

The influence of policy and context on teachers' social media use

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Abstract

Research on teachers' use of social media has typically assumed that it is a) driven by a need for professional learning and b) best understood in terms of individual motivations. In this study, we use a dataset of nearly 600,000 tweets posted to one or more of 48 Regional Educational Twitter Hashtags associated with 44 U.S. states. To explore the influence of local contextual factors on hashtag- and account-level activity in these hashtags, we use an analytic approach heretofore uncommon in social media-focussed education research: generalised linear and multilevel modelling. At the hashtag level, higher numbers of teachers within a state, proportions of students receiving subsidised meals, student-to-teacher ratios, and amounts of state spending per child are associated with more activity within a regional hashtag; by contrast, more left-leaning state governments and citizenries are associated with less activity. At the account level, more experienced accounts and accounts in more right-leaning states contribute more tweets to these hashtags. These findings reinforce established understandings of Twitter as a site for teacher learning; however, they also underline the importance of acknowledging other important purposes of teachers' Twitter use, including receiving emotional support and engaging in activism.

KEYWORDS

educators, professional development, social media, teachers, Twitter

Practitioner notes

What is already known about this topic

- Many teachers use Twitter (and other social media platforms) for professional purposes.
- Teachers have identified professional learning—among other purposes—as motivating their use of Twitter.
- Regional Educational Twitter Hashtags are diverse learning spaces for teachers and other education stakeholders.

What this paper adds

- Local context and policy factors help influence teachers' use of Twitter.
- Teachers may turn to Twitter because of a lack of emotional or political support—not just a lack of material support or professional development opportunities.
- Individual and idiosyncratic factors remain important in explaining teachers' engagement with social media.

Implications for practice and/or policy

- Informal spaces like social media may supplement formal support mechanisms for teachers.
- Teachers' use of social media may help administrators and policymakers identify existing gaps to be repaired in those formal support mechanisms.
- Support for teachers should be conceived holistically and include emotional and political support.

INTRODUCTION

Scholars have been studying social media as a venue for teacher professional development for over a decade (Greenhow et al., 2020). Amid the bevy of social media platforms, Twitter has emerged as a particular focus of researchers (eg, Carpenter & Krutka, 2014, 2015; Fischer et al., 2019; Greenhalgh & Koehler, 2017; Staudt Willet, 2019; Wesely, 2013) due to the relative openness of the platform and the resulting ease of data collection and participant recruitment (Tufekci, 2014).

In the United States, different states—and localities—are generally responsible for differences in curriculum, education policy and teacher support. Many aspects of education research and reform are therefore attentive to local contextual factors. Teacher professional development is no exception. For example, Darling-Hammond and McLaughlin (1995) frame professional development as key to improving teaching and write at length about the relationship between policy, professional development and reform. Likewise, there is considerable research on how local education policy affects teacher development (eg, Birman et al., 2000; Corcoran, 1995).

If teachers' professional development on Twitter is a supplement to perceived inadequacies in formal professional development (eg, Carpenter & Krutka, 2015), one should expect that teachers' activity on social media is influenced in some way by local policy. Indeed, Veletsianos (2017) has argued that the utility and nature of a Twitter hashtag as a learning space is determined in part by its 'broader social, cultural, economic, and political environment' (p. 284). More pointedly, Hashim and Carpenter (2019) have noted that 'there are broader... factors that may influence teachers' social media use' (p. 9), and Romero-Hall (2021) has established that the 'multiplicity, diversity, and heterogeneity' (p. 13) of Latin American contexts and cultures are reflected in the ways social media is used in the region. Yet, research on teachers' professional development through Twitter has often been inattentive to contextual factors, and previous research on teachers' use of Twitter has largely treated participation as driven by individual motivations (eg, Prestridge, 2019).

Is focussing on educator-driven uses of social media for professional development justified? Admittedly, consideration of local factors is made difficult by the fact that Twitter can connect teachers across geographic boundaries (eg, Carpenter & Krutka, 2015; Gao & Li, 2017). Yet, research has documented the existence of geographically situated Twitter spaces (eg, Greenhalgh, 2020; Rosenberg et al., 2016), which provides a means of asking how local social and political climates shape online teacher communities. For example, research has explicitly documented teachers' use of geographically specific Twitter spaces to discuss and respond to local educational policy (Asino et al., 2016; Krutka et al., 2018), suggesting that at least some of the participants in some of these spaces are attentive to local contexts.

