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Using Bibliometric and Social Media Analyses to Explore the "Echo Chamber" Hypothesis

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Abstract

Educational policy debates are no longer occurring exclusively in academic or governmental settings. Intermediary actors are promoting research using a variety of traditional and non-traditional media to advance and oppose policy agendas. Given the current policy arena, it is useful to re-examine the research underlying current reforms, and to determine whether there is an "echo-chamber" effect, where a small, or unrepresentative, sample of studies is repeatedly cited to create momentum around a policy proposal. In exploring the echo-chamber hypothesis, we focus on two distinct methodologies. Using bibliometric methods and examining social media activity by intermediary organizations, our preliminary evidence suggests the presence of an echo-chamber effect in policy debates.

Keywords

bibliometrics, intermediary organizations, social media, research use, school vouchers, charter schools

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Over the past decade, both the Bush and Obama Administrations have emphasized the importance of research on educational interventions, demanding evidence of the effectiveness of reforms in improving the schooling of young people. For instance, the landmark No Child Left Behind legislation repeatedly called for "scientifically based research" on different policy options, and the Obama Administration has declared that the multi-billion dollar Race to the Top discretionary funding from the American Recovery and Reinvestment Act will be disbursed based on "what works," not on ideological preferences or fads (*Washington Post*, 2009). Similarly, venture philanthropists are searching for assurance that their investments in education reforms will pay off in terms of better outcomes for students. Even as policymakers and reformers endorse this standard, many popular reforms such as charter schools and voucher programs have expanded virally, despite the fact that the effectiveness of such reforms are not supported by a research consensus (e.g., Rouse & Barrow, 2008).

Furthermore, policy debates are no longer occurring exclusively in academic or governmental settings. Intermediary organizations, which can include charity organizations, think tanks, grassroots coalitions, philanthropies, and research firms, are promoting research using a variety of traditional and non-traditional media. These organizations, which work to promote or oppose educational policies throughout the United States, advance research that supports their policy objectives, neglecting research that does not. Research on charter schools, school vouchers, and other educational reforms has been funded by a variety of sources, but private organizations account for a great deal more than public funding agencies. The role of intermediary organizations is growing as philanthropic donations and independent research play an increasingly greater role in determining educational policy (Lubienski, Scott, & DeBray, 2011).

Yet the growth of this sector raises concerns about the emergence of an "echo chamber" in research use for educational policymaking, where a relatively small and selective set of studies is repeatedly cited by other researchers and advocacy organizations within an advocacy coalition to advance a policy agenda supporting or condemning policies designed to expand incentivist education reforms (Lubienski, Weitzel, & Lubienski, 2009). The findings of these studies are then simplified as they reverberate through policymaking discussions as proven truths, reinforced by repetition without the nuance and complexity that they deserve. This raises concerns about what research gets cited and what is neglected (Henig, 2009; Lubienski & Weitzel, 2008). Thus, the push by policymakers and foundations to endorse policies based on demonstrated evidence of effectiveness, however laudable, begs the question of who defines "what works"—what is being cited, by which actors,

and in which forums. In this regard, being able to claim that a consensus exists in the research on the effectiveness of interventions is an important objective for advocates but raises questions over the source and strength—indeed, the creation—of that consensus (Lubienski, et al., 2009).

This study is part of a larger project that examines how intermediary organizations broker research for policymakers on different policies that embrace various forms of incentives to improve schooling such as charter schools, vouchers, and performance pay.[1] Given the remarkable proliferation of these policies, it is critical to re-examine the research underlying these reforms. To explore the echo-chamber effect, we focus in this article on two distinct methodologies that approach the issue from independent but linked perspectives. Initially, we use new tools from bibliometrics, a field that quantitatively examines research literature, to reveal, for example, the impact or reach of cited research reports, which studies are cited by whom and how often, which citations are selected by particular intermediary groups and political organizations, the type and quality of the research cited, and the identification of overlaps in these citations. We pilot these methods to examine the current research on school vouchers, and we find preliminary evidence that suggests an echo-chamber effect in the use and citation of research on school vouchers. Next, we examine how intermediary organizations informally cite research in social media networks. We find that, in addition to traditional avenues of information dissemination and communication, intermediary organizations are also using platforms such as Twitter to influence policy, affect trending conversations, and communicate with each other. The growing role of these new media types, coupled with the growing role of intermediary organizations, has created a wider audience for policy debates and allowed more voices to contribute to the conversation. However, there is very little theoretical or empirical analysis of how research and information are disseminated between intermediary organizations via social media platforms. Therefore, this article also assembles and analyzes advocacy data collected from Twitter, including posts about charter schools and education reform by these organizations as they attempt to leverage such outreach to affect the evidence used in the development of education policy. By examining these two cases of what we are calling "incentivist reform" (Lubienski, Gulosino, & Weitzel, 2009), charter schools and school vouchers, we explore how traditional, scholarly patterns of citation and new forms of "citation" and reference using social media reinforce the echo chamber in education policy research.

The article is organized as follows. We first present an overview of the conceptual frame, and then we describe the methods used for the bibliometric and Twitter analyses. Next, we discuss our findings from both sets of

analyses. We conclude by suggesting directions for future applications of bibliometrics and social media analysis to examine research use in policy.

