

## An Exploratory Analysis of the Prevalence of Quantitative Research Methodologies in Journal Articles

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### Abstract

The purpose of this study is to explore the prevalence of quantitative research methodologies in published journal articles to better understand the knowledge and skills necessary for school leaders to meet the expectations of applying research findings to practice. It examines research articles published between 2008 and 2013 in the *American Educational Research Journal*, the *Educational Administration Quarterly*, and the *NASSP Bulletin*. Empirical articles comprise 91 percent of the 449 identified research articles, with 58 percent reporting the use of quantitative methodology.

**Keywords:** Research use; School leaders; Quantitative research

### Introduction

At least since the implementation of the No Child Left Behind Act (NCLB), policy-makers and researchers have pressured school leaders in the United States to apply evidence from research studies to school and classroom practices. If school leaders are expected to read, interpret, evaluate, and apply research evidence, then preparation programs must equip aspiring school leaders with the necessary skills. Numerous authors have debated the skills and coursework sufficient for school leaders to “consume” educational research (Hochbein & Perry, 2013), but their recommendations often lack empirical evidence (Archbald, 2008; De Lisi, 2013). The purpose of this study is to explore the prevalence of quantitative research method-

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ologies in published journal articles to better understand the knowledge and skills necessary for school leaders to meet the expectations of applying research findings to practice. To achieve this purpose, this study examines articles published in peer-reviewed journals associated with three organizations pertinent to the preparation and practice of school leaders: the American Educational Research Association (AERA), the National Association of Secondary School Principals (NASSP), and the University Council for Educational Administration (UCEA). The content of research articles published between 2008 and 2013 was examined in light of four research questions:

- What is the prevalence of empirical articles?
- What is the prevalence of common types of quantitative data collection?
- What is the prevalence of research designs attempting to make causal inferences?
- What is the prevalence of statistical analyses?

## Background

Researchers interested in school leadership have studied published research articles for a variety of reasons. Systematic reviews have critiqued the empirical rigor of research methodologies utilized to study school leadership (Bridges, 1982; Hallinger & Heck, 1996; Heck & Hallinger, 2005). Researchers have also attempted to study the development of school leadership research by examining the content of articles published by a single journal (Campbell, 1979; Murphy, Vriesenga, & Storey, 2007). Researchers have also used bibliometric data from published research articles to compare the influence of different journals (Cherkowski, Currie, & Hilton, 2012; Richardson & McLeod, 2009). This study examines articles from multiple journals to document the prevalence of quantitative research methodologies.

Although school leaders should consider results from both qualitative and quantitative research, this study focuses on quantitative research methodologies for three reasons. First, educational policies and technological advancements have enhanced researchers' abilities to access and analyze quantitative data, as well as disseminate their results and recommendations. Second, educational policy developments have increased expectations about the quantitative data literacy and research competency of school leaders (Levin & Datnow, 2012). In addition to appropriately interpreting school-operation and student-achievement data, educational stakeholders have begun to expect that school leaders implement curricula, reforms, interventions, policies, and procedures supported by strong research evidence (Herman, Dawson, Dee, Greene, Maynard, & Redding, 2008; Leithwood, Seashore-Louis, Anderson, & Wahlstrom, 2004; National Policy Board for Educational Administration, 2015). Third, the typical preparation of school leaders has included a paucity of training dedicated to research or statistical analysis (Hess & Kelly, 2007).

## Data access, analysis, and dissemination

Prior to the implementation of the NCLB, numerous organizations maintained large

educational databases. For example, the National Center for Education Statistics (NCES) administered a variety of data collections and studies, such as the *Schools and Staffing Survey* and *High School and Beyond*. In addition to databases focused specifically on school settings, educational researchers also have utilized large databases such as *The National Longitudinal Study of Adolescent to Adult Health* and *The Panel Study of Income Dynamics* to study factors related to education. From such databases, researchers have conducted numerous studies that reported findings pertinent to educational leaders and their settings (Benner & Crosnoe, 2011; Fryer & Torelli, 2010; Haveman, Wolfe, & Spaulding, 1991; Muhammad, 2008; Printy, 2008).