The purpose of this study is to better understand the influence of local context on activity within geographically situated, education-focussed Twitter hashtags. More specifically, we explored the association between teachers' use of Twitter and local policy and political context by comparing measures of context in the individual United States with measures of Twitter activity in hashtags associated with those states. To do so, we considered a dataset of 598,870 tweets including a total of 48 Regional Educational Twitter Hashtags (RETHs). We found that activity within a geographically situated Twitter hashtag appears to be influenced by contextual factors, including local political ideology and the average number of students per teacher. The results of this study may offer new insight into teachers' motivations for using Twitter and highlight the implications of teachers seeking alternative support through non-traditional means.

BACKGROUND

Teachers' use of Twitter

Much research on teachers' Twitter use has focussed on the platform as a supplement or substitute for traditional professional development (PD). After the emergence of modern social media platforms in the mid-2000 s, scholars began to describe their potential for teachers' *professional learning networks* (Trust, 2012). For example, Trust (2012) reported that many 'teachers are joining online communities ... to continue learning and improve their professional practice' (p. 133). That same year, Forte et al. (2012) commented on Twitter-using teachers' potential 'to be powerful fomenters and enactors of reform in educational communities' (p. 1). Later in the decade, Carpenter and Krutka (2014, 2015) published the results of a survey of nearly 800 K-16 educators using Twitter, explicitly framing teachers' activity as responding to the failures of more formal PD offerings.

More recent research has kept this emphasis on teacher learning and professional development, exploring teachers' specific activities or motivations (Prestridge, 2019; Staudt Willet, 2019) or specific contexts where Twitter has been useful for teachers' learning (Carpenter, Tani, et al., 2020; Greenhalgh & Koehler, 2017; Greenhalgh et al., 2020). Scholars have also discussed potential problems of teachers' social media use, including identity management (Carpenter et al., 2019), data privacy (Marín et al., 2020), improper behaviours (Warnick et al., 2016) or spam (Carpenter, Staudt Willet, et al., 2020). Indeed, Rodesiler (2017) suggested that regional variations in teacher social media use may be due in part to different policy responses to these issues.

Regional Educational Twitter Hashtags

We use the term *Regional Educational Twitter Hashtag* (RETH) to designate education-focussed Twitter hashtags with an explicit focus on a particular geographical area (see Greenhalgh, 2020; Rosenberg et al., 2016). A *hashtag* is a hash (#) symbol followed by a key word or phrase that is included in a tweet to indicate relevance to a particular topic or group. For example, a hashtag like #kyedchat can be useful for helping teachers in the state of Kentucky find—or be found by—other local teachers.

RETHs may have different scopes. They exist at the country level (eg, #UKEdChat or #aussieED; Carpenter, Tani, et al., 2020) and the level of federal units such as U.S. states (eg, #michED; Rosenberg et al., 2016) and Canadian provinces/territories (eg, #eduqc; Greenhalgh, 2020). Anecdotal evidence from our previous research suggests that some schools and districts may also have their own hashtags. RETHs are not the only teacher hashtags (eg, Carpenter, Tani, et al., 2020), and some teachers participate in RETHs from outside the associated region (Greenhalgh et al., 2018); nonetheless, these hashtags provide a promising context for exploring the influence of local context.

Although research has acknowledged the diversity of these hashtags, little work has been done to attribute differences between them to differences between regions. Rosenberg et al. (2016) found differences in the volume of activity between U.S. states' RETHs and noted that they could not be simply attributed to the population of teachers in each state. Similarly, Carpenter, Tani, et al. (2020) found that the activity in some states' hashtags was quite similar despite clear demographic and other differences. Greenhalgh (2020) described further differences between RETHs associated with U.S. states and Canadian provinces but acknowledged that they did not necessarily reflect local political features.

Indeed, in some cases, Greenhalgh (2020) found that states were associated with two different hashtags having different patterns of activity. In this study, we consider 'twin' hashtags for a single state to be 'co-hashtags' and therefore a single phenomenon. In the four cases where U.S. states in this study had 'twin' hashtags, one of the two always included the word 'chat', suggesting that one hashtag is reserved for synchronous conversations while the other is used for asynchronous broadcasting of messages. However, Greenhalgh et al. (2020) have demonstrated that one RETH can host both activities. Thus, 'twin RETHs' in some states are functionally equivalent to single RETHs in others.