Advocacy and the Echo Chamber

Although popular conceptions of the policymaking process may assume that policymakers carefully weigh research evidence on complex issues, it is clear that this is often not the case. As scholars of research use have found, policymakers often use research politically, drawing on evidence simply to support already held views or policy proposals (Weiss, 1979), or they gather evidence via a process of "bricolage" (Ball, 1998), drawing loosely and at times haphazardly from the various sources of evidence they come across. Yet even when people responsible for making policy decisions attempt to search systematically for research evidence, they often feel ill equipped to interpret or evaluate complex research reports (Nelson, Leffler, & Hansen, 2009), an issue that is particularly problematic when there are arcane analytical approaches and mixed or conflicting findings. Instead, they often rely on organizations to gather, interpret, and package research for policymakers, a function that gives such intermediaries remarkable authority in representing research evidence. This is especially true regarding an issue such as vouchers, where the technical specialization required to understand the research puts readers at an informational disadvantage and gives advocacy organizations an incentive to shape perceptions of the findings. For example, Rick Hess, at the American Enterprise Institute, noted this with previous voucher programs:

> In Wisconsin, the Bradley Foundation and the Olin Foundation were instrumental in getting the Milwaukee Parental Choice Program passed—the first real voucher model in the country. They were then instrumental in providing political air cover for the program. They found and supported researchers to document it, and they helped promote it nationally. (Barr et al., 2011, para. 49)

The Advocacy Coalition Framework suggests that groups and individuals may align along certain beliefs to advocate on behalf of policy supporting a shared belief (Sabatier, 1993). Groups align along core beliefs and are willing to abandon secondary beliefs to align with the larger group. Although individuals and groups may align to form a coalition to advocate for a certain policy, members of that coalition may oppose each other on different issues. Groups in favor of charter schools, for example, may align in a coalition despite differences in the expected function of the charter schools

themselves. The intermediary organizations examined in this study tend to organize themselves as those in favor of market-based reforms and those opposed to such reforms (DeBray et al., 2013).

Although increasing activity is apparent in this intermediary sector, little is known about how these organizations produce, package, and promote ideas, either alone or in concert with other organizations. Yet these are key questions for understanding the changing nature of knowledge production and use in social and educational policy, particularly in an era of rapid information dissemination and easy access via the web and social media. Knowledge of these issues is crucial for assessing the potential of the intermediary sector for moving educational policymaking toward a more empirical basis, while shifting the institutional models for knowledge production away from university-based research toward more private (and perhaps more efficient) modes of research funding and responsiveness.

As Carol Weiss's (1979) "political model" of research utilization would predict, some university-based researchers favorable to that agenda may enjoy access to the policy process in defining what works, while others may be excluded as the administration attempts to make a public case for those measures (see, for example, U.S. Department of Education, 2010). The exclusion of research contrary to an administration's agenda becomes more likely if the existing empirical basis used to justify the diffusion of these educational policies is relatively thin—what Davies and Nutley (2008) refer to as "tactical" use or misuse.

We believe we are already seeing evidence of this type of tactical research use around vouchers and other related school-reform policies, although it has not been systematically tested. Lubienski and Garn (2010), as well as others, have posited the emergence of an "echo chamber" in research use for educational policymaking, where a small but defined set of studies is repeatedly cited by policy advocates, as well as by a small and relatively self-contained set of researchers, as proof that vouchers or charter schools "work," while neglecting the methodological concerns about the studies and mixed effects of these programs on different populations (e.g., Lubienski, et al., 2009; Wolf, 2008). These studies are then cited in the press, on Twitter, and in blogs, often by sophisticated policy advocates, to advance that agenda or to counter perceived threats (e.g., Thomas, 2006; Watkins, 2006). A key method of dissemination and promotion of these research findings is through the use of modern media such as blogging, Twitter, and Facebook. These have become powerful tools as organizations promote their own agendas and the research supporting those agendas. We trace how those citations "cluster" in various reports—which studies get cited together (and which are excluded) for various audiences.

Method

To explore the echo-chamber hypothesis, and how intermediary organizations cite and disseminate research in scholarly publications and via social media platforms, we use bibliometrics and social media analyses. Bibliometric analyses have been used to understand scientific and scholarly networks in other fields, studying, for example, patterns in co-authorship (White, 2011), the emergence of "invisible colleges" as vehicles for the quick transmission of scientific news (Crane, 1972; White, 2011), and "warring schools of thought" (White, 2011, p. 277). But bibliometric analysis of this kind has not yet been done to any serious degree in the field of education. Given that social media platforms are increasingly being used to disseminate research, we also extend this analysis by examining how organizations use Twitter to communicate within and across organizations regarding research evidence. In our larger study, we are drawing on different approaches to study various types of incentivist policies. Thus, in the present article, the bibliometric analysis focuses on evidence dissemination surrounding school vouchers in the research literature, and the social media analysis focuses on evidence dissemination surrounding charter schools. Each analysis presents an opportunity to examine these distinct incentivist reforms in a medium that is particularly suited to discussion of these particular policies. Given the unresolved academic debate surrounding research on school vouchers, this subject is particularly suited to a bibliometric analysis; however, the school voucher debate does not have the same social media presence that charter schools have. Given the coalition of supporters of charter schools, which spans the political spectrum, and the role of both researchers and advocates in supporting or denouncing these policies in public spaces, with and without evidence that would pass peer review, charter schools are a particularly appropriate subject for this social media analysis.

Our specific questions include: Are there clustering tendencies in the production and dissemination of research that would suggest an "echo-chamber" effect? Are there key differences in the patterns of citations among the "gold-standard" studies as nominated by voucher advocates and those from the general academic literature? How do intermediary organizations use social media, such as Twitter, to connect with policymakers, individuals, and other organizations, and does this reinforce or break away from the echo chamber?