Although such datasets have existed for decades, federal and state policies have increased the amount of data accessible for quantitative educational studies. For example, mandates associated with the NCLB compelled leaders of state departments of education to implement extensive data collection related to the education of students. The Race to the Top grant competition provided further incentives to gather and evaluate data from schools, educators, and students (Maxwell, 2009). In addition, public and private funding organizations have prioritized quantitative analyses and research designs that establish causal inferences (What Works Clearinghouse, 2014). Although critics have questioned the credibility of these collected data (Forte, 2010; Kane & Staiger, 2002; Reback, 2008; Stringfield & Yakimowski-Srebnick, 2005), numerous researchers have capitalized upon the publicly available datasets to conduct rigorous and informative educational studies (Hemelt, 2011; Ladd & Lauen, 2010; Winters, Trivitt, & Greene, 2010).

Along with greater amounts of publicly available data, increased computing power and enhanced statistical software have enabled the complex analysis of once-unthinkable amounts of data. Advances in computer hardware have increased the amount of data that researchers can analyze (Mayer-Schonberger & Cukier, 2014). Similarly, improved statistical software has furthered researchers' abilities to run complex statistical models that attempt to disentangle the interrelated factors accounting for variance in measured outcomes (Raudenbush & Bryk, 2002; Singer & Willett, 2003). For researchers, improvements in data storage and computation have simplified the processes of accessing and analyzing substantial amounts of data.

In addition to increased data access and analysis capabilities, technological advancements have facilitated the dissemination of research findings. The expansion of research journals onto the internet has lessened the time to public release and increased readership opportunities. Educators can access journal archives as well as consume research articles before journals formally release hard-copy publications. Moreover, memberships to libraries and professional organizations have reduced access barriers imposed by journal subscription fees. Despite increased access to journal articles, questions remain about educational leaders' penchants for (Mayo & Zirkel, 2002; Zirkel, 2007) and capabilities of (Hess & Kelly, 2007; Hochbein & Perry, 2013) participating in, consuming, or applying sophisticated research.

## Expectations of school leaders

During the last several decades, the roles and responsibilities of school leaders have increased in complexity. Accounts of school leaders prior to the NCLB demonstrated

that the role of school leader historically entailed a multitude of responsibilities and expectations, which commonly included supervising instruction, disciplining students, accounting for school budgets, monitoring extracurricular programs, maintaining community relations, and other such duties (Duke, 1995; Grant, 1988; Wolcott, 1973). However, the expansion of accountability policies and the proliferation of school reforms have increased the number and complexity of educational leaders' duties. For example, the adoption of school-choice policies has required school leaders to develop operations that make their schools viable competitors in an educational marketplace (Lubienski, 2005). Moreover, to select from the multitude of recommended strategies to lead an effective improvement of schools, school leaders must evaluate the validity and utility claims of available evidence (Shadish, Cook, & Campbell, 2002).

The 2008 *Standards for School Leaders*, created and published by the Council of Chief State School Officers (CCSSO) (2008), illustrates the complexity of leading a school in an era of accountability. Yet, the *Professional Standards for Educational Leaders 2015* adopted by the National Policy Board for Educational Administration (NPBEA) (2015) expanded the number of standards expected of educational leaders from six to ten. Content from the updated standards indicated the need for school leaders to read and comprehend research, to "Deliver actionable feedback about instruction and other professional practice through valid, research-anchored systems of supervision and evaluation to support the development of teachers' and staff members' knowledge, skills, and practice" (p. 18). However, reading and understanding research are not listed among the proposed standard updates. Without appropriate training, however, how can school leaders decipher the sophisticated research related to the evaluation of teachers (Ballou & Springer, 2015; Donaldson, 2013; Goldring, Grissom, Rubin, Neumerski, Cannata, Drake, & Schuermann, 2015)?