Education policy and professional development

Twitter is not representative of the general public, nor is it a homogenous group of social media users. Rather, it is a small but active subset of actors—in this case education stakeholders—driving discussions (McGregor et al., 2017; Parmelee, 2013; Wu et al., 2011). Twitter provides a space for education networks, serving a professional

development function that fosters necessary learning—particularly amid a bevy of inconsistent state and local policies that many describe as either inefficient or ineffective to service the needs of K-12 teachers (Moreno, 2007; Morey et al., 1997; Wei et al., 2009). Teacher quality has an impact on student performance, and a key aspect of teacher quality is support for professional development—a system for continued learning that some say is broken (Hill, 2009).

Varying degrees of teacher resources at the state level are associated with teacher development inside and outside the classroom (Birman et al., 2000; Corcoran, 1995), and we expect that political climate moderates how and when teachers seek alternative venues, including Twitter, for professional development. Implicit in this assumption is that a state's ideology and political context matter for the administration of education. For example, the debate over charter school administration and the expansion of these schools are influenced by a state's political context (Schober et al., 2007). More recently, teacher strikes and similar actions in Republican-leaning and anti-labor states like West Virginia, Oklahoma, Kentucky and Arizona suggest that political culture shapes the collective experience of teachers (Blanc, 2019). Ideological identification allows for group identification (Conover & Feldman, 1981), and with these labels come inherent assumptions about the role of government and the issue priorities of those institutions.

Research in 2019 by the Pew Foundation suggests that public views on education have become more partisan over time in the United States—mirroring broader trends in polarisation among the public and policymakers (Abramowitz & Saunders, 2008; McCarty et al., 2006; Russell, 2018). Ideological differences in each state condition the context surrounding teacher activity and avenues for professional engagement. For example, the U.S. Democratic Party has a record of support for teacher unions and expanded fiscal support for public education at the federal and state level, while Republican support for education has recently been redirected to charter school discussions. More broadly, in the United States and elsewhere, more left-leaning governments are closely tied to education, as these parties are assumed to 'own' the issue due to their reputation in that policy area (Budge & Farlie, 1983; Egan, 2013; Petrocik, 1996). The reputation of Democratic leaders and left-leaning ideology on education is buttressed by teacher union support and a belief in an expanded role for the government to deliver public goods and services, including education.

We expect this partisan culture that permeates education policy to affect not only expenditures and accountability but also professional development through the alternative sources of support teachers pursue with the digital communities they engage online.

PURPOSE AND RESEARCH QUESTIONS

The purpose of this study is to better understand the influence of local context on activity within geographically situated, education-focussed Twitter hashtags. More specifically, we explore what relationship (if any) exists between measures of state policy and political ideology and measures of Twitter activity in U.S. Regional Educational Twitter Hashtags (RETHs). In particular, we ask the following two questions:

RQ1: What relationship exists between a state's policies and ideology and the overall level of activity in its Twitter hashtag(s)?

RQ2: What relationship exists between a state's policies and ideology and the level of activity of individuals participating in its Twitter hashtag(s)?

METHOD

Data sources and collection

This research combines data collection methods associated with social media research in education (Greenhalgh et al., 2021) with the quantitative techniques and public data common to political science and public policy research.

We collected tweets containing any of the 48 U.S. RETHs in the Appendix between January and June 2016 using Twitter Archiving Google Sheets (TAGS; Hawksey, 2014) and reprocessed these tweets using the *rtweet* package for the R software (Kearney, 2017). There were four cases in which we aggregated activity across a state's two 'co-hashtags' into a single RETH, resulting in 44 considered RETHs (one per state). Based on these data, we created the following measures:

- *tweets per RETH*: total number of tweets associated with a particular RETH
- *accounts per RETH*: total number of Twitter accounts who contributed to a particular RETH
- *tweets per account (per RETH)*: average number of tweets composed by Twitter accounts within a particular RETH
- *age of account*: amount of time since each Twitter account was created (in years)

We also employed two measures of political ideology within states. These kinds of measures are useful for measuring state policy outputs, including welfare (Soss et al., 2001) and education spending (Wood & Theobald, 2003). We expect that more liberal governments and citizens are more likely to provide support for teachers and education communities, thus possibly reducing reliance on informal Twitter networks. In particular, we employ the following two measures:

- *government ideology*: a measure of ideology within each state government, where higher values indicate liberal or higher levels of state government support; derived from Berry et al. (1998)
- *citizen ideology*: a measure of the average location of the electorate on a similar liberal-conservative continuum; derived from Berry et al. (2010)

