



CHAPTER 8

Secondary Data Analysis in the Field of Educational Leadership and Policy Studies

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The use of large-scale, secondary data with representative samples allows researchers to draw generalizable conclusions for research questions related to educational leadership and policy issues. Most common to this field, administrative school or district data address local issues or give examples of practice. Further, qualitative data answer more in-depth questions that address the what, how, and why. In contrast, established national and international data sets can be used to analyze trends across the country, or countries. This type of analysis can better inform state and federal policy, extend research on commonalities or differences across systems of education, and provide a means for advancing quantitative analysis techniques.

There are several benefits to the secondary data analysis approach. First, large organizations, agencies and/or centers collect data and, for the most part, have it available in a format that is ready to use. With many sources and data sets available, a researcher will likely find an existing study and survey designed to assess one or more target research interests. A scholar

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can then spend more time on study conceptualization and data analysis to rigorously address state, national, or international issues with generalizability. Second, established national and international data sets have large sample sizes and several administrations over time. With sufficient power and multiple time points across samples, there are many options for statistical analysis. Third, common data sets provide an opportunity for scholars to replicate research. Scholars can refer to past studies which analyze their data set of interest to understand how variables have been used, and their results, which guides future study. This potential for replication supports emerging researchers with a clearer direction of how to use the data, as well as with a clearer comparison of what has and has not been studied.

This chapter focuses on six main data sets: three national and three international (refer to Table 8.1). These surveys serve different purposes as evidenced by the research framework themes, which detail the intended design of the survey by sponsoring organizations (see right column, Table 8.1). National Assessment of Educational Progress (NAEP), Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) are each designed with a different intent, but all include student achievement scores. NAEP seeks to measure the progress of academic literacy in grades 4, 8, and 12 with the nation, states, and districts compared across time. With similar goals, TIMSS measures formal learning in grade 4 and 8 mathematics and science with varying degrees of cognitive skill (i.e. knowledge, application, reasoning), but TIMSS also allows for cross-national comparison. Whereas PISA is noted for the assessment of knowledge applied to everyday life for a sample based on age 15, rather than grade. Each of these data sets has background and perception questionnaires which connect home and school environments to these unique academic assessments. High School Longitudinal Study of 2009 (HSLS) also includes baseline and follow-up measures of academic achievement. However, the purpose of HSLS is to follow a cohort of ninth graders in 2009 through high school and beyond. This data set is ideal for the study of postsecondary transitions and success as well as to connect high school to career aspirations and training. This is the newest cohort study. There are previous waves of cohort studies available through National Center for Education Statistics, or NCES, (i.e. Educational Longitudinal Study of 2002). Finally, Schools and Staffing Survey (SASS) (U.S. data) and Teaching and Learning International Survey (TALIS) (international data) both focus on the work conditions of teachers and principals in schools. SASS is best known as a source to track

Table 8.1 Main surveys for educational leadership and policy secondary data analysis

Survey	Years	Organization	Population	Data	Research framework themes
Schools and Staffing Survey (SASS) https://nces.ed.gov/surveys/sass/	88, 91, 94, 00, 04, 08, 12	National Center for Education Statistics (NCES)	U.S. public schools (traditional, charter, military and special purpose); private schools; teachers provided by sampled schools	District, school, principal, teacher and library media center questionnaires	School quality, school management, school choice, teacher quality (see Cox et al. 2017)
National Assessment of Educational Progress (NAEP) https://nces.ed.gov/nationsreportcard/	69–17	National Center for Education Statistics (NCES)	U.S.: public and private schools selected, then students	Student, school, students with disabilities/English language learners, teacher, National Indian Education Study, long-term trend student questionnaires; Grade level subject assessments;	Opportunities to learn in and out of classroom, educational experiences, teacher training and instructional practices, school policies and characteristics, assessment of academic literacy (see NCES 2009)
High School Longitudinal Study of 2009 (HSLS) https://nces.ed.gov/surveys/hsls09/index.asp	09, 12, 13, 14, 17	National Center for Education Statistics (NCES)	U.S. public and private high schools, then grade 9 students in base year of study	High school transcript study	Student, parent, teacher, school counselor and school administrator questionnaires; Only relevant questionnaires collected for subsequent follow ups

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Table 8.1 (continued)

Survey	Years	Organization	Population	Data	Research framework themes
Teaching and Learning International Survey (TALIS) http://www.oecd.org/edu/school/talis.htm	08, 13, 18	Organisation for Economic Co-operation and Development (OECD)	Around 24 to 45 countries which includes United States in 2013 and 2018	Principal and teacher questionnaires	Teacher education, school leadership, teacher appraisal and feedback, school climate and ethos, teachers' pedagogical beliefs and practices (see Rutkowski et al. 2013)
Programme for International Student Assessment (PISA) http://www.oecd.org/pisa/ https://nces.ed.gov/surveys/pisa/	00, 03, 06, 09, 12, 15, 18	Organisation for Economic Co-operation and Development (OECD)	Around 88 countries or regions across 2000–2018; schools selected then 15-year-old students	Student, school, parent and teacher questionnaires; Education career and information and communication technology familiarity questionnaires for students; Science, reading, math and financial literacy assessments	Non-cognitive outcomes, teaching and learning processes, school policies and governance, student background, application of academic knowledge (see Vayssettes et al. 2016)
Trends in International Mathematics and Science Study (TIMSS) https://timssandpirls.bc.edu/ https://nces.ed.gov/timss/	95, 99, 03, 07, 11, 15	International Association for the Evaluation of Educational Achievement (IEA)	Around 49 countries; schools selected then 4 and 8 grade students	Student, home, teacher, school and country curriculum questionnaires; Math and science assessments	Home contexts, student characteristics and attitudes toward learning, principal leadership, resources, instruction, teacher preparation and experience; assessment of formal learning with degrees of cognitive skill (see Mullis and Martin 2013)

teacher turnover trends, and includes school leadership measures. TALIS includes school leadership measures, as well as measures around instruction. Further, TALIS can be linked to the student data available in PISA. Particularly, these data sets, and this chapter primarily focus on K-12 education rather than higher education.

Instead of a “how to” guide, the purpose of this chapter is to provide novice researchers with enough information about secondary data analysis to decide whether it is a fit for their research interests. Likely, the most valuable information in this chapter is the collection of references provided in an organized way. Within the narrative and tables, a reader can identify additional articles and texts that will support the development knowledge and skills needed to apply this method beyond this chapter. Due to the vastness of available data sets and possible statistical analyses to apply to them, it would be difficult to supply the reader with a singular, introductory and relevant example. Rather, the literature review identifies research topics which can be studied with these six data sets. An application section describes which statistical procedures a researcher would want to learn to use with this data, and finally, the recommendations detail the nature of future work for this approach. By the end of this chapter, a novice researcher should be able to decide if secondary data analysis aligns with their research agenda as well as their desired methodological skill set.

REVIEW OF RELEVANT LITERATURE

This review of literature broadly demonstrates what has been studied using these six national and international surveys in the field of educational leadership and policy studies. Organizations sponsoring these data sets create research frameworks to describe the extent and nature of variables included, which are often found in user guides. However, researchers can apply new perspectives, theories, and concepts to existing items. In addition, intended research themes can be left unexplored, which gives direction for new contributions. However, rather than compare new perspectives to these intended research frameworks and identify unexplored areas—which would be difficult to do in one review—this review is a synthesis of what has been studied and how content in these data sets might overlap. This synthesis supplies the reader with a list of potential research topics suitable for secondary data analysis across these main surveys in order to stimulate ideas about how to link or compare surveys in future use. This review includes broad topics of study connected to these six data

sets since 2010. While it is comprehensive, it is not exhaustive. Across these six main data sets, scholars have investigated teachers, principals, and students as individuals, the contexts of classrooms and schools, postsecondary transitions, and national policy issues.