### The preparation of school leaders

Numerous authors have argued that the research preparation, curricula, and skills for those returning to educational practice from a university-preparation program need to differ from students entering academic or research professions (Labaree, 2003; Shulman, 2004). Some authors have suggested focusing research training for educational practitioners on specific methodologies, such as action research (Davis, Darling-Hammond, LaPointe, & Meyerson, 2005) or networked improvement communities (Bryk, Gomez, & Grunow, 2010). Other supporters of differentiating the research curricula of practitioners from researchers often suggest that educational practitioners need only to consume educational research (Andrews & Grogan, 2005; Archbald, 2008; De Lisi, 2013; Prestine & Malen, 2005). Although the consumption of research might be a critical skill for educational leaders (Hochbein & Perry, 2013), other research and methodological skills might also contribute to the effective leadership of schools and districts.

The discourse related to the research preparation of school leaders has, however, largely focused on the curricula of the professional doctorate and not that of the initial preparation of aspiring school leaders (Anderson, 1983; Brown, 1966; Deering, 1998; Guthrie, 2009). Despite expectations that school leaders read and apply research evidence, the preparation of aspiring school leaders has often provided mini-

mal research training (Hess & Kelly, 2007). For example, the Pennsylvania Department of Education (2008) framework for developing a school administrator certification program, which cited the need for school leaders to use and apply research, included this guideline for students: “Shares research findings with teachers in order to help them understand the connection to student learning and effective instructional practices” (p. 11). Despite this objective, these guidelines did not require a single course dedicated to research methodology. Moreover, these guidelines required applicants to specify the “administrator/leadership experience” (p. 20) of program faculty, but not their research qualifications or experience. If aspiring school leaders do not receive explicit research instruction from capable faculty, then they might lack the skills necessary to apply research evidence to their school contexts as practicing school leaders.

When authors have suggested the need for aspiring leaders to complete research coursework, they routinely recommended introductory content (Reames, 2010; Reed & Llanes, 2010). For example, Michelle D. Young (2006) recommended that Master’s programs in educational leadership include research coursework, advising that “students develop a basic understanding of action research skills and how those skills can be put to use within a school setting for the purpose of program evaluation and school improvement” (p. 7). A basic understanding of research methodology will not afford school leaders the ability to read published research and apply the findings to school settings. To improve knowledge about the skills necessary for school leaders to consume quantitative research, this study reviews published journal articles for the prevalence of quantitative research methodologies.

## Methodology

This review of articles published in three peer-reviewed journals specifically examines the prevalence of empirical articles, quantitative data collection, quantitative research designs, and statistical analyses. This section specifies the sampling strategy and the selected journals. The next section describes the protocols for coding the content of the sampled articles. After presenting the results, this article identifies how methodological limitations introduced plausible threats to the validity of these claims and provides guidance for future research.

## Sample and population

A variety of sampling strategies could be employed to achieve the purpose of improving understanding about the skills educational leaders need to apply research findings to practice. For example, William Penuel, Derek Briggs, Kristen Davidson, Corinne Herlihy, David Sherer, Heather Hill, Caitlin Farrell, and Anna-Ruth Allen (2017) surveyed educational leaders about their opinions regarding reading and applying research. Focused specifically on the preparation of educational leaders, Frederick Hess and Andrew Kelly (2007) reviewed the curricula of preparation programs for research references. Rather than relying on the identification of research methodologies recalled by educational leaders or valued by the faculty of leadership preparation programs, this study reviews the content from a sample of published studies in peer-reviewed educational journals.

Arguably, the entire population of peer-reviewed educational research journals offers some content pertinent to school leaders. Yet, a random selection of peer-reviewed publications would likely over-represent journals, articles, and content written for an audience of researchers. To avoid such bias, peer-reviewed journals published by organizations that represent researchers (AERA), faculty who prepare educational leaders (UCEA), and school leaders (NASSP) (see Table 1) were purposefully selected. This purposeful stratified sample provided peer-reviewed articles that authors, reviewers, and editors thought warranted publication in scholarly journals aimed at a specific readership.