As indications of local implementations of education within states, we retrieved the following measures from 2015 to 2016 data (or, if that was unavailable, 2014–2015 data) provided by the National Center for Education Statistics (NCES) and from Fiscal Year 2016 data provided by the United States Census Bureau:

- *teachers per state*: number of full time-equivalent teachers per state (NCES)
- *proportion free/reduced lunch*: proportion of students in each state receiving free or reduced-price lunch (NCES)
- *student-to-teacher ratio*: number of students enrolled in state schools (NCES) divided by *teachers per state*.
- *state spending per child*: amount of money spent by each state on education (in thousands of dollars; Census Bureau) divided by the number of students enrolled in state schools (NCES)

Data analysis

We used a generalised linear regression model to understand state-level activity (for RQ1) and generalised multi-level modelling to understand individual participant activity (for RQ2).

For the multi-level analysis, tweets were considered to be nested within states (eg, tweets containing #miched can be considered nested within Michigan) and within individuals (eg, 15 tweets from participant 1 can be considered nested within this participant), such that the model can be considered to be cross-classified (Raudenbush & Bryk, 2002; West et al., 2014).

The state- and individual-level models differed in terms of the measures used. Our state-level analysis regressed *teachers per state*, *student-to-teacher ratio*, *state spending per child*, *citizen ideology*, and *government ideology* upon *tweets per RETH*. Our individual analysis added *age of account* to the previously mentioned independent variables and regressed them upon *tweets per account (per RETH)*.

The two models otherwise had much in common. For example, the dependent variable for both models was a count, so we specified a Poisson outcome distribution. To facilitate interpretation of the estimated models, all independent variables were scaled to $M = 0$, $SD = 1$. To interpret the models, we focussed on the regression coefficient (B) (which we exponentiated to be an Incident Rate Ratio, or *IRR*), its standard error or *SE* (also exponentiated) and the p -value.

The *IRR* can be interpreted as the increase in the *incidence rate* of tweets associated with a one *SD* change in the independent variable (because of standardised independent variables). While more interpretable than log-odds units, *IRRs* remain difficult to interpret because (a) an incidence rate is not as intuitive as a difference in the units of the dependent variable, and (b) they are interpreted multiplicatively. Thus, we also calculated average marginal effects. The average marginal effect is the value of the effect of a one *SD* change in the independent variable upon the dependent variable in the original units of the dependent variables (Leeper, 2018). Finally, we checked the assumptions of the model using the *performance* R package (Lüdtke et al., 2020).

RESULTS

First, we examined descriptive statistics for the key variables that we conjectured could be related to Twitter activity at the state or individual levels (see Table 1). For the state-level variables, we used 44 valid cases: Although our analysis considered 48 hashtags, four states (Kansas, Nevada, Texas and Utah) were associated with two hashtags each. At the individual level, we considered 57,642 individual accounts.

Next, we examined first-order Pearson correlations among the variables used in the analyses. At this stage, we explored these correlations without consideration for which were at the *state* level and which were at the *individual* level. We note that it is likely very important to account for this structure in the data (West et al., 2014)—and that we do so in our data analyses. We noted that accounts per RETH were strongly associated with a greater number of posts at the state level—as does the number of teachers in the state. Ideology measures, for which higher values indicate more liberal tendencies, were also moderately, negatively associated with posts at the state level. The period of time for which individuals had their account on Twitter was associated with the number of posts by individuals, though with a small magnitude.

RQ1: Understanding variation in the number of tweets per RETH

For this analysis, we explored the relationship between state-level factors and the *overall* level of Twitter activity at the *hashtag* level. Thus, this analysis is based upon 44 cases (states). The results are presented in Table 2. The intercept, representing the estimated

TABLE 1 Descriptive statistics for variables used in analyses

| Independent variable | <i>M</i> | <i>SD</i> |
|---|-----------|-----------|
| Tweets per RETH | 13,693.51 | 18,977.36 |
| Accounts per RETH | 1,903.71 | 2,476.13 |
| Tweets per account (per RETH) | 32.91 | 42.99 |
| Age of account (in years) | 4.04 | 2.31 |
| Teachers per state | 67,316.13 | 69,165.03 |
| Proportion of students receiving free/reduced lunch | 0.48 | 0.10 |
| Student-to-teacher ratio | 15.56 | 2.99 |
| State spending per child (in thousands of dollars) | 13.18 | 3.78 |
| Government ideology (liberalism) | 39.32 | 17.35 |
| Citizen ideology (liberalism) | 51.56 | 16.22 |