Bibliometric Methods

Our bibliometric analysis examined various elements of the cited research studies such as the number, type, and quality of research cited by particular

intermediary organizations. Other attributes of the research base, including whether citations were peer-reviewed or non-peer reviewed, the journal impact factor, the research methodology utilized, and the authors and institutions involved in the research, were also analyzed. Bibliometric tools can reveal patterns and clusters in the research literature. This process, dependent on the research base and number of citations, can be time consuming and patterns difficult to identify. By combining detailed citation analysis with network-analysis software we are more efficiently and effectively able to identify these patterns and clusters in the research literature and represent the information in a more effective and user-friendly format.

Our methods included two general approaches. First, we examined the citations of empirical studies on vouchers from academic indexes, such as Web of Knowledge (WOK), Google Scholar, and Publish or Perish,[2] tracing backward to report the studies that were cited by empirical voucher studies. We examined the reports, coding for the type of research design (e.g., experimental, cross-sectional), the institutional background of the author (e.g., think tank, university), whether it was peer-reviewed, and a host of other characteristics. Second, we created citation maps in UCINET to show the backward mapping of these studies. The citation maps illustrated, among other characteristics, the number of research studies cited and revealed clusters of reports that tended to cite each other, creating an "echo chamber."

Selection of studies. To examine the literature that could be used by intermediaries as evidence in favor of vouchers, we use a "nomination strategy" (Lubienski & Garn, 2010), whereby we examined studies put forth by proponents as making the strongest case for their positions—in this case, the "gold-standard" studies cited by the Friedman Foundation.[3] The Friedman Foundation is one of the leading champions of this evidence and has been an influential voice in identifying the evidence in support of vouchers. To compare these studies to the wider academic literature, we searched for "school vouchers" in WOK, an academic citation indexing and search service provided by Thomson Reuters.[4] The academic literature data set was produced through a series of filters that were employed to narrow the initial search results. We prioritized the need for a narrower inspection that could possibly be expanded later rather than a broader inspection that may not reveal significant patterns or relationships due to an excess of data. We thus constrained our search to studies that examined school vouchers in K–12 schools in the United States, were peer-reviewed, and examined the achievement effects of vouchers. We focused on studies that tended toward new empirical analysis rather than reviews of the literature.

Thus, we ended up with two sets of studies that are thought to be high quality: One set where the findings are used to support vouchers, from the Friedman Foundation, and another set that is in contrast to that, the general academic literature base. (See Appendix A for a complete list of included studies.)

Data analysis. Once the studies in the separate data sets were identified, we analyzed the various elements and features of the studies. First, we identified key characteristics for each individual article in our two samples, including the author, title, journal, whether the journal was refereed or not, the ISI impact factor, general research design (e.g., experiment, quasi-experiment), and the sample size. Then, for the set of articles in each data set, we created a comprehensive bibliography that identified all research cited by those individual articles combined. This full bibliography, created for each of our two data sets, allowed for an identification of research that was cited by two or more of the articles within the data sets. We focused on those that were cited more than once to identify patterns in the citations and to eliminate studies that were not as central to the voucher literature.

The studies cited two or more times in this backward mapping were subsequently extracted from the full list, and we examined their characteristics or attributes following the same protocol as for the original sample of studies. For the "Friedman Foundation" and "General Academic" sets, we examined patterns within each set through a matrix format where the relationships between the selected articles and the research they cited two or more times were identified with the binary use of a "one" or a "zero." This matrix format allowed for the information to be exported directly into network-analysis software. The data sets were first illustrated as basic network diagrams and then refined to indicate various attributes, such as whether studies were peer-reviewed. In these figures, we identified research that was cited by both sets of studies, the "Friedman" and the "General Academic" bodies of literature, as well as those that were only cited by one set or the other.

Social Media Analysis

While the previous analyses focused on how one intermediary organization defined a set of "gold-standard" studies and the citation patterns embedded within those studies, the social media analyses used descriptive statistics to look across multiple intermediary organizations. We examine how these organizations used Twitter to connect with policymakers, individuals, and other organizations. The list of intermediary organizations included in this analysis was collected from the organizations examined by the larger study

(see introductory essay to this issue), which was generated by asking prominent scholars and intermediaries in the field to name organizations active in studying or promoting incentivist reforms. We used these initial contacts to conduct informational interviews, during which we solicited suggestions of additional suitable respondents, a technique known as "snowball sampling" (Bogdan & Biklen, 1992). Interviews and publicly available documents were used to categorize organizations as in favor of, opposed to, or neutral in reference to the incentivist reforms that were a part of the study.

There were three primary restrictions implemented in the collection of data to examine how intermediary organizations use popular social networking sites to interact with others and disseminate evidence. First, we limited the scope of study to organizational use of social networking sites. Therefore, only "tweets" sent from organizational accounts belonging to organizations themselves were examined. Institutional usage of these tools was the primary interest, so accounts belonging to individuals were not included in this analysis, although would be a logical next step in future analyses. Second, we restricted the social networking sites examined to Twitter. Third, we restricted the tweets of interest to only those that included "charter school" or "charter schools." We did not include additional variations on the term "charter school," such as "charters," although an analysis containing a comprehensive list of "charter school" variants is a logical next step in future analyses.

After collecting the list of organizations, we collected information on the organizational use of Twitter. To determine whether an organization used Twitter, we first visited each organization's website and attempted to locate a link to Twitter. In the event the organization's website did not link, we visited Twitter's website and searched for the organizations there. After verifying that the account of interest was the actual account for the organization, it was included in the list. Some organizations have multiple Twitter accounts, such as the American Enterprise Institute, which has an official Twitter account for the entire organization (@AEI) and an account specifically for education related tweets (@aeieducation). Furthermore, as the larger study has found that the intermediary organizations organize themselves into two coalitions, one in opposition to and one in support of, charter schools and other incentivist reforms (see introductory essay to this special issue), the organizations were coded to indicate the coalition to which they belonged. Appendix B includes a list of organizations included in the study, primary Twitter account name, and coalition affiliation.