Teachers, principals, and students have different backgrounds, roles, beliefs, and attitudes, which make them individual actors within the organization and/or policy. For these reasons, many questionnaires are designed to measure their individual contributions or enactments within the education system. For example, teachers are hired into positions with varying qualifications (see Lee 2012a; Meroni et al. 2015) and receive different pay (Woessmann 2011). Within the position, teachers have unique attitudes toward their commitment and satisfaction (Price 2012; Reback et al. 2014), unique perceptions about their efficacy (Conley and You 2017; Ware and Kitsantas 2011), and distinct needs for professional development (Phillips et al. 2011). Further, teachers experience their position based on race and gender, among other characteristics (Farinde-Wu and Fitchett 2018), and the conditions in their schools (Grissom et al. 2014; Ni 2012). Altogether, background, beliefs, and attitudes have predicted their decisions to stay in a school or the profession (Grissom and Keiser 2011; Urick 2016b).

Similarly, principals experience their role based on their background (Shen et al. 2012) and perceived work conditions (Sun and Ni 2016). These characteristics help to explain or moderate their attitudes toward commitment and satisfaction (Boyce and Bowers 2016; Price 2012) as well as their own efficacy (Ware and Kitsantas 2011), and how teachers may view them as effective (Grissom and Harrington 2010). Principal background, beliefs, and attitudes also contribute to their decisions about whether to remain as a principal in a school or in the profession (Boyce and Bowers 2016; Sun and Ni 2016; see Table 8.2). Likewise, students experience schools and learning based on their background: race (Anderson 2016), gender (Pope and Sydnor 2010), and their parents and home environment (Noble and Morton 2013; Froiland and Davison 2016; Tsai et al. 2017). Students have individual views of their own academic self-concept (Marsh 2016), motivation, and interest (Yu and Singh 2018; Ainley and Ainley 2011), which relates to their sense of belonging (Akgul et al. 2016), persistence (Ashford et al. 2016), and resilience (Sandoval-Hernández and Bialowolski 2016; see Table 8.3).

These individual backgrounds, attitudes and beliefs of teachers, principals, and students—studied separately or as interactions—help to explain

Table 8.2 Teachers and principals studied across six main surveys

<i>Category</i>	<i>Research concepts</i>	<i>Surveys</i>	<i>Example of authors</i>
Teachers	Teacher satisfaction	SASS, TFS	Price (2012), Tickle et al. (2011)
	Intent to stay/attrition risk	SASS	Grissom et al. (2014)
	Teacher commitment	SASS, ECLS	Reback et al. (2014)
	Teacher efficacy, collective efficacy	SASS, TALIS	Warc and Kitsantas (2011), Conley and You (2017) and Gálvez et al. (2017)
	Teacher cognitive self-regulation	PISA	Mattern and Bauer (2014)
	Teacher turnover	SASS, TFS	Grissom and Keiser (2011), Urick (2016b)
	Teacher compensation	SASS, census, PISA	Goldhaber et al. (2010), Woessmann (2011)
	Teacher hiring	SASS	Engel (2012)
	Teacher qualifications	SASS, TFS, NAEP, F-33, TMSS, PISA, PIAAC	Lee (2012a), Ronfeldt et al. (2014), Woo and Henfield (2016) and Meroni et al. (2015)
	Teacher professional development	SASS, Education Week's Quality Counts, American Federation of Teachers' "Making Standards Matter," Fordham Foundation's "State of State Standards" reports	Phillips et al. (2011), Wieczorek (2017)
Principals	Teacher work conditions/attitudes	SASS, TALIS	Ni (2012), Grissom et al. (2014) and Duyar et al. (2013)
	Black female teachers	SASS	Farinde-Wu and Fitchett (2018)
	Principal turnover	SASS, PFS	Boyce and Bowers (2016), Sun and Ni (2016)
	Principal background	SASS	Shen et al. (2012)
	Principal satisfaction	SASS, PFS	Price (2012), Boyce and Bowers (2016)

(continued)

Table 8.2 (continued)

Category	Research concepts	Surveys	Example of authors
Principal professional development		SASS, TALIS	Grissom and Harrington (2010), Gumus and Bellibas (2016)
Principal efficacy	SASS		Warc and Kitsantas (2011)
Principal commitment	SASS		Pricc (2012)
Principal attitude	SASS, PFS		Boyce and Bowers (2016)
Principal effectiveness	SASS		Grissom and Harrington (2010), Sun and Ni (2016)
Principal work conditions	SASS		Sun and Ni (2016)

Notes: *TFS* Teacher Follow-up Survey, *ECLS* Early Childhood Longitudinal Survey, *F-33* School District Finance Survey, *PIAAC* Programme for the International Assessment of Adult Competencies, *PFS* Principal Follow up Survey

the variance within organizations, and how learning is supported or experienced by each actor. While these roles can be studied separately, when studied together, they bring a more complete and accurate measure of perceptions in a school. For instance, using SASS, Urick (2016b) investigated the influence of both teacher and principal perceptions of leadership on teacher retention, and found different types of perceptions of leadership for both, which predicted whether a teacher stayed in their current school. Since schools are social organizations where different perceptions, experiences and beliefs merge, an understanding of the convergence or divergence of these interests is important (further, see Goldring et al. 2015).

While individuals have their own experiences and beliefs, they overlap within common school and classroom contexts within the school system. Questionnaires often ask respondents not only about themselves but also about the community, practices, or structures that are shared with others. Teachers and principals respond to the degree of teacher classroom autonomy, practices of school leadership, teacher collaboration, and teacher-principal relationships within the school (Duyar et al. 2013; Liu et al.

Table 8.3 Students studied across six main surveys

<i>Category</i>	<i>Research concepts</i>	<i>Surveys</i>	<i>Example of authors</i>
Students	Gender differences in math	NAEP	Pope and Sydnor (2010)
	Academic achievements of Black students	HSLS	Anderson (2016), Young (2017)
	Home influence	NAEP, American community survey	Dunst and Hamby (2016)
	Home educational resources	TIMSS; PISA	Azina and Halimah (2012), Tsai et al. (2017)
	Parental involvement	HSLS; PISA	Froiland and Davison (2016), Tramonte and Willms (2010)
	African American parental influence	NAEP	Noble and Morton (2013)
	Student motivation	HSLS, TIMSS, PISA	Yu and Singh (2018), Liou (2017), Marsh et al. (2013) and Guzel and Berberoglu (2010)
	Interest development	PISA	Ainley and Ainley (2011)
	Academic self-concept	TIMSS, PISA	Min et al. (2016), Marsh (2016)
	Self-efficacy	PISA	Wu (2016), Akgul et al. (2016)
	Sense of belonging	PISA	Akgul et al. (2016)
	Student perception of learning participation	TIMSS	Chen et al. (2012)
	Big-fish-little-pond effect	TIMSS, PISA	Marsh et al. (2014), Nagengast and Marsh (2012)
	STEM persistence	HSLS	Andersen and Ward (2014), Ashford et al. (2016)
	Academic resilience	TIMSS	Sandoval-Hernández and Bialowolski (2016)
	Math course enrollment	HSLS	Froiland and Davison (2016)

2016; Oberfield 2016; Price 2012; Urick 2016a, b). They also perceive the disciplinary climate or student behavior within the classroom and across the school (Jenkins and Ueno 2017; Curran 2016). Teachers provide information about their classroom resources, instructional practices, and other teaching-learning processes with students (Akyuz and Berberoglu 2010; Dee et al. 2013; Lambert et al. 2015). These school and classroom contexts include the relationships within them, and also the characteristics of groups or structures like class size (Li and Konstantopoulos 2017), socioeconomic composition of the classroom (Chudgar et al. 2012),

or race of those served in the school community (Kelly 2010). These school and classroom context items, or constructs provide measures of the common practices and environment shared by the individuals within it (refer to Table 8.4). Many of these processes and characteristics of the school and classroom can be tested together to build frameworks of the systems through which schools operate and improve (see Urick et al. 2018, as example).