TABLE 2 Estimates for the generalised linear model explaining overall Twitter activity

| Independent variable | Incidence rate ratio | Average marginal effect | Confidence interval | <i>p</i> |
|-------------------------------|----------------------|-------------------------|---------------------|----------|
| (Intercept) | 11,486.41 | | 11,452.45–11,520.42 | <0.001 |
| Teachers per state | 1.46 | 5,272.0 | 1.45–1.46 | <0.001 |
| Proportion free/reduced lunch | 1.04 | 562.4 | 1.04–1.04 | <0.001 |
| Student-to-teacher ratio | 1.12 | 1,615 | 1.12–1.13 | <0.001 |
| State spending per child | 1.03 | 378.3 | 1.02–1.03 | <0.001 |
| Government ideology | 0.83 | –2,672.0 | 0.82–0.83 | <0.001 |
| Citizen ideology | 0.69 | –5,291.0 | 0.68–0.69 | <0.001 |

average number of posts per state, was around 11,500. The two ideology measures stand out as demonstrating a strong, negative association with the number of posts; a more liberal citizen ideology of one *SD* was associated with 5,291 fewer tweets posted. In addition, states with more teachers were associated with more activity; every increase of one *SD* in the number of teachers was associated with 5272 more tweets. Finally, hashtags saw an increase of 1,615 tweets for every increase of one *SD* in the student-teacher ratio; in other words, states with more students per teacher were associated with slightly higher activity. Other effects were smaller in magnitude.

RQ2: Understanding variation in the number of tweets per account (per RETH)

For this analysis, we explored the associations between both state and individual level factors and individual account activity. First, we estimated a null model, with only the grouping of users within states specified. This model suggested that nearly 64% of the variation in individual activity was associated with states (*ICC* = 0.639). This indicates the need for a multi-level model, without which this variation would be (mis)attributed to individual users.

TABLE 3 Estimates for the generalised multi-level model explaining individual level of Twitter activity

| Independent variable | Incidence rate ratio | Average marginal effect | Confidence interval | <i>p</i> |
|-----------------------------------|----------------------|-------------------------|---------------------|----------|
| (Intercept) | 5.89 | | 4.95–7.02 | <0.001 |
| Age of account | 1.21 | 1.395 | 1.21–1.22 | <0.001 |
| Teachers per state | 0.83 | –1.316 | 0.65–1.06 | 0.141 |
| Proportion free/reduced lunch | 0.98 | –0.114 | 0.86–1.13 | 0.818 |
| Student-to-teacher ratio | 1.10 | 0.690 | 0.92–1.32 | 0.292 |
| State spending per child | 1.03 | 0.180 | 0.83–1.26 | 0.812 |
| Citizen ideology | 0.82 | –1.395 | 0.69–0.99 | 0.035 |
| Government ideology | 0.93 | –0.494 | 0.76–1.15 | 0.520 |
| <i>Random effects</i> | | | | |
| σ^2 | 0.15 | | | |
| τ_{00} state | 0.17 | | | |
| ICC | 0.53 | | | |
| N state | 44 | | | |
| Observations | 57,642 | | | |
| Marginal R^2 /Conditional R^2 | 0.293/0.667 | | | |

Table 3 reports the output from this analysis. In keeping with the shift in focus from whole hashtags to individual users, the intercept is much smaller, with the average account sending just short of six tweets. One state-level variable was statistically significant: A one *SD* increase in the citizen ideology of a state was associated with 1.395 fewer tweets posted per user. Like at the state level, this indicates that more left-leaning states were associated with less activity. Although not significant, it is noteworthy that individuals from states with more teachers appeared to compose fewer tweets, with 1.316 fewer tweets for every *SD* increase in the number of teachers in the state. This stands in contrast with results from the previous model. Users with accounts created further in the past were significantly associated with more tweets; for every single *SD* increase in the age of the account, users sent 1.395 more tweets during this time frame. Finally, like at the state-level, states with a higher student-teacher ratio were associated with more user-level activity (though in this model, the effect was not found to be significant).