**Table 1. Information for selected educational organizations and the associated journal**

	AERA	NASSP	UCEA
Mission	Founded in 1916, AERA aims to advance knowledge about education, to encourage scholarly inquiry related to education, and to promote the use of research to improve education and serve the public good.	Founded in 1916, NASSP's mission is to connect and engage school leaders through advocacy, research, education, and student programs.	Since its launch in 1954, UCEA's mission has been to improve the professional preparation of educational leadership personnel through pre-service and professional development programs and to promote the development of research, policy, and professional knowledge.
Primary constituency	Educational researchers	School leaders	Faculty who prepare school leaders
Membership	25,000 individuals	30,000 individuals	99 postsecondary institutions, with 2,200 faculty and staff
Selected journal	<i>AERJ</i>	<i>BUL</i>	<i>EAQ</i>
Issues per year	6	4	5
Ranking	15/219	unranked	111/219
Citations	2844	N/A	604
Impact factor	2.275	N/A	0.723

The *American Educational Research Journal (AERJ)* was selected from the six peer-reviewed journals published by the AERA. According to the *AERJ* (n.d.) website, the journal publishes “original empirical and theoretical studies and analyses in education.” Articles published in the *AERJ* offer a breadth of topics at multiple grade levels that related to a wide variety of school leader activities and decisions. In addition, articles in the *AERJ* focus on the creation of new knowledge, rather than the synthesis of prior research.

The *Educational Administration Quarterly (EAQ)* was selected from the three peer-reviewed journals published by the UCEA. Although *The Journal of Cases in*

*Educational Leadership* provides useful scenarios for school leaders to consider, it was excluded because the content varies from typical research articles. *The Journal of Research on Leadership Education* utilizes more traditional research methods, but it was excluded because it focuses on issues related to the preparation of school leaders. By contrast, the *EAQ* provides content relevant to the activities and decisions of current school leaders. According to the *EAQ* (n.d.) website, the journal publishes “prominent empirical and conceptual articles focused on timely and critical leadership and policy issues facing educational organizations.”

Although the NASSP publishes multiple periodicals, only the *NASSP Bulletin (BUL)* employs a peer-review process for article selection. According to the *BUL* (n.d.) website, the journal publishes “scholarly and research-based knowledge that informs practice, supports data-driven decisions, and advances the performance of middle and high school principals.” The focus of the *BUL* content on middle school and high school presents a limitation to the study, but an investigation into viable elementary school options revealed that the *Elementary School Journal* is not associated with an organization similar to the AERA, the UCEA, or the NASSP. Furthermore, the National Association of Elementary School Principals publishes several periodicals, but none of them employ a peer-review process.

In addition to the differences in publishers, the three peer-reviewed journals also vary in their bibliographic metrics. As demonstrated in Table 1, the *AERJ* garnered the highest ranking, most citations, and largest impact factor. By contrast, the Journal Citation Reports® of the Web of Science™ did not list the *BUL* among the 219 assessed education journals (Thomson Reuters, n.d.). These journals also differ in their publication formats, such as the number of issues per year. However, the variation among the sampled journals does not hinder the assessment of the prevalence of research procedures.

As the *AERJ* published more articles, within the time period of the study, than the *EAQ* and the *BUL* combined, the aggregation of results could mask differences between the journals. To avoid such bias, individual journal results are reported and evaluated. The intent of this disaggregation was not to judge the quality of the journal content, nor recommend readings for school leaders. Instead, identifying the prevalence of quantitative methodologies is an attempt to discern the knowledge and skills necessary to comprehend the quantitative studies published in these three journals.

## Procedures

From each of the three journals, every issue published between 2008 and 2013 was downloaded. Any non-research articles, such as introductions to special issues, book reviews, or commentaries, were excluded. With the remaining research articles, the title, abstracts, methodology, and results sections were read to code content and categorize articles. First, articles were categorized as either empirical or theoretical. Articles classified as empirical included and described the use of a research methodology to collect evidence, whereas theoretical articles did not demonstrate any methodical means of collecting evidence. Therefore, empirical articles would include systematic reviews, bibliographic analyses, reviews of legal cases, and other such research that systematically gathers evidence. Similar to Joseph Murphy, Michael

Vriesenga, and Valerie Storey (2007), empirical articles were further categorized as qualitative, quantitative, or mixed-methods, based upon their methodology.