Table 8.4 Classrooms and schools studied across six main surveys

<i>Category</i>	<i>Research concepts</i>	<i>Surveys</i>	<i>Example of authors</i>
Classroom	Teacher perception of classroom resources and demands	SASS	Lambert et al. (2015)
	Teacher classroom autonomy	SASS	Oberfield (2016)
	Classroom resources	SASS, F-33	Dee et al. (2013)
	Instructional time	SASS, F-33, NAEP, ECLS	Fitchett et al. (2014), Dee et al. (2013), Blank (2013) and Reback et al. (2014)
	Classroom disciplinary climate	TALIS	Jenkins and Ueno (2017)
	Instructional practices	TALIS, TIMSS, PISA, NAEP	Shi et al. (2014), Charalambous and Kyriakides (2017), Rivkin and Schiman (2015) Jiang and McComas (2015) and Bittman and Russell (2016)
	Teaching-learning process	TIMSS	Akyuz and Berberoglu (2010)
	Class size	TIMSS	Li and Konstantopoulos (2017)
	Classroom composition of socioeconomic status	TIMSS	Chudgar et al. (2012)
	School processes	SASS	Shen et al. (2012), Farinde-Wu and Fitchett (2018)
School	School resources and facilities	TIMSS	Afana et al. (2013), Hopland (2013)
	Work environment/conditions	SASS, TFS, TIMSS	Grissom (2011), Ingersoll and May (2012) and Winnaar et al. (2015)

(continued)

Table 8.4 (continued)

<i>Category</i>	<i>Research concepts</i>	<i>Surveys</i>	<i>Example of authors</i>
Teacher Cohesion and Interaction		SASS	Price and Collett (2012)
Teacher sense of community		SASS	Weathers (2011)
Teacher collaboration		TALIS	Duyar et al. (2013)
School climate		SASS, PFS, F-33, HSLS	Dee et al. (2013), Boyce and Bowers (2016) and Froiland et al. (2016)
Teacher and principal perceptions of student behaviors		SASS, U.S. Dept. of Ed. OCR data, Chicago School Study and Partnership for Literacy Study	Curran (2016), Kelly (2010)
Administrator support		SASS	Tickle et al. (2011), Conley and You (2017)
Principal influence		SASS	Boyce and Bowers (2016)
Leadership types, styles, and practices		SASS, TALIS	Weathers (2011), Urick (2016a, b), Liu et al. (2016) and Bellibas and Liu (2018)
Principal-teacher relationship		SASS	Price (2012)
Teacher leadership/autonomy		SASS	Fitchett et al. (2014), Xie and Shen (2013)
School innovation		SASS	Preston et al. (2012)
Organizational quality		SASS	Jackson and Marriott (2012)
School quality		TIMSS, World Bank, International Monetary Fund	Bouhlila (2017)
School effectiveness		TIMSS	Chen (2014)
Production function, school inputs, outputs		PISA	Woessmann (2016), Giménez et al. (2017)
Predominately black schools		SASS, Chicago School Study and Partnership for Literacy Study	Kelly (2010)

Notes: *F-33* School District Finance Survey, *ECLS* Early Childhood Longitudinal Survey, *TFS* Teacher Follow-up Survey, *PFS* Principal Follow up Survey

These measures of individuals and their school and classroom contexts extend beyond research topics immediately relevant to practice or leadership in K-12 schools. Because of the generalizability of samples, and how K-12 schools are situated within a larger system of national education, these measures also address research questions related to postsecondary transitions, as well as pressing policy issues. Scholars have studied college supports for K-12 students' academic readiness and planning for college financing (Hillman et al. 2015; Hurwitz and Howell 2014; Schneider and Saw 2016; refer to Table 8.5). While the main data sets in this chapter are situated within K-12 schools, scholars have linked these to others focused on higher education or adult learning, which are noted in Tables 8.2 and 8.6 (see Integrated Postsecondary Educational Data System, IPEDS, Programme for the International Assessment of Adult Competencies, PIAAC, and Baccalaureate and Beyond Survey, B&B). However, an overarching purpose of national and international data is to assess country trends and policies. For example, scholars have studied how students are sorted across the education system based on race, socioeconomic status, language, and/or immigrant status (Fairchild et al. 2012; Spees et al. 2016), access to education resources (Lee 2012a), and opportunities to learn (Schmidt et al. 2015), as well as achievement trajectories (Lee 2010). Policies specific to the United States have been assessed such as No Child Left Behind (Dee et al. 2013) and Common Core State Standards (Porter et al. 2011), as well as those that compare similar issues or reforms across countries, such as grade retention (Goos et al. 2012), pre-school education (Pholpirul 2016), or the underrepresentation of women (Stoet and Geary 2015). Ties between the education system and the economy have also been studied (Condron 2011; see Table 8.6).

Table 8.5 Post-secondary transitions studied across six main surveys

<i>Category</i>	<i>Research concepts</i>	<i>Surveys</i>	<i>Example of authors</i>
Postsecondary transitions	College support for k-12 students	SASS	Hurwitz and Howell (2014)
	Gaps in math for college readiness	NAEP, TIMSS, ECLS	Lee (2012b)
	Race and college readiness/enrollment	HSLS	Alvarado and An (2015), Schneider and Saw (2016)
	College financing	HSLS	Hillman et al. (2015)

Notes: ECLS Early Childhood Longitudinal Survey

Table 8.6 National policy issues studied across six main surveys

<i>Category</i>	<i>Research concepts</i>	<i>Surveys</i>	<i>Example of authors</i>
National policy issues	Accountability / testing / no child left behind	SASS, F-33, ECLS, NAEP, PISA, World Bank	Dee et al. (2013), Reback et al. (2014), Fitchett et al. (2014), Wicczorek (2017), Lee and Reeves (2012) and Smith (2017)
	Charter schools	SASS	Preston et al. (2012), Sun and Ni (2016)
	Teacher supply or shortage	SASS, TFS, IPEDS, B&B	Ingersoll and Perda (2010)
	Alternative schools and special education teacher qualifications	SASS	Mason-Williams and Gagnon (2017)
	Private schools and teacher compensation	SASS	Goldhaber et al. (2010)
	Racial composition: Students, teachers, principals	SASS	Grissom and Keiser (2011), Renzulli et al. (2011) and Fairchild et al. (2012)
	Common Core state standards	NAEP, State Standards and Assessment Database, TIMSS	Porter et al. (2011), Schmidt and Houang (2012)
	Zero tolerance policies	SASS, U.S. Dept. of Ed. OCR data	Curran (2016)
	Age and grade	TIMSS	Cliffordson (2010)
	Grade retention	PISA, TIMSS	Goos et al. (2012)
	Pre-school education effects	PISA	Pholphirul (2016)
	Gender equity and sex differences in performance	PISA	Stoet and Geary (2015)
	Religiosity in nation, sex differences, performance	PISA, World Values Survey, TIMSS, World Factbook, Education at a Glance Reports	Stoet and Geary (2017)
	Language policies	NAEP, PISA, PIRLS	McEneaney et al. (2014), Arya et al. (2016)
	Immigrant status and achievement	NAEP; HSLS, PISA, TIMSS	Spees et al. (2016), Bozick et al. (2016)

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Table 8.6 (continued)