DISCUSSION

Previous research has largely treated teachers' use of Twitter as an individual or idiosyncratic phenomenon. For example, many studies are largely dedicated to documenting how and why teachers use Twitter (Carpenter & Krutka, 2014, 2015; Forte et al., 2012; Prestridge, 2019), thereby providing insights into how individual motivations shape Twitter behaviour. Furthermore, explorations of hashtag-level activity (Carpenter, Tani, et al., 2020; Greenhalgh & Koehler, 2017; Greenhalgh et al., 2020; Staudt Willet, 2019) are largely focussed on the unique patterns associated with a specific setting instead of contextual factors that may inform these patterns (eg, Hashim & Carpenter, 2019). These contributions are important to our understanding; however, they necessarily ignore the relationship of this activity with larger structural factors, echoing a tendency in educational technology research to focus

more on the particulars of technologies than on contextual factors shaping their use (eg, Rosenberg & Koehler, 2015).

By contrast, our exploration of RETHs allows us to explore the influence of local factors on activity in teacher-focussed hashtags. Previous work on RETHs has established that differences exist between them (Greenhalgh, 2020; Rosenberg et al., 2016), and this study suggests that contextual factors are partially responsible for those differences. These findings are a limited, initial exploration of this relationship—for example, not all RETH participants are teachers (Rosenberg et al., 2016), and not all RETH participants live or work in the associated region (Greenhalgh et al., 2018). Furthermore, political and policy factors vary even within a state, and this analysis is not attentive to those differences. Nonetheless, our results are important for further understanding contextual influences on teachers' use of Twitter—especially because 'macro-level' factors have been studied the least within other areas of educational technology research (eg, Rosenberg & Koehler, 2015).

Much research on teachers' use of social media emphasises the benefits of these platforms for professional development. That is, research implicitly or explicitly suggests that the value of social media is in providing learning opportunities that improve teachers' practice (eg, Trust, 2012) and brings about educational reform (eg, Forte et al., 2012). Our findings lend some support to this possibility but also suggest the importance of being attentive to other benefits.

Professional learning needs

Our findings suggest that structural factors that may put more work and stress on teachers are associated with more hashtag-level activity. For example, higher numbers of students per teacher in a state are associated with more activity in the corresponding hashtag. However, one seemingly contradictory finding must also be addressed. Our findings suggest that higher levels of state spending per child in a state are associated with higher participation in that state's hashtag(s). We derived this measure by dividing the amount of state spending on education by the number of students in state schools in that state; thus, the more that a state spends on education (as a whole), the more that teachers (and other education stakeholders) appear to participate. By contrast, much research emphasises that teachers 'may voluntarily use social media in an effort to compensate for perceived shortcomings of formal PD' (Hashim & Carpenter, 2019, p. 5). One might, therefore, assume that states with smaller education budgets provide less—or worse—professional development, and that teachers in less-funded states would be more likely to turn to Twitter. Why, then, does the opposite appear to be true? One possible interpretation of these findings is that they represent inequity in patterns of teachers' Twitter use. Kimmons and colleagues (2018) have established that wealthier schools in more populated areas are more likely to use Twitter than poorer schools in less populated areas; our findings could suggest the existence of a similar dynamic for teacher use of Twitter at a state level.

However, the relationship between state spending and teachers' perceptions of support is not as straightforward as it may appear. Differences in states' education budgets may reflect differences in state revenue, teacher salaries, teacher benefits, local cost of living and a number of other factors. Thus, spending *on education* is not necessarily equivalent to spending *on teachers*. Indeed, our proportion free/reduced lunch measure is an example of education spending that benefits students but not necessarily teachers. While providing food for students living in poverty is crucial, these students may also need additional support from their teachers. If teachers do not know how to provide such support, it would be unsurprising to see them turn to informal professional learning—especially if that learning is not available through local, formal means. In short, our results draw further attention to

the relationship between professional development needs and Twitter use but stop short of defining it in detail.

Teacher support as a holistic phenomenon

Much research has suggested that teachers' use of social media may be a response to insufficient or inadequate professional development (eg, Carpenter & Krutka, 2014, 2015)—that is, that teachers turn to Twitter when resources and material support are absent. Indeed, this was one of the guiding assumptions of this study. However, studies have also acknowledged other benefits to Twitter use for teachers. For example, many of the teachers Wesely (2013) interviewed found Twitter helpful for overcoming feelings of isolation, and a quarter of the educators Carpenter and Krutka (2014, 2015) surveyed reported using Twitter for emotional support. Trust and colleagues (2016) suggested that a 'whole teacher' perspective that acknowledged 'affective, social, cognitive, and identity aspects' (p. 16) of professional learning is more appropriate than one solely focussed on cognitive benefits of professional learning networks. Similarly, Greenhalgh (2020) has argued that Twitter spaces for teachers can be distinguished in terms of *intimacy*—not just *sharing* or *volume*. Furthermore, even among social media communities characterised by focus on professional learning, informal social discourse is still very much present (van Bommel et al., 2020; Rosenberg et al., 2020).

