hammond, L., & Luczak, J. (2005). How teaching conditions predict teacher turnover in California schools. *Peabody Journal of Education*, 80(3).

Pogodzinski, B., Youngs, P., Frank, K., & Belman, D. (2012). Administrative climate and novices' intent to remain teaching. *The Elementary School Journal*, 113(2).

Steele, J., Hamilton, L., & Stecher, B. (2010). *Incorporating student performance measures into teacher evaluation systems*. Santa Monica, CA: RAND Corporation.

Swanlund, A. (2011). *Identifying working conditions that enhance teacher effectiveness: The psychometric evaluation of the Teacher Working Conditions Survey*. Chicago. IL: American Institutes for Research.

UCLA: Statistical Consulting Group. Factor Analysis: from http://www.ats.ucla.edu/stat/spss/output/factor1.htm (accessed November 20, 2012).

About the New Teacher Center

New Teacher Center focuses on improving student learning by accelerating the effectiveness of new teachers. NTC partners with states, school districts, and policymakers to design and implement systems that create sustainable, high-quality mentoring and professional development; build leadership capacity; work to enhance teaching conditions; improve retention; and transform schools in vibrant learning communities where all students succeed.