As all "tweets" are public, we were able to use a program called Tweet Archivist (www.tweetarchivist.com) to gather this information and collected over 25,000 tweets. This archive held every tweet that included "charter school" or "charter schools" and occurred between February 4, 2013, and

March 8, 2013. To create the data set for analysis, we removed any tweets that were not sent by one of the organizations included in Appendix B. To examine how organizations were using Twitter to connect within and across organizations, we examined whether each tweet was a "retweet"[5] and if another user was mentioned. The users mentioned in tweets by the intermediary organizations were coded as "in same organization," "in same coalition," "outside coalition," "media organization," or "policymaker." To code the users mentioned, we visited each user's Twitter account, examining the user's tweets and/or visited the user's webpage if listed. In all, 200 tweets sent by 26 organizations were included in the analysis.

Results: Evidence of the Echo-Chamber Effect

In this section, we report our findings from each of the analyses—the bibliometric citation analysis and the social media analysis—in turn. Then we discuss how these findings complement one another in the implications section.

Citation Patterns in Studies of School Vouchers

As described in the bibliometrics methods, we conducted a backward citation analysis of our two sets of studies. We report the results from this analysis, which explored the citations contained within the initial set of studies, and then present findings from diagrams created using network-analysis software programs.

At first glance, the two sets of studies appeared to be similar on many measures, including the number of citations contained within the sets, the number of citations cited more than twice, and the number of unique first authors in those citations. We even noticed some authors were frequently cited by both sets of studies, especially authors Greene, Peterson, Rubin, and Witte (see Table 1). The academic set contained a higher percentage of cited studies that were peer-reviewed (48.48% as opposed to 40.54% in the Friedman set). One important difference between the two sets of studies was that in the General Academic set, more studies were methodological, responding to methods used by authors of studies in the Friedman set or reanalyzing their findings (e.g., Krueger & Zhu, 2004a, 2004b; see Appendix A).

There was little to moderate overlap between the two sets. Of the 56 unique studies that were cited at least twice in the full sample, only 11 of them (approximately 20%) were cited by both sets. The studies that were cited by both included refereed journal articles (63.64%), books (27.27%), and reports (9%). These included "classic texts," including books by Chubb

Table 1. Comparing Two Sets of Studies.

Set of studies	Number of studies	Number of citations (total)	Cited 2+	% peer-reviewed (cited 2+)	Unique first author, *n* (%)	Most commonly cited authors
Friedman Foundation	6	261	37	40.54	146 (67.59)	Barnard, Coleman, Greene, Hanushek, Krueger, Peterson, Rubin, Witte, Wolf
General Academic	7	281	33	48.48	144 (61.54)	Angrist, Epple, Figlio, Frangakis, Greene, Hastings, Heckman, Howell, Hoxby, Krueger, Nechyba, Peterson, Rubin, Witte

and Moe and Coleman, and methodological pieces, such as Angrist, Imbens, and Rubin (1996), Goldberger and Cain (1982), Krueger and Zhu (2004a), and Rubin (1974). The limited overlap between the two sets of literature provides some evidence of an echo-chamber effect, where each side cites different studies in supporting its claims.

This pattern is clearer when we mapped the citation networks. We first mapped the studies to see overlap (Figure 1). In this network map, the lighter squares depict the studies from the academic set, and the darker squares represent the Friedman Foundation set. The darker circles on the periphery indicate studies cited by just one set; the ones on the left are those cited only by the academic set, while the ones on the right are those cited only by the Friedman set. Finally, the gray circles in the center of the diagram indicate studies cited by both sets. It can clearly be seen that each side of the vouchers debate more often cites articles not cited by the opposing side. We can see here that there are many more studies cited by just one set or side of the voucher debate (denoted by the darker circles on the periphery), when compared with the number of studies cited by both sets (denoted by the lighter circles in the center), suggesting an echo-chamber effect.

We then added to the diagram whether the studies were peer-reviewed or not. In Figure 2, the square nodes on the left depict the studies from the academic set, and the square nodes on the right represent the Friedman Foundation set (the lighter shaded square nodes on the right are not peer-reviewed). The darker circles indicate peer-reviewed studies—the ones on the left are those cited only by the academic set, while the ones on the right are those cited only by the Friedman set. The lighter circles are citations that are not peer-reviewed, and the articles cited by only one of the sets of