Category	Research concepts	Surveys	Example of authors
Long-term academic literacy		PISA, PIAAC	Gustafsson (2016)
Achievement trajectories		NAEP, ECLS, NELS, HS&B, ELS, NLS	Lee (2010)
Equity and adequacy resource gaps		NAEP, F-33, SASS	Lee (2012a)
National Education and the economy		PISA, TIMSS, Fraser Institute, Heritage Foundation	Condron (2011), Rindermann and Thompson (2011)
Environment, wealth and achievement		PISA, bio-temperature calculations, World Bank	He et al. (2017)
Socioeconomic status composition and mediators		TIMSS, PISA	Chudgar et al. (2012), Schmidt et al. (2015)
Opportunity to learn		TIMSS, PISA, World Bank	Carnoy et al. (2016), Schmidt et al. (2015)

Notes: *F-33* School District Finance Survey, *ECLS* Early Childhood Longitudinal Survey, *PIRLS* Progress in International Reading Literacy Study, *PIAAC* Programme for the International Assessment of Adult Competencies, *NELS* National Education Longitudinal Study, *HS&B* High School and Beyond, *ELS* Educational Longitudinal Study of 2002, *NLS* National Longitudinal Surveys, *TFS* Teacher Follow-up Survey, *IPEDS* Integrated Postsecondary Educational Data System, *B&B* Baccalaureate and Beyond Survey

The study of these postsecondary transitions and national policies demonstrate how the context of K-12 schools fit within a larger societal system and purpose. For instance, Grissom et al. (2014) tested how teachers' perceptions of their work environment changed during a period of No Child Left Behind legislation. Further, Condron (2011) explains, with a cross-national comparison, that the association between economic inequality and low academic achievement might be due to the extent of egalitarianism and of economic inequality across racial/ethnic groups. Through comparisons to other policy contexts across countries, data collection during policy implementation, or connections to long-term workforce or adult outcomes, large-scale data sets allow researchers to situate findings within politics/policy, economics, and an understanding of the overall purpose of education.

For this review, a broad search was conducted for studies that applied secondary data analysis using these six main surveys since 2010. While it is not exhaustive due to the volume of publications, most research topics relevant to educational leadership and policy are represented in Tables 8.2, 8.3, 8.4, 8.5 and 8.6. From the literature searched, a few suggestions can be made for future research. First, the largest number of articles on topics of principals and school leadership used SASS data. Similar principal and leadership measures are available in TALIS, TIMSS, and PISA data sets but are not used as often. In fact, comparatively, there were few articles that used TALIS, which is most like SASS but with an international sample. Further, scholars who publish with TIMSS and PISA are more interested in issues of instruction, curriculum, and achievement, and often do not connect leadership or organizational concepts. Second, NAEP is underutilized. The sampling structure for NAEP allows for an analysis of states and districts. There are longitudinal data as well as questionnaires that have not been used to their capacity. Most studies that used NAEP found in this search were descriptive or only used test scores. Finally, scholars across different fields—educational leadership, education policy, public policy, educational psychology, teacher education, curriculum studies, math/science education, and economics—were using similar and/or related items, but discussions were disconnected across this literature. Scholars would benefit from reviews of interdisciplinary research on a select data set.

APPLICATIONS TO THE STUDY OF LEADERSHIP AND POLICY

Like most quantitative research methods, the application of secondary data analysis is dependent on how the research question aligns with available data. Scholars who use large-scale data rely on the existing body of research to understand which items to include as variables and how these variables fit together. From the nature of the research question, either correlational or causal, and the known relationship among the variables in the literature, a theory is formulated and tested with an appropriate statistical analysis.

While some research studies test hypotheses without an overarching framework, theoretical frameworks add direction and understanding to the use of large-scale data. Sponsoring organizations of data sets provide research frameworks which explain what measures were collected and suggest how they can be used, but a theoretical framework, which guides a research study of secondary data use, explains why and how select variables

answer a research question and extend knowledge. For example, scholars have applied expectancy value theory to formulate testable models to show how student motivation influences science learning (Liou 2017), or theories of organizational quality to demonstrate the importance of teacher-principal interactions (Jackson and Marriott 2012; Price 2012). Scholars have used secondary data to test and extend theory about the overlap and relationships among leadership styles and practices (e.g. Bellibas and Liu 2018; Liu et al. 2016; Urick 2016a, b). These applicable theoretical frameworks are interdisciplinary and stem from psychology, leadership and organizational theory, and sociology, as well as economics with frameworks of school quality, efficiency, equity, and production (e.g. Giménez et al. 2017; Lee 2012a; Woessmann 2016). Past literature, available measures, and a theoretical framework provide a map for which statistical analysis will answer a research question.

There are two main quantitative design approaches for secondary data analysis: (1) correlational, which tests the relationships among variables, or (2) causal, which tests the efficacy or impact of a “treatment.” Since the data are already collected, and there is no control over the assignment of participants to treatment or control groups, quasi-experimental designs are followed to estimate causal inference. Both correlational and causal designs have basic and advanced statistical methods which can be applied to secondary data.

A vast number of articles that have applied secondary data analysis in educational leadership and policy use some form of regression. For a basic approach, scholars apply regression from bivariate to multivariate approaches. Descriptive studies have used bivariate regressions or correlations to demonstrate simple relationships. Inferential studies extend these descriptive models with multivariate regression, nonparametric or parametric, and sometimes with a stepwise test of competing models (for statistical procedures, see Howell 2017; Mertler and Vannatta Reinhart 2017; e.g. Bellibas and Liu 2018; Ingersoll and May 2012). If a scholar is trained in multiple regression, this can be expanded to more advanced methods of theory testing with path analysis and structural equation models (for statistical procedures, see Bowen and Guo 2012; Kaplan 2009; e.g. Chen et al. 2012). Often, scholars apply exploratory or confirmatory factor analysis as a separate study or in preparation of some type of regression analysis (e.g. Marsh et al. 2013).

While sponsoring organizations of data sets publish reports and manuals with the psychometric properties of items and composites, scholars

may want to test the way in which these existing items measure new theories or constructs, which can be explored with factor analysis, and then used to build structural equation models. However, the sampling frames of most data sets have a nested structure, for example, teachers in schools, or students in classrooms. Because of this nested structure, or levels in unit of analysis, if a scholar wants to simultaneously test the effects of multiple, nested units (e.g. teachers nested in schools, or students nested in classrooms) on an outcome, a multilevel analysis is applied. In these cases, researchers use multilevel regression, also called hierarchical linear models (see Raudenbush and Bryk 2002), which can be extended to multilevel path analysis, multilevel factor analysis, and multilevel structural equation models (see Harring et al. 2015; Heck and Thomas 2015; e.g. Tsai et al. 2017).

If the purpose of a study is to estimate causal inference, a researcher can apply a quasi-experimental design which uses measures to account for non-random selection or assignment to treatment versus control, as well as possible covariates in the relationship of the treatment to the outcome. Rather than test how variables are related as in correlational design, quasi-experimental researchers present a clear logic for what variables matter and why, and try to present evidence which negates possible selection or assignment bias and missing covariates (for procedures, see Shadish et al. 2002). Some statistical techniques include propensity score matching (e.g. Ni 2012) to remove selection or assignment bias and regression discontinuity (e.g. Hurwitz and Howell 2014) or comparative interrupted time series (e.g. Dee et al. 2013) to test the change in outcome before and after treatment using multiple time points. Quasi-experimental design prompts researchers to think carefully about reasons for the inclusion of variables, as well as extent of bias and error in models. Because of the large-scale, representative samples, secondary data analysis offers a unique opportunity to test the impact of policy, reforms, and implementation of instructional and leadership practices.