From articles identified as quantitative and mixed-methods, the content was further examined to identify the type of data collection and statistical analyses. To avoid underestimation in the assessment of quantitative methodologies, content from the quantitative aspect of articles identified as mixed-methods was analyzed. After an initial review, three codes were derived for the means of data collection: secondary database, survey, and multi-method. Articles coded as secondary database included data collection that relied upon previously collected and stored data. Examples of secondary database collection include, but are not limited to, databases maintained by the NCES, state departments of education, or individual school districts.

Articles coded as employing a survey data collection relied on the distribution of an instrument to collect information from respondents. The most common form of survey data collection consisted of researchers seeking respondents' opinions to a questionnaire. However, alternative formats of data gathering were also coded as survey collection, such as data collected for a social network analysis. Similarly, if respondents completed a task distributed by the researchers, such as a test, the collection was coded as a survey.

Articles required two elements to be coded as multi-method. First, the research methodology identified multiple means of data collection. Second, the researchers combined or linked the data to conduct an integrated analysis. For example, a multi-method collection might include researchers who utilized observation protocols to gather teacher information and linked the observations to student outcomes. Similarly, if researchers linked information from either a survey or secondary database to another data source, the article was coded as multi-method. For example, the linkage of a state department of education database with an administrative database of a school district was classified as multi-method data collection.

In addition to categorizing the form of data collection in quantitative articles, contents were also analyzed for the identification of quantitative research designs. The examined sample of articles employed numerous types of designs, most of which might be labeled as correlational (Shadish, Cook, & Campbell, 2002). Therefore, the focus is on three specific types of quantitative research designs that attempted to demonstrate a causal relationship or a direct impact: experimental, quasi-experimental, and action research. Articles were only coded as one of these three designs if authors explicitly identified a research design in the content of the article; articles were not judged on whether they satisfied the criteria required by these designs.

Finally, the content of the articles was analyzed to identify the applied statistical techniques. As the authors utilized a variety of terms to describe their statistical techniques, it was necessary to group certain procedures under a single code. The challenge of developing the coding system arose in developing valid as well as informative codes. Broad coding, such as "central tendency measures" and "general linear model," or "univariate" and "multivariate," would mask the prevalence of specific types of statistical techniques. Therefore, the aim was to form codes that might provide an accurate depiction of the described statistical techniques, as well as enough specificity to help guide the research instruction of school leaders.



Three particular codes required greater explanation. First, when authors utilized statistical techniques that accounted for variance at different analytic levels, the article was coded as “multilevel model.” Second, articles that employed variations of the Analysis of Variance (ANOVA), such as including covariates or analyzing multiple outcomes, were included under the single code of “ANOVA.” Third, an article was only identified as utilizing descriptive statistics if the authors included the measures as a primary element in their interpretation of the results. Virtually every study utilized common measures of central tendency, which resulted in no variation between articles. However, some authors included these statistics as a primary means of analyzing and interpreting the data. Examples of such usage might include analyzing data from an entire population or responses to survey questions.

## Results

Between 2008 and 2013, the *AERJ*, the *EAQ*, and the *BUL* published 449 articles. As expected from their respective formats and number of issues published per year, the *AERJ* (49%) accounted for the greatest percentage of the sample and the *BUL* (21%) accounted for the least (see Table 2). Among the three journals, the *AERJ* published the greatest fraction of empirical (95%) and quantitative (64%) articles. All three journals published a larger percentage of empirical articles, with the *BUL* exhibiting the smallest fraction at 81 percent. Similarly, the majority of articles published by the journals employed a quantitative component, with the *BUL* again demonstrating the smallest fraction at 51 percent.