While our study lends support to the assumption that social media participation is driven by an absence of adequate material support (including professional development opportunities), it also highlights other possibilities more in line with a holistic view of teacher professional learning. At a hashtag level, the ideology of both the associated state government and the associated citizenry was found to have a significant effect on teacher participation, and citizen ideology was found to be the only state-level independent variable with a significant association with the number of tweets posted to individual hashtags. As described previously, support for education is increasingly a partisan issue in the United States. While partisan differences certainly manifest themselves in terms of material support for teachers, we also suggest that the influence of ideology ought to be considered more broadly.

These findings may suggest that a lack of appreciation and emotional support for teachers drives education activism on Twitter. For example, despite being a politically conservative candidate in a conservative U.S. state, it is popularly held that former governor of Kentucky Matt Bevin's public antagonism of teachers—and voters' rallying around them—contributed to his narrow 2019 defeat for re-election (Camera, 2019; Reilly, 2019). If teachers' feeling politically unappreciated can (possibly) influence election results, it is not out of the question that it could also drive social media activity. Indeed, Krutka et al., (2018) specifically documented teachers' use of Oklahoma's #oklaed hashtag to organise a walkout driven by a lack of appreciation that they felt.

Furthermore, it was citizens' ideology (and not government ideology) that had a more important effect on hashtag-level activity and that had the only significant state-level effect on individual-level activity. The citizenry of a state is less likely to have a direct effect on policy but may contribute to discourse about teachers and education within that state. In short, teachers may turn to Twitter in response to a political and social climate that they do not feel fully welcome in. Previous suggestions that some teachers use Twitter to overcome feelings of isolation (Carpenter & Morrison, 2018; Wesely, 2013) assume that teachers do not have the adequate number or types of peers in their schools where they work; we suggest that feelings of isolation may also be created on a broader, societal scale.

The continued importance of other factors

Although these findings provide an important supplement to previous work's focus on individual and idiosyncratic factors, these latter influences remain important. This is in keeping with Hashim and Carpenter's (2019) conceptualisation of a broader context that informs but does not replace *individual* teacher motivations. Indeed, we found that the age of a given Twitter account was associated with more tweets per participant within a hashtag. Thus, individual experience remained a salient factor in understanding teachers' experience (see also Koehler & Rosenberg, 2018).

Furthermore, our analysis suggests that there are state-level factors that influence participation within RETHs that are not accounted for by the variables that we have identified. Based on McFadden's pseudo R^2 calculated via the *pscl* R package (Jackman, 2020), 65.3% of the variance at the state level remained unexplained. Similarly, based on Nakagawa et al., and's (2017) conditional ICC via the *sjPlot* R package (Lüdtke, 2020), 31.6% of the variance at the individual user level (estimated including the effects of each state) remained unexplained.

Existing studies of teachers' use of social media provide some possible explanations for differences between RETHs that complement—or even challenge—our findings. For example, Carpenter et al. (2016) have established that pre-service teachers in different countries have different feelings about Twitter as a professional tool, highlighting the possibility of cultural differences between regions. Likewise, Rodesiler (2017) has demonstrated that local policies on teachers' social media use vary, which may influence RETH activity. Given the emergence of *edu-influencers*, it is also possible that one 'microcelebrity' (Shelton et al., 2020, p. 530) who engages with their local RETH attracts others to it through force of reputation while other RETHs lack influential advocates.

More importantly, this illustrates that teachers' use of social media is ultimately constituted of a *network* composed of elements corresponding to teachers' needs (eg, Trust et al., 2016). That is, it should not be reduced to participation in just one geographical (or other) space. Teachers may find more value in following influential accounts, participating in national-level RETHs (eg, Staudt Willet, 2019), connecting with teachers across borders (eg, Carpenter & Krutka, 2015; Gao & Li, 2017), or in choosing Twitter resources focussed on subject matter (eg, Rosenberg et al., 2020). These professional uses of Twitter will also be influenced by context and policy—but are not accounted for in the RETH data we have considered.