RECOMMENDATIONS FOR NOVICE AND EMERGING SCHOLARS

Scholars who are new to large-scale secondary data have three important areas to learn. First, sampling procedures often incorporate multiple characteristics as strata, then calculate proportions of strata for the sample to represent population, and nest stages of selection, such as school then participant. All components of these sampling frames must remain intact to generalize to the

population. Thus, researchers need to understand the application of sampling weights and missing data analyses which adjust collected data back to the intended sampling frame. Second, organizations that administer these assessments forgo a design process in which frameworks are created to guide the kinds of research topics or content that the items measure. They provide technical reports on the frameworks used to guide the intended content in surveys and assessments, and on the statistical results of the extent that items measure a concept or skill. Finally, a new secondary data analysis researcher must learn how to access each data set, and each year of each data set. Some data are publicly available through online downloads, and other data are restricted, requiring a formal request to use. There are different ways in which data are downloaded. For example, PISA offers a “manual” download in which a researcher saves a zip folder of multiple raw data files on their computer, and downloads and edits syntax for SPSS software, or other package, to extract data. To avoid edits of syntax and data merges which might compromise sampling frame structure, some organizations—like IEA for TIMSS—offer a free software download which helps a researcher construct data sets in their chosen statistical software package, and even provides access to run basic statistics to explore available data before creating formatted files.

Data download is the first step, next a researcher must understand data structure, data labels, composite variables, and how to prepare for an analysis. This is specific to each data set and learned with practice. For these reasons, learn one data set, then expand to other years of the same data set, and next other data sets. Once the structure and procedures of most national and international data sets are understood, then a scholar can think about how to link multiple data sets across years to answer substantial, nuanced, national leadership and policy questions.

Scholars who are advanced users of large-scale data and statistical techniques can work to extend the application of secondary data analysis. Scholars have begun to create their own data sets from funded research projects to share widely with other researchers, for example, the National Center for Teacher Effectiveness at Harvard University. Further, with technology and large information systems, data mining from websites is another means to create a secondary data set. The availability and collection of “big data” widens the scope of data analysis. Scholars have started to include intensive longitudinal data with numerous time points for each participant in statistical models (see Asparouhov et al. 2017). Because of the size and structure of this longitudinal data, the quantitative methods mentioned above—correlational, like structural equation models, and

causal, like time series analysis—have been extended to these “dynamic” versions. New dynamic statistical analyses can account for a larger number of time points, and potentially smaller samples of participants. Secondary data analysis makes it possible to apply new statistical theory and models.

CHAPTER SUMMARY

The National Center for Education Statistics (NCES), as well as international organizations, administer large-scale surveys and assessments which can be used for secondary data analysis. Existing, generalizable data allow researchers to address pressing national and systemic issues in educational leadership and policy. These common data sets provide an opportunity for an easier comparison and replication of findings in the literature across fields. Due to the large scale of the data sets, there are more options for advanced statistical analysis. Once researchers learn how to analyze one of these main data sets, this knowledge can be applied across additional years of the same data set, extended to other available national/international surveys, and can provide an example of how future original data collections may be shared with other researchers.

Recommended Readings

Rutkowski, L., Gonzalez, E., Joncas, M., & von Davier, M. (2010). International large-scale assessment data: Issue in secondary analysis and reporting. *Educational Researcher*, 39(2), 142–151.

These authors explain common issues in the analysis and reporting of results of international data sets including TIMSS and PISA. They provide further discussion and resources on sampling, weights and estimation of test scores. This article presents key analysis issues which are important to understand in order to use these data appropriately.

Schneider, B., Saw, G., & Broda, M. (2016). A future for the National Education Longitudinal Program. *AERA Open*, 2(2), 1–13.

This article reviews the history of surveys administered by the U.S. National Center for Education Statistics. Schneider, Saw, and Broda provide readers with an understanding of how research using these federal data sets has informed policy, as well as suggested areas of growth for NCES.

Strayhorn, T. (2009). Accessing and analyzing national databases. In T. Kowalski and T. Lasley (Eds.), *Handbook of Data-Based Decision Making in Education* (pp. 105–122). New York: Routledge.

Strayhorn's (2009) chapter is an introduction to the use of U.S. secondary data in research. Data sets included in this chapter are relevant to early childhood, elementary, secondary and, specifically postsecondary interests. This chapter guides researchers' application of data with discussions of generalizability, combining data, common analysis challenges and supports, as well as an illustrative example.

REFERENCES

- Afana, Y., Lietz, P., & Tobin, M. (2013). The relationship between school resources and grade 8 mathematics achievement: A comparison of Palestinian Authority, Israeli Hebrew and Israeli Arab schools in TIMSS 2007. *Journal for Educational Research Online*, 5(1), 59.
- Ainley, M., & Ainley, J. (2011). Student engagement with science in early adolescence: The contribution of enjoyment to students' continuing interest in learning about science. *Contemporary Educational Psychology*, 36(1), 4–12.
- Akgul, G., Cokamay, G., & Demir, E. (2016). Predictors of teacher support: Turkey and Shanghai in the programme for international student assessment, 2012. *Eurasian Journal of Educational Research*, 16(63), 115–132.
- Akyuz, G., & Berberoglu, G. (2010). Teacher and classroom characteristics and their relations to mathematics achievement of the students in the TIMSS. *New Horizons in Education*, 58(1), 77–95.
- Alvarado, S. E., & An, B. P. (2015). Race, friends, and college readiness: Evidence from the High School Longitudinal Study. *Race and Social Problems*, 7(2), 150–167.
- Andersen, L., & Ward, T. J. (2014). Expectancy-value models for the STEM persistence plans of ninth-grade, high-ability students: A comparison between black, hispanic, and white students. *Science Education*, 98(2), 216–242.
- Anderson, K. A. (2016). Examining organizational practices that predict persistence among high-achieving black males in high school. *Teachers College Record*, 118(6), 1–26.
- Arya, D. J., McClung, N. A., Katznelson, N., & Scott, L. (2016). Language ideologies and literacy achievement: Six multilingual countries and two international assessments. *International Journal of Multilingualism*, 13(1), 40–60.
- Ashford, S. N., Lanehart, R. E., Kersaint, G. K., Lee, R. S., & Kromrey, J. D. (2016). STEM pathways: Examining persistence in rigorous math and science course taking. *Journal of Science Education and Technology*, 25(6), 961–975.
- Asparouhov, T., Hamaker, E., & Muthén, B. (2017). Dynamic structural equation models. Technical Report. Version 2. Retrieved on May 18, 2017, from <https://www.statmodel.com/TimeSeries.shtml>