**Table 2. Distribution of article type, data collection, and research design by journal**

	<i>AERJ</i>		<i>BUL</i>		<i>EAQ</i>		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Total published	219		96		134		449	
Empirical	209	95	78	81	121	90	408	91
Quantitative*	141	64	49	51	73	54	263	59
Data-collection method								
Multi-method	72	51	12	24	24	33	108	41
Secondary database	57	40	11	22	19	26	87	33
Survey	12	9	26	53	30	41	68	26
Research design								
Experimental	23	16	1	2	2	3	26	10
Quasi-experimental	14	10	3	6	0	0	17	6
Action research	0	0	2	4	0	0	2	1

Note: \*Includes mixed-methods articles

Among the 263 articles that utilized a quantitative methodology, researchers employed a multi-method data collection the most often (41%) and survey the least (26%). Yet, results demonstrated that the three journals exhibited substantial differences in their composition of data-collection techniques. Articles published in the *BUL* (53%) and the *EAQ* (41%) exhibited the greatest use of survey data collection, but neither secondary database nor multi-method collection accounted for less than 22 percent of the collection techniques in the *BUL* or the *EAQ*. By contrast, survey data collection accounted for 9 percent of the *AERJ* articles, with 51 percent demonstrating multi-method data collection.

Among the sample of aggregated quantitative articles, 17 percent reported the use of one of the three examined research designs: experimental, quasi-experimental, and action research. Although the *AERJ* published 37 of the 45 articles that utilized one of the quantitative research designs, the journal did not publish a single article that specified the use of action research. The *EAQ* published two articles employing an experimental design, but no articles identified as quasi-experimental or action research. Among the 49 quantitative articles published by the *BUL*, 12 percent purported utilizing one of the examined research designs, with at least one article in each category.

From the quantitative articles published in the *AERJ*, the *BUL*, and the *EAQ*, 23 different statistical techniques were identified. As exhibited by the results in Table 3, researchers' use of more than one type of statistical technique per article resulted in the identification of 332 utilizations of these techniques in the 263 articles. The examination of these results revealed that a substantial percentage of articles relied on a limited number of statistical techniques. For instance, the six most common statistical techniques collectively accounted for 76.5 percent of all identified statistical procedures. The prevalence of these six statistical techniques in quantitative articles ranged from 34.6 percent to 8.0 percent.

**Table 3. The distribution of statistical techniques included in quantitative journal articles**

Technique	<i>AERJ</i>		<i>BUL</i>		<i>EAQ</i>		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Multilevel model	64	45.4	3	6.1	24	32.9	91	34.6
Regression	20	14.2	8	16.3	17	23.3	45	17.1
Descriptive	10	7.1	19	38.8	10	13.7	39	14.8
ANOVA	18	12.8	11	22.4	5	6.8	34	12.9
SEM	11	7.8	1	2.0	12	16.4	24	9.1
Logistic regression	15	10.6	1	2.0	5	6.8	21	8.0
Factor analysis	3	2.1	–	–	8	11.0	11	4.2
Social network analysis	1	0.7	8	16.3	2	2.7	11	4.2
t-test	6	4.3	–	–	5	6.8	11	4.2
Chi-Square	2	1.4	5	10.2	3	4.1	10	3.8

Table 3. (continued)

Technique	AERJ		BUL		EAQ		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Correlation	3	2.1	–	–	3	4.1	6	2.3
Hazard analysis	4	2.8	–	–	2	2.7	6	2.3
Path analysis	1	0.7	–	–	4	5.5	5	1.9
Latent growth model	3	2.1	–	–	–	–	3	1.1
Cluster analysis	2	1.4	–	–	–	–	2	0.8
Latent class analysis	1	0.7	–	–	1	1.4	2	0.8
Mann-Whitney U	–	–	1	2.0	1	1.4	2	0.8
Meta-analysis	1	0.7	–	–	1	1.4	2	0.8
Rasch model	1	0.7	–	–	1	1.4	2	0.8
Tobit regression	2	1.4	–	–	–	–	2	0.8
Event sequence analysis	1	0.7	–	–	–	–	1	0.4
Risk Ratio	–	–	–	2.0	–	–	1	0.4
ROC curve analysis	–	–	–	2.0	–	–	1	0.4
<b>Totals</b>	<b>169</b>	–	<b>59</b>	–	<b>104</b>	–	<b>332</b>	–

Individually, the three journals also demonstrated this trend of a limited number of statistical techniques accounting for a substantial number of procedures reported in articles. For example, 84 of the 169 procedures identified in the AERJ were classified as either a multilevel model or regression analysis. They also represented the top two types of techniques in the EAQ and accounted for 41 of the 104 identified statistical procedures. In the BUL, descriptive analysis and ANOVA were identified as the two most common statistical techniques, which accounted for 30 of the 59 identified procedures.