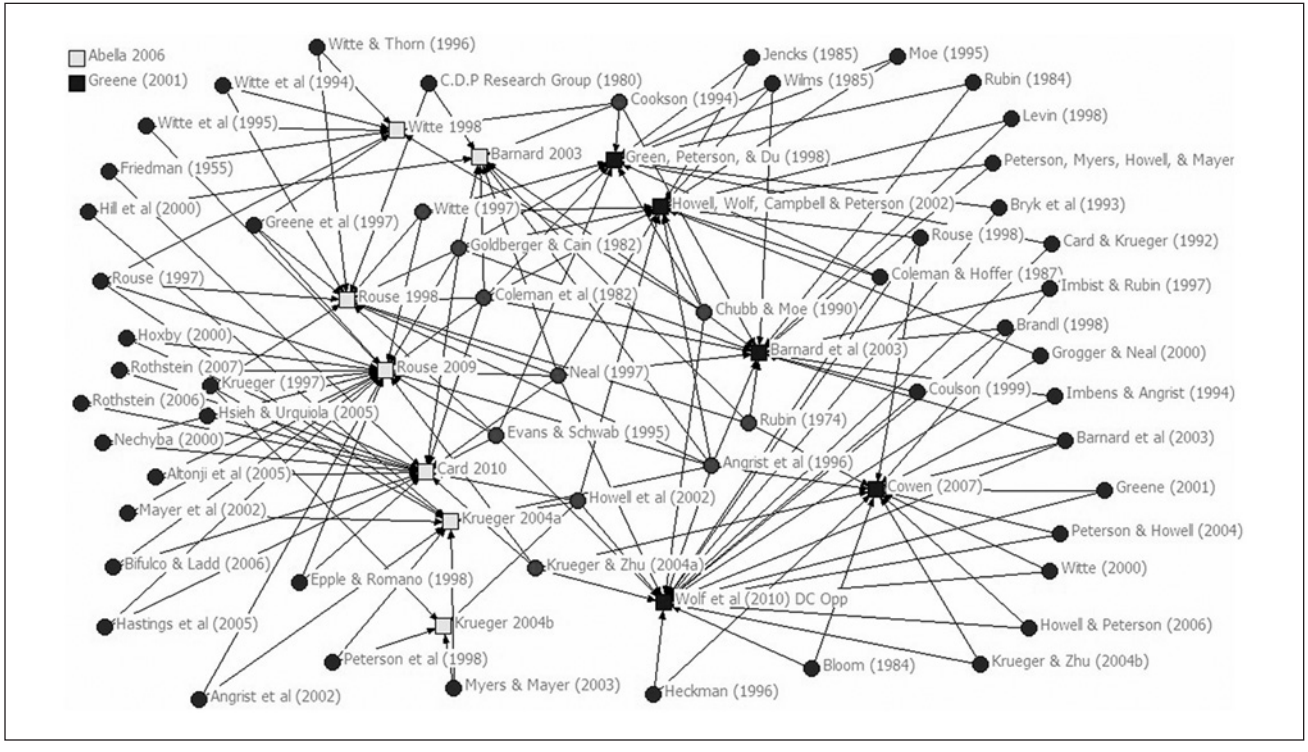

Figure 1. Citation patterns in the two sets.

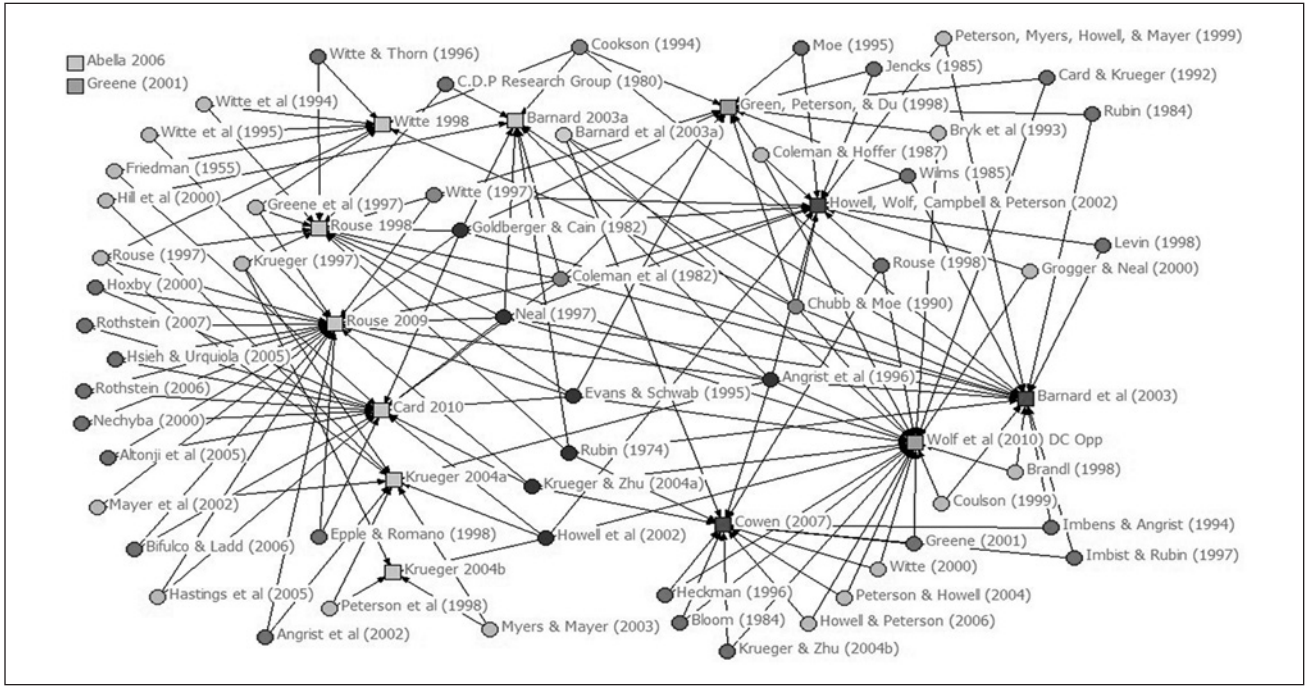

Figure 2. Map of citation networks with peer review status.

literature are again on the periphery. The circles in the center represent the studies that are cited by both the General Academic and the Friedman Foundation sets (darker nodes indicate peer-reviewed articles, whereas lighter nodes indicate non-peer-reviewed articles).[6]

From this mapping, we see several things. First, we note that most studies are cited by only one set or the other; in other words, there are many studies on the far left and far right sides of the map, represented by the dark and light circles on the periphery. As indicated above, this indicates a moderate echo-chamber effect, where studies from two different "sides" of the voucher debate tend not to rely on the same studies. However, it is also important to examine where they do overlap (the nodes in the center). Of the articles cited by both sides, the most prominent are: Angrist et al. (1996), which is cited eight times; Coleman, Hoffer, and Kilgore (1982), Goldberger and Cain (1982), and Neal (1997), each of which is cited seven times; and Chubb and Moe (1990), which is cited six times. The majority of the shared studies (7 out of 11) are peer-reviewed.