Implications for providing teacher support

If teachers' use of Twitter is indeed influenced by an absence of appreciation and emotional support for teachers, this has implications far beyond social media platforms. Indeed, our findings suggest that schools, districts and states that embrace, support, or encourage teachers' use of Twitter may fail to respond to teachers' needs if they focus on this platform merely as a way of delivering professional learning. An overly narrow focus on professional development as solely improving teacher practice may inadvertently conceive of teachers merely as means of achieving an aggregated and abstract improvement in student performance; supporting teachers' use of Twitter because it may contribute to that improvement risks failing to meet some of the personal needs that drive their adoption of social media. We therefore echo Trust et al.'s (2016) assertion that teacher professional development (and the role of social media therein) should be considered in terms of not only cognitive but also 'affective, social,... and identity aspects of teaching' (p. 16). Likewise, we underline the importance of school, district, and state level practices and policies that support teacher well-being—not only as a means of further improving education but also as a worthy goal in and of itself.

We are writing this manuscript during the COVID-19 pandemic, which further underlines the importance of these implications. Research has already explored teachers and teacher educators' use of social media to support the abrupt and difficult shift to emergency remote teaching in the spring of 2020 (eg, Trust et al., 2020). As we have previously argued, Twitter and other social media platforms can and do play an important role in teacher learning and collaboration. Nonetheless, given the considerable stress teachers have experienced during the pandemic—and the apparent importance of political climate and emotional support for teachers' decisions to use social media—it is especially important to provide political and emotional support for teachers as this pandemic continues and other disruptions to traditional educational contexts emerge.

CONCLUSION

Research has repeatedly demonstrated that teachers use social media as a means of professional support, but most of this research conceives of teachers' social media use as an individual or idiosyncratic phenomenon. In this study, we have considered the influence of local context (including demographic, political and policy factors) on activity in geographically situated Twitter hashtags for teachers. Our findings suggest that local context does influence teachers' activity in local hashtags. This supports popular assumptions that teachers use Twitter to pursue professional learning and development that is not available through formal channels; however, they also highlight the importance of considering other kinds of support (eg, emotional or political support) that teachers are obtaining from Twitter but not other sources. These findings can inform theory and practice related to teachers' needs—both on social media and in other contexts.

ETHICS STATEMENT

Our Institutional Review Boards considered this project to involve 'public data' and therefore not subject to ethical review or approval. Nonetheless, we have followed the considerations for ethical research of social media in education outlined by Greenhalgh et al., (2021).

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CONFLICT OF INTEREST

The authors report no conflicts of interest.

DATA AVAILABILITY STATEMENT

Most data and code for this project can be accessed at <https://github.com/jrosen48/seths-policy>. Twitter data have not been made available because they include identifiable information. However, researchers can request these data from the corresponding author by submitting a description of how they will use it and the ethical guidelines they will follow.

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APPENDIX

TABLE A1 RETHs considered in this study

| RETH | State |
|------------|----------------|
| #aledchat | Alabama |
| #arkedchat | Arkansas |
| #caedchat | California |
| #coedchat | Colorado |
| #ctedchat | Connecticut |
| #edude | Delaware |
| #fledchat | Florida |
| #gaed | Georgia |
| #edchathi | Hawai'i |
| #idedchat | Idaho |
| #iledchat | Illinois |
| #inelearn | Indiana |
| #ksed | Kansas |
| #ksedchat | Kansas |
| #laedchat | Louisiana |
| #edchatme | Maine |
| #mdedchat | Maryland |
| #edchatma | Massachusetts |
| #miched | Michigan |
| #mnedchat | Minnesota |
| #msedchat | Mississippi |
| #moedchat | Missouri |
| #mtedchat | Montana |
| #nebedchat | Nebraska |
| #nved | Nevada |
| #nvedchat | Nevada |
| #nhed | New Hampshire |
| #njed | New Jersey |
| #nyedchat | New York |
| #nced | North Carolina |
| #ndedchat | North Dakota |
| #ohedchat | Ohio |
| #oklaed | Oklahoma |
| #oredu | Oregon |
| #paedchat | Pennsylvania |
| #edchatri | Rhode Island |
| #sced | South Carolina |
| #sdedchat | South Dakota |
| #tnedchat | Tennessee |

APPENDIX Continued

| RETH | State |
|--------------|---------------|
| #txed | Texas |
| #txeduchat | Texas |
| #uted | Utah |
| #utedchat | Utah |
| #vachat | Virginia |
| #wateachlead | Washington |
| #wvedchat | West Virginia |
| #wischat | Wisconsin |
| #wyoedchat | Wyoming |