- Azina, I. N., & Halimah, A. (2012). Student factors and mathematics achievement: Evidence from TIMSS 2007. *Eurasia Journal of Mathematics, Science and Technology Education*, 8(3), 249–255.
- Bellibas, M. S., & Liu, Y. (2018). The effects of principals' perceived instructional and distributed leadership practices on their perceptions of school climate. *International Journal of Leadership in Education*, 21(2), 226–244.
- Bittman, B., & Russell, W. (2016). Civic education in the United States: A multiple regression of civic education scores from the National Assessment of Educational Progress. *Research in Social Sciences and Technology*, 1(2), 1–16.
- Blank, R. (2013). Science instructional time is declining in elementary schools: What are the implications for student achievement and closing the gap? *Science Education*, 97(6), 830–847.
- Bouhlila, D. S. (2017). Parents' education and literacy skills: Evidence on inequality of socioeconomic status in Arab countries. *World Development Perspectives*, 5, 34–43.
- Bowen, N. K., & Guo, S. (2012). *Structural equation modeling*. Oxford/New York: Oxford University Press.
- Boyce, J., & Bowers, A. (2016). Principal turnover: Are there different types of principals who move from or leave their schools? A latent class analysis of the 2007–8 Schools and Staffing Survey and the 2008–2009 Principal Follow-up Survey. *Leadership and Policy in Schools*, 15(3), 237–272.
- Bozick, R., Malchiodi, A., & Miller, T. (2016). Premigration school quality, time spent in the United States, and the math achievement of immigrant high school students. *Demography*, 53(5), 1477–1498.
- Carnoy, M., Khavenson, T., Loyalka, P., Schmidt, W. H., & Zakharov, A. (2016). Revisiting the relationship between international assessment outcomes and educational production: Evidence from a longitudinal PISA-TIMSS sample. *American Educational Research Journal*, 53(4), 1054–1085.
- Charalambous, C. Y., & Kyriakides, E. (2017). Working at the nexus of generic and content-specific teaching practices: An exploratory study based on TIMSS secondary analyses. *The Elementary School Journal*, 117(3), 423–454.
- Chen, Q. (2014). Using TIMSS 2007 data to build mathematics achievement model of fourth graders in Hong Kong and Singapore. *International Journal of Science and Mathematics Education*, 12(6), 1519–1545.
- Chen, S. F., Lin, C. Y., Wang, J. R., Lin, S. W., & Kao, H. L. (2012). A cross-grade comparison to examine the context effect on the relationships among family resources, school climate, learning participation, science attitude, and science achievement based on TIMSS 2003 in Taiwan. *International Journal of Science Education*, 34(14), 2089–2106.
- Chudgar, A., Luschei, T. F., & Zhou, Y. (2012). Science and mathematics achievement and the importance of classroom composition: Multicountry analysis using TIMSS 2007. *American Journal of Education*, 119(2), 295–316.

- Cliffordson, C. (2010). Methodological issues in investigations of the relative effects of schooling and age on school performance: The between-grade regression discontinuity design applied to Swedish TIMSS 1995 data. *Educational Research and Evaluation, 16*(1), 39–52.
- Condron, D. J. (2011). Egalitarianism and educational excellence: Compatible goals for affluent societies? *Educational Researcher, 40*(2), 47–55.
- Conley, S., & You, S. (2017). Key influences on special education teachers' intentions to leave: The effects of administrative support and teacher team efficacy in a mediation model. *Educational Management Administration and Leadership, 45*(3), 521–540.
- Cox, S., Parmer, R., Stizek, G., Thomas, T., & Spiegelman, M. (2017). Documentation for the 2011–12 schools and staffing survey. National Center for Education Statistics. Retrieved on May 18, 2017, from <https://nces.ed.gov/pubs2016/2016817.pdf>
- Curran, F. C. (2016). Estimating the effect of state zero tolerance laws on exclusionary discipline, racial discipline gaps, and student behavior. *Educational Evaluation and Policy Analysis, 38*(4), 647–668.
- Dee, T., Jacob, B., & Schwartz, N. (2013). The effects of NCLB on school resources and practices. *Educational Evaluation and Policy Analysis, 35*(2), 252–279.
- Dunst, C., & Hamby, D. (2016). Effects of cumulative family risk factors on American students' academic performance. *American Journal of Educational Research, 4*(2), 150–154.
- Duyar, I., Gumus, S., & Sukru Bellibas, M. (2013). Multilevel analysis of teacher work attitudes: The influence of principal leadership and teacher collaboration. *International Journal of Educational Management, 27*(7), 700–719.
- Engel, M. (2012). The timing of teacher hires and teacher qualifications: Is there an association? *Teachers College Record, 114*, 1–29.
- Fairchild, S., Tobias, R., Corcoran, S., Djukic, M., Kovner, C., & Noguera, P. (2012). White and black teachers' job satisfaction: Does relational demography matter? *Urban Education, 47*(1), 170–197.
- Farinde-Wu, A., & Fitchett, P. G. (2018). Searching for satisfaction: Black female teachers' workplace climate and job satisfaction. *Urban Education, 53*(1), 86–112.
- Fitchett, P., Heafner, T., & Lambert, R. (2014). Assessment, autonomy, and elementary social studies time. *Teachers College Record, 116*, 1–34.
- Froiland, J. M., & Davison, M. L. (2016). The longitudinal influences of peers, parents, motivation, and mathematics course-taking on high school math achievement. *Learning and Individual Differences, 50*, 252–259.
- Froiland, J. M., Davison, M. L., & Worrell, F. C. (2016). Aloha teachers: Teacher autonomy support promotes Native Hawaiian and Pacific Islander students' motivation, school belonging, course-taking and math achievement. *Social Psychology of Education, 19*(4), 879–894.

- Gálvez, I. E., López-Martín, E., Ayuso, J. M., & López, J. M. V. (2017). Determining factors of teachers' self-efficacy in countries of the European Union. Results from TALIS 2013 (pp. 225–248). *Educación, XXI*.
- Giménez, V., Thieme, C., Prior, D., & Tortosa-Ausina, E. (2017). An international comparison of educational systems: A temporal analysis in presence of bad outputs. *Journal of Productivity Analysis, 47*(1), 83–101.
- Goldhaber, D., Destler, K., & Player, D. (2010). Teacher labor markets and the perils of using hedonics to estimate compensating differentials in the public sector. *Economics of Education Review, 29*, 1–17.
- Goldring, E., Cravens, X., Porter, A., Murphy, J., & Elliott, S. (2015). The convergent and divergent validity of the Vanderbilt Assessment of Leadership in Education (VAL-ED) Instructional leadership and emotional intelligence. *Journal of Educational Administration, 53*(2), 177–196.
- Goos, M., Schreier, B. M., Knipprath, H. M. E., De Fraine, B., Van Damme, J., & Trautwein, U. (2012). How can cross-country differences in the practice of grade retention be explained? A closer look at national educational policy factors. *Comparative Education Review, 57*(1), 54–84.
- Grissom, J. (2011). Can good principals keep teachers in disadvantaged schools? Linking principal effectiveness to teacher satisfaction and turnover in hard-to-staff environments. *Teachers College Record, 113*(11), 2552–2585.
- Grissom, J., & Harrington, J. (2010). Investing in administrator efficacy: An examination of professional development as a tool for enhancing principal effectiveness. *American Journal of Education., 116*(4), 583–612.
- Grissom, J., & Keiser, L. (2011). A supervisor like me: Race, representation, and the satisfaction and turnover decisions of public sector employees. *Journal of Policy Analysis and Management, 30*(3), 557–580.
- Grissom, J., Nicholson-Cotty, S., & Harrington, J. (2014). Estimating the effects of No Child Left Behind on teachers' work environments and job attitudes. *Educational Evaluation and Policy Analysis, 36*(4), 417–436.
- Gumus, E., & Bellibas, M. S. (2016). The effects of professional development activities on principals' perceived instructional leadership practices: Multi-country data analysis using TALIS 2013. *Educational Studies, 42*(3), 287–301.
- Gustafsson, J. E. (2016). Lasting effects of quality of schooling: Evidence from PISA and PIAAC. *Intelligence, 57*, 66–72.
- Guzel, C. I., & Berberoglu, G. (2010). Students' affective characteristics and their relation to mathematical literacy measures in the programme for international student assessment (PISA) 2003. *Eurasian Journal of Educational Research, 40*, 93–112.
- Harring, J., Stapleton, L., & Beretvas, S. (2015). *Advances in multilevel modeling for educational research: Addressing practical issues found in real-world applications*. Charlotte: Information Age Publishing.