Furthermore, although both sides use a combination of peer-reviewed and non-peer-reviewed studies to support their claims, there do appear to be certain authors who rely more or less heavily on peer-reviewed work.

The Use of Social Media to Promote Charter Schools

To examine whether the "echo-chamber" hypothesis is extending beyond research use into organizational interactions, we examine whom these intermediary organizations contact when they tweet about charter schools, another key incentivist reform. Although Twitter posts tweets in chronological order, a user may alert another user to the content of their tweet by including that user's name in the tweet. This is typically done for one of the three reasons: First, the user is "retweeting" another user's tweet; second, the user is replying directly to a tweet posted by another user; third, the user is including the other user because the tweet is directed to that user or may concern that user. Of the tweets that included "charter school" or "charter schools" 45% mentioned another Twitter user (44 to an individual and 40 to an organization). As these intermediary organizations are using Twitter to reach out to individuals and groups, the question is to whom are these organizations connecting.

Figure 3 shows that when intermediary organizations use Twitter to connect with other users, such connections are typically made with users from within the organization or within the coalition. There are many possible reasons for this; however, the most obvious reasons are that the organization is attempting to promote a member of its organization or engage in a conversation.

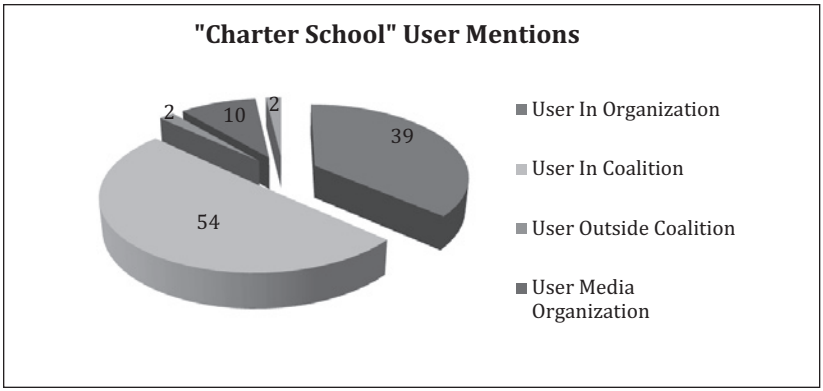

Figure 3. Type of user mentioned by intermediary organizations tweeting about "charter schools."

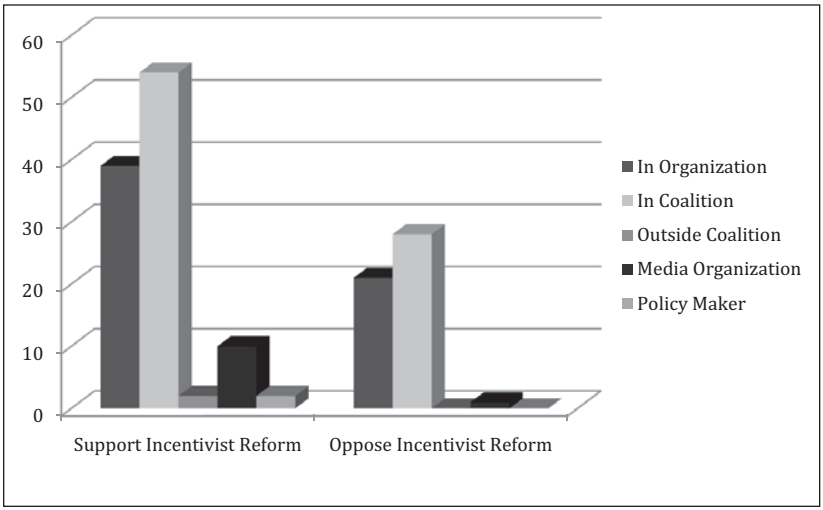

Figure 4. Number of users mentioned by intermediary organizations and type of user mentioned in tweets about "charter schools."

As can be seen in Figure 4, in the tweets that contained "charter school" or "charter schools," intermediary organizations tended to mention users inside their coalition but outside their organization. It is clear that, regardless of coalition affiliation, intermediary organizations are primarily using Twitter to connect with like-minded individuals; those associated with promoting incentivist reforms are using Twitter to promote individuals within their

organizations while those in the oppositional coalition are using Twitter to connect with members within their coalition but outside their organization.