Although the individual rankings of the statistical techniques varied between the three journals, the composition of the most prevalent statistical techniques demonstrated considerable stability among the journals. Among the six most common statistical techniques identified in the AERJ, the EAQ shared five and the BUL shared four. In the EAQ, factor analysis appeared more often, with researchers utilizing it in eight of the 73 articles, which ranked it fifth among journal procedures. Among the 49 quantitative articles published in the BUL, eight analyzed data with Social Network Analysis and five applied Chi-Squared tests, which ranked them fifth and sixth, respectively, among the statistical techniques that appeared in the journal.

### Synthesis and discussion

Results calculated from the aggregation of the articles published in the three journals provided answers to the four research questions, as well as providing evidence about the knowledge and skills necessary for school leaders to read and apply research findings. First, the majority of research articles published in the sampled journals

included some form of quantitative analysis. Second, the data-collection methods of the quantitative articles were almost equally divided among the three coded techniques: multi-method (41%), secondary database (33%), and survey (26%). Third, less than 20 percent of the quantitative articles identified a quantitative research design that attempted to demonstrate a causal relationship or impact. Finally, the vast majority of articles relied on a limited number of statistical analyses, with multilevel modeling identified as the most common statistical technique and applied in more than a third of the quantitative articles.

Although the aggregated articles exhibited such trends, differences in their constituencies, rankings, and formats warranted the examination of individual journal trends. The composition varied by journal, yet results demonstrated that the majority of articles in each of the examined journals utilized quantitative analysis. However, the methods by which researchers collected their data exhibited substantial variation between the journals. Also similar to the aggregated results, a limited number of statistical analyses accounted for a majority of the quantitative articles in each of the three journals. Moreover, four statistical analyses (multilevel models, regression, descriptive, and ANOVA) appeared among the six most prevalent statistical procedures identified in each journal. Despite this commonality among the ranking of the statistical procedures, the utilization of the techniques varied widely among journals.

### Limitations and recommendations

Before offering recommendations, several limitations and validity threats warrant consideration. The limited and purposive sampling of articles weakens the external validity of the results. The sampling strategy relied upon publications produced by organizations that represent the research, preparation, and practice interests related to school leaders. Yet, the research content of the articles from these publications does not necessarily represent the population of research articles pertinent to school leaders. For instance, journals that rely on a composition of articles that differs from the *AERJ*, the *BUL*, and the *EAQ* might exert greater influence and impact on the activities and decisions of school leaders (Penuel et al., 2017; Zirkel, 2007).

Similarly, the sampling strategy identified articles published between 2008 and 2013, which spans an era of increased school accountability and data use. During this period, numerous education stakeholders emphasized quantitative research (Herman et al, 2008). Given such priorities, it is reasonable to assume that journal editors and editorial boards might have also prioritized the publication of quantitative research articles. Results from this period might have overestimated the prevalence of quantitative research methodologies.

However, two aspects of the methodology potentially contributed to an underestimation of the prevalence of quantitative research methodologies. First, although all of the statistical procedures utilized within an article were identified, repetitions of an analysis were not counted. For instance, researchers might have used the same statistical analysis to test five different models. Yet, the identification scheme used here would only count this as a single instance. This method of coding enabled an accurate accounting of statistical prevalence in articles, but failed to capture the amount of research questions or information assessed by the statistical procedures.

Second, only recording the methods of data collection, quantitative research designs, and statistical procedures implemented by researchers in an article likely underestimated the prevalence of quantitative methodologies. Instances of authors justifying their use of a technique by explaining the inappropriateness of another technique were discovered. For instance, William Saunders, Claude Goldenberg, and Ronald Gallimore (2009) defended their decision to not use a multilevel model:

This analysis of treatment and comparison schools during the years of intervention did not control for baseline scores, ruling out a longitudinal mixed model (hierarchical linear model) that would take in account the schools' starting status. However, neither the state nor the district could provide SAT-9 data in a form that permitted such an analysis. (p. 1018)

Without an understanding of multilevel modeling, readers might not understand if this was a defensible decision.