- He, J., Van de Vliert, E., & Van de Vijver, F. J. (2017). Extreme response style as a cultural response to climato-economic deprivation. *International Journal of Psychology*, 52(S1), 67–71.
- Heck, R., & Thomas, S. (2015). *An introduction to multilevel modeling techniques: MLM and SEM approaches using Mplus*. New York: Routledge.
- Hillman, N. W., Gast, M. J., & George-Jackson, C. (2015). When to begin? Socioeconomic and racial/ethnic differences in financial planning, preparing, and saving for college. *Teachers College Record*, 117(8), 1–16.
- Hopland, A. O. (2013). School facilities and student achievement in industrial countries: Evidence from the TIMSS. *International Education Studies*, 6(3), 162.
- Howell, D. (2017). *Fundamental statistics for the behavioral sciences* (9th ed.). Boston: Cengage Learning.
- Hurwitz, M., & Howell, J. (2014). Estimating causal impacts of school counselors with regression discontinuity designs. *Journal of Counseling and Development*, 92, 316–327.
- Ingels, S. J., Pratt, D. J., Herget, D. R., Burns, L. J., Dever, J. A., Ottem, R., Rogers, J. E., Jin, Y., & Leinwand, S. (2011). *High School Longitudinal Study of 2009 (HSLS:09): Base-year data file documentation*. NCES. Retrieved on May 18, 2017, from <https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2011328>
- Ingersoll, R., & May, H. (2012). The magnitude, destinations, and determinants of mathematics and science teacher turnover. *Educational Evaluation and Policy Analysis*, 34(4), 435–464.
- Ingersoll, R., & Perda, D. (2010). Is the supply of mathematics and science teachers sufficient? *American Educational Research Journal*, 47(3), 563–594.
- Jackson, K., & Marriott, C. (2012). The interaction of principal and teacher instructional influence as a measure of leadership as an organizational quality. *Educational Administration Quarterly*, 48(2), 230–258.
- Jenkins, A., & Ueno, A. (2017). Classroom disciplinary climate in secondary schools in England: What is the real picture? *British Educational Research Journal*, 43(1), 124–150.
- Jiang, F., & McComas, W. F. (2015). The effects of inquiry teaching on student science achievement and attitudes: Evidence from propensity score analysis of PISA data. *International Journal of Science Education*, 37(3), 554–576.
- Kaplan, D. (2009). *Structural equation modeling: foundations and extensions* (Vol. 10). Los Angeles: SAGE.
- Kelly, S. (2010). A crisis of authority in predominately black schools? *Teachers College Record*, 112(5), 1247–1274.
- Lambert, R., McCarthy, C., Fitchett, P., Lineback, S., & Reiser, J. (2015). Identification of elementary teachers' risk for stress and vocational concerns using the national schools and staffing survey. *Education Policy Analysis Archives*, 23(43), 1–37.

- Lee, J. (2010). Tripartite growth trajectories of reading and math achievement: Tracking of national academic progress at primary, middle, and high school levels. *American Educational Research Journal*, 47(4), 800–832.
- Lee, J. (2012a). Educational equity and adequacy for disadvantaged minority students: School and teacher resource gaps toward national mathematics proficiency standard. *Journal of Educational Research*, 105(1), 64–75.
- Lee, J. (2012b). College for all: Gaps between desirable and actual P-12 math achievement trajectories for college readiness. *Educational Researcher*, 41(2), 43–55.
- Lee, J., & Reeves, T. (2012). Revisiting the impact of NCLB high-stakes school accountability, capacity, and resources: State NAEP 1990–2009 reading and math achievement gaps and trends. *Educational Evaluation and Policy Analysis*, 34(2), 209–231.
- Li, W., & Konstantopoulos, S. (2017). Does class-size reduction close the achievement gap? Evidence from TIMSS 2011. *School Effectiveness and School Improvement*, 28(2), 292–313.
- Liou, P. Y. (2017). Profiles of adolescents' motivational beliefs in science learning and science achievement in 26 countries: Results from TIMSS 2011 data. *International Journal of Educational Research*, 81, 83–96.
- Liu, Y., Bellibas, M. S., & Printy, S. (2016). How school context and educator characteristics predict distributed leadership: A hierarchical structural equation model with 2013 TALIS data. *Educational Management Administration & Leadership*. <https://doi.org/10.1177/1741143216665839>.
- Marsh, H. W. (2016). Cross-cultural generalizability of year in school effects: Negative effects of acceleration and positive effects of retention on academic self-concept. *Journal of Educational Psychology*, 108(2), 256.
- Marsh, H. W., Abduljabbar, A. S., Abu-Hilal, M. M., Morin, A. J., Abdelfattah, F., Leung, K. C., Xu, M., Nagengast, B., & Parker, P. (2013). Factorial, convergent, and discriminant validity of TIMSS math and science motivation measures: A comparison of Arab and Anglo-Saxon countries. *Journal of Educational Psychology*, 105(1), 108.
- Marsh, H. W., Abduljabbar, A. S., Parker, P. D., Morin, A. J., Abdelfattah, F., & Nagengast, B. (2014). The big-fish-little-pond effect in mathematics: A cross-cultural comparison of US and Saudi Arabian TIMSS responses. *Journal of Cross-Cultural Psychology*, 45(5), 777–804.
- Mason-Williams, L., & Gagnon, C. (2017). An analysis of teacher sorting in secondary special education and alternative schools. *The Journal of Special Education*, 50(4), 239–250.
- Mattern, J., & Bauer, J. (2014). Does teachers' cognitive self-regulation increase their occupational well-being? The structure and role of self-regulation in the teaching context. *Teaching and Teacher Education*, 43, 58–68.

- McEneaney, E., Lopez, F., & Nieswandt, M. (2014). Instructional models for the acquisition of English as bridges into school science: Effects on the science achievement of U.S. Hispanic English language learners. *Learning Environments Research, 17*, 305–318.
- Meroni, E. C., Vera-Toscano, E., & Costa, P. (2015). Can low skill teachers make good students? Empirical evidence from PIAAC and PISA. *Journal of Policy Modeling, 37*(2), 308–323.
- Mertler, C., & Vannatta Reinhart, R. (2017). *Advanced and multivariate statistical methods: Practical application and interpretation* (6th ed.). New York: Routledge.
- Min, I., Cortina, K. S., & Miller, K. F. (2016). Modesty bias and the attitude-achievement paradox across nations: A reanalysis of TIMSS. *Learning and Individual Differences, 51*, 359–366.
- Mullis, I., & Martin, M. (2013). *TIMSS 2015 assessment framework*. IEA. Retrieved on May 18, 2017, from <https://timssandpirls.bc.edu/timss2015/frameworks.html>
- Nagengast, B., & Marsh, H. W. (2012). Big fish in little ponds aspire more: Mediation and cross-cultural generalizability of school-average ability effects on self-concept and career aspirations in science. *Journal of Educational Psychology, 104*(4), 1033.
- National Center for Education Statistics (NCES). (2009). *NAEP technical documentation*. Retrieved on May 18, 2017, from <https://nces.ed.gov/nationsreportcard/tdw/>
- Ni, Y. (2012). Teacher working conditions in charter schools and traditional public schools: A comparative study. *Teachers College Record, 114*(3), 1–26.
- Noble, R., & Morton, C. (2013). African Americans and mathematics outcomes on National Assessment of Educational Progress: Parental and individual influences. *Journal of Child and Family Studies, 22*(1), 30–37.
- Oberfield, Z. (2016). A bargain half fulfilled: Teacher autonomy and accountability in traditional and public schools and public charter schools. *American Educational Research Journal, 53*(2), 296–323.
- Phillips, K., Desimone, L., & Smith, T. (2011). Teacher participation in content-focused professional development and the role of state policy. *Teachers College Record, 113*(11), 2586–2630.
- Pholhirul, P. (2016). Pre-primary education and long-term education performance evidence from Programme for International Student Assessment (PISA) Thailand. *Journal of Early Childhood Research*. <https://doi.org/10.1177/1476718X15616834>.
- Pope, D., & Sydnor, J. (2010). Geographic variation in the gender differences in test scores. *Journal of Economic Perspectives, 24*(2), 95–108.
- Porter, A., McMaken, J., Hwang, J., & Yang, R. (2011). Common core standards: The new U.S. intended curriculum. *Educational Researcher, 40*(3), 103–116.