Implications and Directions for Future Research

Our analyses suggest that the echo-chamber effect holds in both scholarly citation patterns and in communications via social media. For both cases of incentivist reforms, people tended to cite and communicate with others in their own coalitions. Our work also suggests that bibliometrics and social media analysis are promising tools for studying the politics of research use in education policy. Citation analysis is able to reveal patterns in the use and take-up of research studies that are otherwise hard to see, particularly those suggesting an "echo-chamber effect." While we limited our analyses to a particular set for the purpose of this article, our next steps are to examine the take-up of these studies in policy briefs, other social media such as Facebook and blogs, and congressional hearings. Furthermore, Tweet Archivist, the software used in this study has limited visualization options in the analysis of Twitter posts; in future research, we also plan to explore new visualization techniques in the analysis of Twitter and Facebook posts. We will also use broader search terms to capture a larger set of articles for citation analysis and to explore citation usage among a wider range of intermediary organizations, including more groups in favor of incentivist reforms as well as teachers' unions and other national groups that typically oppose such reforms, to see if the echo chamber operates similarly across these different ends of the political spectrum.

Intermediary organizations that work on policies related to incentivist education reforms have embraced the use of social networking sites. Twitter, for example, is being used to reach out to other users, but those users tend to be others already in the organization's coalition, further emphasizing the likelihood of an echo chamber in social media communications. Furthermore, policymakers at the federal, state, and local levels are increasingly using social networking sites, like Twitter, to stay abreast of the latest research. An insulated echo chamber on Twitter gives policymakers a place to find information that supports their existing ideologies, but may hinder the dissemination of diverse research findings. Academics and public intellectuals are also using these tools to share research and evidence on education reforms. We believe that this wider net of places where research is disseminated will help us to see whether the echo-chamber effect holds or is intensified through social networking sites.

We outline three areas of further research using bibliometrics and social media analysis that would significantly expand our understanding of the uses of research in policymaking:

1. *Overlaying citation and social networks*: Combining the citation maps with network maps representing who policymakers and intermediaries go to for research on incentive-based education reforms would allow us to see whether the echo chamber is amplified within particular social and political networks, and, when combined with qualitative methods of inquiry, how research disseminated by intermediaries ends up influencing key policymakers.
2. *Examining patterns in co-authorship and co-citation*: From our qualitative research, we have noted that several researchers move between the policymaking, advocacy, and academic worlds. Studies that examine how these researchers' co-author articles with particular advocacy groups and think tanks (such as the Manhattan Institute, Economic Policy Institute, etc.) may help to reveal unseen policy networks that shape education reforms. An examination of social media such as Twitter, Facebook, and blogs may answer the question of how researchers transition between the policymaking, advocacy, and academic worlds. Furthermore, we plan to build on our current analyses to examine co-citation networks, such as when studies are cited together and the extent to which two studies share references. We also plan to explore more advanced data visualization techniques to display such patterns.
3. *Citation patterns across the disciplines and policy spheres*: Finally, while previous studies have examined citation networks across disciplines, particularly in the sciences, this has not been examined in education. In addition to exploring the reach of particular disciplines in the academic education policy literature, such analysis can help to identify the particular social science disciplines that are cited most by policymakers and intermediary organizations on different sides of policy debates. For example, scholars have argued that economists have outsized influence in directing education policy on incentive-based reforms (Allais, 2012), but this claim has not yet been examined empirically. Furthermore, examining the way in which particular types of research-based documents (policy briefs, peer-reviewed articles, and books) make their way through policy and intermediary organization networks and into speeches and congressional hearings may help to identify the characteristics of successful translation of research into practice. This would almost certainly require an understanding and analysis of the use of social media in research dissemination.

Appendix A

List of All Studies and Their Key Characteristics

Author(s)	Article title	Journal	Type	ISI impact factor 2010	Research design	Includes pretest score	Duration of study (years)	First author department	Assigned set
Wolf et al. (2010)	Evaluation of the DC opportunity scholarship program: Final report	N/A	Report	N/A	Randomized control trial	Yes	4	Education	Friedman
Cowen (2008)	School choice as a latent variable: Estimating the "complier average causal effect" of vouchers in Charlotte	*Policy Studies Journal*	Refereed Journal	1.17	Randomized control trial	No	1	Political Science	Friedman
Greene (2001)	Vouchers in Charlotte	Ed Next	Non-Refereed Journal	N/A	Randomized control trial	No	1	N/A	Friedman
Greene, Peterson, and Du (1998)	School choice in Milwaukee: A randomized experiment	N/A	Report	N/A	Randomized control trial	Yes	4	N/A	Friedman
Howell, Wolf, Campbell, and Peterson (2002)	School vouchers and academic performance	*Journal of Policy Analysis and Management*	Refereed Journal	2.246	Randomized control trial	Yes	2	Political Science	Friedman
Barnard, Frangakis, Hill, and Rubin (2003)	Principal stratification approach to broken randomized experiments: A case study of school choice vouchers in New York City	*Journal of the American Statistical Association*	Refereed Journal	2.063	Randomized control trial	Yes	1	Statistics	Friedman

(continued)

Appendix A (continued)

Author(s)	Article title	Journal	Type	ISI impact factor 2010	Research design	Includes pretest score	Duration of study (years)	First author department	Assigned set
Rouse (1998)	Private school vouchers and student achievement: An evaluation of the Milwaukee parental choice program	*Quarterly Journal of Economics*	Refereed Journal	5.94	Randomized control trial	Yes	4	Economics	General Academic
Krueger and Zhu (2004a)	Another look at the New York city school voucher experiment	*American Behavioral Scientist*	Refereed Journal	0.492	Methodological	N/A	N/A	Economics	General Academic
Krueger and Zhu (2004b)	Inefficiency, subsample selection bias, and non-robustness: A response to Paul E. Peterson and William G. Howell	*American Behavioral Scientist*	Refereed Journal	0.492	Methodological	N/A	N/A	Economics	General Academic
Witte (1998)	The Milwaukee voucher experiment	*Educational Evaluation and Policy Analysis*	Refereed Journal	1.919	Methodological	N/A	N/A	Economics	General Academic
Rouse and Barrow (2009)	School vouchers and student achievement: Recent evidence and remaining questions	*Annual Review of Economics*	Refereed Journal	1.762	Review of empirical research	N/A	1	Economics	General Academic
Abella (2006)	An analysis of the academic performance of voucher students in the opportunity scholarship program	*Education and Urban Society*	Refereed Journal	0.406	Comparison: Control group and sample group	Yes	2	Education	General Academic
Card, Dooley, and Payne (2010)	School competition and efficiency with publicly funded Catholic schools	*American Economic Journal: Applied Economics*	Refereed Journal	1.588	Methodological	Yes	7	Economics	General Academic