Given these limitations and results, four recommendations related to researchers, policymakers, and educators are offered. First, it is recommended that researchers extend this study to examine content not included in this sampling strategy and coding scheme. This sampling strategy focused on a limited number of journals and quantitative methodologies. Future research might include analysis provided by a greater array of journals, such as those identified by Sabre Cherkowski, Russell Currie, and Sandy Hilton (2012) and Jayson Richardson and Scott McLeod (2009). However, as access to such journals might prevent educational leaders from reading their content, it is advisable that future studies also examine accessibility to research. Moreover, it is recommended that researchers study the content of widely distributed and commonly read editorially reviewed periodicals such as the *Phi Delta Kappan* and *Educational Leadership* (Mayo & Zirkel, 2002; Zirkel, 2007). In addition to different sampling, researchers interested in extending this study might also study the prevalence of qualitative methodologies. Examining qualitative research articles would provide further information about how to train aspiring school leaders.

Second, policymakers and preparation programs should expand the certification requirements for educational leaders to include explicit instruction regarding research methodologies and knowledge. This study's findings contradicted the claims of Young (2006) and suggested that preparation programs should include preparation beyond introductory coursework in quantitative methodology. If school leaders are to read, interpret, and apply evidence from quantitative studies, they need more than a basic understanding of quantitative methodology. Coursework should include but not be limited to preparing students to judge the validity and limitations related to common data-collection techniques and research designs. Moreover, preparation programs are encouraged to implement statistical coursework that covers at minimum regression analysis, but also enables students to understand more sophisticated educational research. Instead of focusing on the parameters of running analyses, these courses could focus on teaching the parameters required for valid results, as well as interpreting reported outcomes.

Third, preparation programs are advised to include, utilize, and critique more empirical research articles within traditional leadership content courses. Rather than

popular works that translate or interpret research, such as Robert Marzano, Phil Warrick, and Julia Simms (2014), faculty who prepare school leaders should assign original research pertinent to the leadership of schools and districts, such as Sam Stringfield, David Reynolds, and Eugene Schaffer (2008). In addition to reviewing the findings, faculty and aspiring leaders are advised to assess the validity, utility, and practicality of researchers' claims. By incorporating original research into content courses, aspiring school leaders will be able to apply and supplement the skills learned from courses focused explicitly on statistical and research content.

Fourth, it is recommended that faculty associated with school leadership-preparation programs develop assignments and activities that encourage the rigorous examination of policies and procedures in aspiring leaders' schools and settings. For example, faculty could use Michael Gottfried's (2017) analysis of transportation and student absenteeism to instruct aspiring school leaders about how to use data from their own districts to conduct a similar analysis. Faculty might also challenge their students to develop an implementation plan that applies the random assignment of an absenteeism intervention in their school or district. In addition, the faculty could ask students to consider if available data enable the use of quasi-experimental designs, such as regression discontinuity or interrupted time series, to study the influence of absenteeism policies. Moreover, students might review the results of program evaluations to identify plausible validity threats to the claims and recommendations of the evaluations. Incorporating rigorous research methodology to investigate local issues would not only increase students' familiarity and capability with research concepts but also foster a greater understanding of the power and limitations of research methodologies (Hochbein & Perry, 2013).

In the last several decades, the enactments of educational policy and the evolution of technology have facilitated the quantitative study of education. Along with these increases in school accountability, data collection, and research dissemination, expectations about the research competence of school leaders have also grown. Although school leaders might not be expected to conduct and publish rigorous studies, they are expected to use research evidence to select, implement, operate, and evaluate academic and extracurricular programs. To ensure that school leaders possess the capabilities to meet these demands, the preparation of aspiring school leaders must teach them to value, read, interpret, question, and apply findings from quantitative research.

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