- Preston, C., Goldring, E., Berends, M., & Cannata, M. (2012). School innovation in district context: Comparing traditional public schools and charter schools. *Economics of Education Review*, 31, 318–330.
- Price, H. (2012). Principal-teacher interactions: How affective relationships shape principal and teacher attitudes. *Educational Administration Quarterly*, 48(1), 39–85.
- Price, H., & Collett, J. (2012). The role of exchange and emotion on commitment: A study of teachers. *Social Science Research*, 41, 1469–1479.
- Raudenbush, S., & Bryk, A. (2002). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks: Sage.
- Reback, R., Rockoff, J., & Schwartz, H. (2014). Under pressure: Job security, resource allocation, and productivity in schools under No Child Left Behind. *American Economic Journal: Economic Policy*, 6(3), 207–241.
- Renzulli, L., Parrott, H., & Beattie, I. (2011). Racial mismatch and school type: Teacher satisfaction and retention in charter and traditional public schools. *Sociology of Education*, 84(1), 23–48.
- Rindermann, H., & Thompson, J. (2011). Cognitive capitalism the effect of cognitive ability on wealth, as mediated through scientific achievement and economic freedom. *Psychological Science*, 22, 754–763.
- Rivkin, S. G., & Schiman, J. C. (2015). Instruction time, classroom quality, and academic achievement. *The Economic Journal*, 125(588), F425–F448.
- Ronfeldt, M., Schwartz, N., & Jacob, B. (2014). Does preservice preparation matter? Examining an old question in new ways. *Teachers College Record*, 116(10), 1–46.
- Rutkowski, D., Rutkowski, L., Belanger, J., Knoll, S., Weatherby, & Prusinski, E. (2013). *Teaching and Learning International Survey TALIS 2013 conceptual framework*. OECD. Retrieved on May 18, 2017, from http://www.oecd.org/edu/school/TALIS%20Conceptual%20Framework_FINAL.pdf
- Sandoval-Hernández, A., & Białowolski, P. (2016). Factors and conditions promoting academic resilience: A TIMSS-based analysis of five Asian education systems. *Asia Pacific Education Review*, 17(3), 511–520.
- Schmidt, W. H., & Houang, R. T. (2012). Curricular coherence and the common core state standards for mathematics. *Educational Researcher*, 41(8), 294–308.
- Schmidt, W. H., Burroughs, N. A., Zoido, P., & Houang, R. T. (2015). The role of schooling in perpetuating educational inequality: An international perspective. *Educational Researcher*, 44(7), 371–386.
- Schneider, B., & Saw, G. (2016). Racial and ethnic gaps in postsecondary aspirations and enrollment. *Russell Sage Foundation Journal of the Social Sciences*, 2(5), 58–82.
- Shadish, W., Cook, T., & Campbell, D. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton Mifflin.

- Shen, J., Leslie, J., Spybrook, J., & Ma, X. (2012). Are principal background and school processes related to teacher job satisfaction? A multilevel student using Schools And Staffing Survey 2003–04. *American Educational Research Journal*, 49(2), 200–230.
- Shi, Q., Zhang, S., & Lin, E. (2014). Relationships of new teachers' beliefs and instructional practices: Comparisons across four countries. *Action in Teacher Education*, 36(4), 322–341.
- Smith, W. C. (2017). National testing policies and educator based testing for accountability. *OECD Journal: Economic Studies*, 2016(1), 131–149.
- Spees, L., Potochnick, S., & Perreira, K. (2016). The academic achievement of limited English proficient (LEP) youth in new and established immigrant states: Lessons from the National Assessment of Educational Progress (NAEP). *Education Policy Analysis Archives*, 24(99), 1–27.
- Stoet, G., & Geary, D. C. (2015). Sex differences in academic achievement are not related to political, economic, or social equality. *Intelligence*, 48, 137–151.
- Stoet, G., & Geary, D. C. (2017). Students in countries with higher levels of religiosity perform lower in science and mathematics. *Intelligence*, 62, 71–78.
- Sun, M., & Ni, Y. (2016). Work environments and labor markets: Explaining principal turnover gap between charter and traditional public schools. *Educational Administration Quarterly*, 52(1), 144–183.
- Tickle, B., Chang, M., & Kim, S. (2011). Administrative support and its mediating effect on US public school teachers. *Teaching and Teacher Education*, 27, 342–349.
- Tramonte, L., & Willms, J. D. (2010). Cultural capital and its effects on education outcomes. *Economics of Education Review*, 29(2), 200–213.
- Tsai, S. L., Smith, M. L., & Hauser, R. M. (2017). Families, schools, and student achievement inequality: A multilevel MIMIC model approach. *Sociology of Education*, 90(1), 64–88.
- Urwick, A. (2016a). Examining US principal perception of multiple leadership styles used to practice shared instructional leadership. *Journal of Educational Administration*, 54(2), 152–172.
- Urwick, A. (2016b). The influence of typologies of school leaders on teacher retention: A multilevel latent class analysis. *Journal of Educational Administration*, 54(4), 434–468.
- Urwick, A., Wilson, A. S., Ford, T. G., Frick, W. C., & Wronowski, M. L. (2018). Testing a framework of math progress indicators for ESSA: How opportunity to learn and instructional leadership matter. *Educational Administration Quarterly*, 54(3), 396–438.
- Vaysettes, S., Achiron, M., & Limoges, S. (2016). *PISA 2015 assessment and analytical framework*. OECD. Retrieved on May 18, 2017, from <http://www.oecd.org/publications/pisa-2015-assessment-and-analytical-framework-9789264255425-en.htm>

- Ware, H., & Kitsantas, A. (2011). Predicting teacher commitment using principal and teacher efficacy variables: An HLM approach. *Journal of Educational Research, 104*(3), 183–193.
- Weathers, J. (2011). Teacher community in urban elementary schools: The role of leadership and bureaucratic accountability. *Education Policy Analysis Archives, 19*(3), 1–39.
- Wieczorek, D. (2017). Principals' perceptions of public schools' professional development changes during NCLB. *Education Policy Analysis Archives, 25*(8), 1–45.
- Winnaar, L. D., Frempong, G., & Blignaut, R. (2015). Understanding school effects in South Africa using multilevel analysis: Findings from TIMSS 2011. *Electronic Journal of Research in Educational Psychology, 13*(1), 151–170.
- Woessmann, L. (2011). Cross-country evidence on teacher performance pay. *Economics of Education Review, 30*(3), 404–418.
- Woessmann, L. (2016). The importance of school systems: Evidence from international differences in student achievement. *The Journal of Economic Perspectives, 30*(3), 3–31.
- Woo, H., & Henfield, M. S. (2016). Student and teacher factors' impact on fourth grade students' mathematics achievement: An HLM analysis of TIMSS 2007. *Journal of Mathematics Education, 9*(1), 69–87.
- Wu, Y. (2016). Universal beliefs and specific practices: Students' math self-efficacy and related factors in the United States and China. *International Education Studies, 9*(12), 61.
- Xie, D., & Shen, J. (2013). Teacher leadership at different school levels: Findings and implications from the 2003–04 Schools And Staffing Survey in US public schools. *International Journal of Leadership in Education, 16*(3), 327–348.
- Young, J. L. (2017). Access, achievement, and academic resilience: The relationship between AVID and Black student participation in advanced placement courses. *Journal of Multicultural Affairs, 1*(2), 4.
- Yu, R., & Singh, K. (2018). Teacher support, instructional practices, student motivation, and mathematics achievement in high school. *The Journal of Educational Research, 111*(1), 81–94.