Appendix B

List of All Organizations Included in Twitter Analysis

Institution	Region	Twitter Account	Facebook
4.0 Schools	LA	4pt0schools	Yes
504 Ward	LA	504ward	Yes
Albert Shanker Institute	Nat'l	shankerblog	Yes
American Enterprise Institute	Nat'l	AEI	Yes
American Federation of Teachers	Nat'l	AFTunion	Yes
American Legislative Exchange Council	Nat'l	ALEC_Ed	Yes
Better Choices for a Better Louisiana	LA	BetterChoicesLA	Yes
Broad Foundation	Nat'l	broadfoundation	Yes
Brookings Institute	Nat'l	brookingsed	Yes
Business Roundtable	Nat'l	BizRoundtable	Yes
Center for American Progress	Nat'l	amprog	Yes
Center for Education Reform	Nat'l	edreform	Yes
Center for Research on Education Outcomes	Nat'l	CREDOatStanford	Yes
Center on Reinventing Public Education	Nat'l	CRPE_UW	Yes
Charter School Growth Fund	Nat'l	CharterGrowth	Yes
Coalition for LA Public Education	LA		Yes
Council for a Better LA	LA		Yes
Cowen Institute	LA	CowenInstitute	Yes
Democrats for Education Reform	Nat'l	DFER_News	Yes
East Bank Collaborative	LA		Yes
Educate Now!	LA	educatenownet	No
Education Sector	Nat'l	EducationSector	Yes
Education Trust	Nat'l	EdTrust	Yes
Educators 4 Excellence	Nat'l	Ed4Excellence	Yes
Families and Friends of LA's Incarcerated Children	LA	fflicla	Yes
Fordham Institute	Nat'l	educationgadfly	Yes
Gates Foundation	Nat'l	gatesfoundation	Yes
Heartland Institute	Nat'l	heartlandinst	Yes
Jefferson Federation of Teachers	LA		No
LA Association of Business and Industry	LA	LABI_biz	Yes
LA Association of Public Charter Schools	LA		Yes
LA Budget Project	LA	LABudgetProject	Yes
LA Federation of Teachers	LA	LaFedTeachers	Yes
LA Justice Institute	LA		Yes
LA Partnership for Children and Families	LA		No
LA Retired Teachers Association	LA		Yes
LA School Boards Association	LA		Yes

(continued)

Appendix B (continued)

Institution	Region	Twitter Account	Facebook
Louisiana Black Alliance for Educational Options	LA	LaBAEO	Yes
National Alliance for Public Charter Schools	Nat'l	charteralliance	Yes
National Association of Charter School Authorizers	Nat'l	QualityCharters	Yes
National Education Association	Nat'l	edvotes	Yes
National Education Policy Center	Nat'l	NEPCtweet	Yes
New Leaders for New Schools	Nat'l	NewLeadersOrg	Yes
New Orleans Education Equity Roundtable	LA		Yes
New Schools for New Orleans	LA	NSNO_NOLA	No
Orleans Public Education Network	LA	OPEN_NOLA	Yes
Pelican Institute	LA	PelicanInst	Yes
Public Impact	Nat'l	publicimpact	Yes
Pyramid Community Parent Resource Center	LA	PyramidCPRC	No
RAND	Nat'l	RANDCorporation	Yes
Research on Reforms	LA		No
Southern Institute for Education and Research	LA		Yes
Stand for Children	Nat'l	Stand4Children	Yes
Students First	Nat'l	studentsfirst	Yes
Teach for America	Nat'l	TeachForAmerica	Yes
Teach NOLA	LA		Yes
The New Teacher Project	Nat'l	TNTP	Yes
United Teachers of New Orleans	LA	UTNO_Teachers	Yes
Walton Family Foundation	Nat'l		Yes
White Board Advisors	Nat'l	WhiteBdAdvisor	No

Note. LA = Louisiana; Nat'l = National.

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1. Lubienski, C., Scott, J., & DeBray-Pelot, E. (2011–2014). How do intermediary organizations define and disseminate research for educational policymaking? Funded by the William T. Grant Foundation.
2. Publish or Perish is a software program that retrieves and analyzes academic citations. It uses Google Scholar to obtain the raw citations, and then analyzes these to produce a variety of statistical data.
3. http://www.edchoice.org/Research/Gold-Standard-Studies.aspx
4. Web of Knowledge (WOK) provides search tools to enable researchers to access, analyze, and manage bibliographic content across a multitude of disciplines through multiple integrated databases. Over 20,000 academic and scientific journals and 100,000 conference papers can be accessed through this search tool. Subscription access can be made directly through wokinfo.com or through university library institutional access.
5. "Retweet" refers to whether a Twitter user is reposting another user's tweet.
6. Barnard et al. was cited by both the Friedman Foundation and General Academic sets; however, we decided to designate it as belonging to the Friedman set because it was listed on their website.

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