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"You Can Tell a Lot About a Person by Reading Their Bio": What Educators Can Learn from Inauthentic Accounts' Activity in #Edchat

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Abstract: There is an abundance of scholarship documenting educators' uses of for-profit social media platforms for professional learning, but little is known about how inauthentic accounts affect those experiences. We studied 83 state-sponsored accounts' interactions with the teacher-focused #Edchat hashtag by analyzing their profiles, profiles of accounts they retweeted, and tweets they shared. We found no patterns of overt state interference in #Edchat; however, state-sponsored accounts amplified other inauthentic accounts, such as those focused on commercial, spam, and self-promoting #Edchat messages. Most state accounts used formulaic methods to create relatable account profiles that may go unnoticed by educators using the hashtag.These findings raise questions for educators and researchers about anonymity, identity, and community in social media environments polluted by inauthentic amplification.

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Keywords: Social Media, Mixed Methods, Technology, Inservice Professionals

Research in educational technology has historically tended to focus on the *intended uses* of technologies with less attention to how the medium *environment* influences those uses. Consequently, educational technologies are often introduced as solutions, not technologies with both benefits and downsides (Papert, 1988). This techno-solutionism and -optimism has resulted in a historical pattern of emerging media technologies being sold as having the potential to transform education without living up to the hype (Cuban, 1986, 2003). Moreover, research often fails to adequately attend to the school and societal contexts (Rosenberg & Koehler, 2015) and oppressive ideologies (Benjamin, 2019; Heath & Segal, 2021; Noble, 2018) which influence the effects of technologies. Social media platforms are worth particular scrutiny as mediated contexts, as the design of each "shapes the performance of social acts instead of merely facilitating them" (van Dijck, 2013, p. 29). van Dijck and colleagues (2018) suggested that this is particularly important when social media platforms intersect with education, as a given platform may challenge "the values that are fundamental to publicly funded education" (p. 118; see also van Dijck & Poell, 2018).

Over the last decade, scholars have primarily researched the *intended uses* of Twitter by educators for their professional learning using hashtags such as #Edchat (e.g., Britt & Paulus, 2016; Staudt Willet, 2019). This body of research has helped document educators' perspectives on the value of Twitter (e.g., Prestridge, 2019), offered analysis of tweet content (e.g., Greenhalgh & Koehler, 2017), and identified themes or patterns across tweets or tweeters (e.g., Kerr & Schmeichel, 2018; Rosenberg et al., 2020). However, researchers have focused less on the nature of the medium *environment*, including the degree to which activity might be considered *authentic*.

We define authenticity in this context as presenting oneself and interacting with others in good faith. In doing so, we do not agree with Mark Zuckerberg's contention that "having two identities for yourself is an example of a lack of integrity"; rather, we acknowledge the validity of having multiple social roles and only presenting or emphasizing one (or some) of them in particular contexts (Carpenter et al., 2019; Tufekci, 2017, p. 140). We define inauthenticity as deceiving users or exploiting social spaces for one's own commercial, political, or personal aims. We acknowledge that inauthenticity exists along a spectrum, is context dependent, and may even be justifiable in certain circumstances.

State-sponsored social media accounts which seek to interfere with political discourse offer compelling examples of inauthentic accounts. During the 2016 and 2020 U.S. Presidential Elections, one of the *intended uses* of Twitter by authentic accounts was to comment on and respond to the candidates' ongoing campaigns; however, as seen in Figure 1, inauthentic accounts inserted themselves into these social media conversations. Whatever the intentions of these state-sponsored accounts—and whether or not they succeeded in those intentions—these insertions draw attention to features of the Twitter *environment* (e.g., digital anonymity afforded by the platform) that authentic Twitter users should keep in mind (e.g., the possibility that not all participants contribute to a conversation in good faith).

Figure 1. Twitter update on information operation efforts from Iran during a U.S. presidential debate.

If we consider social media platforms as *environments* in which people act, then we might also consider the harms of *pollutants* like the inauthentic accounts shown in Figure 1. Even if an individual social media user does not perceive direct harm from these pollutants, there may be collateral consequences for social participation in a polluted social media environment. These pollutants are present, at least in part, because of the form, design, and business model of social media platforms and may have implications for teachers' professional uses of social media (Krutka et al., 2019). Although education researchers have begun to name other pollutants, such as spammers' presence in teacher spaces (Carpenter, Staudt Willet et al., 2020) and risks to teachers of cyber-violence (Nagle, 2018), most studies remain inattentive to the implications of

pollutants—and no research has yet explored the possible intersection of state-sponsored accounts and teachers' social media spaces.

In this paper, we report on an analysis of activity in the teacher-focused #Edchat hashtag from 83 primarily Iranian state-sponsored accounts, including their profiles, the profiles of accounts they retweeted, and the tweets they shared. After reporting on the results of emergent coding, we consider *media as environments* to discuss the implications of not only the presence (or absence) of inauthentic accounts in teacher-focused hashtags but also the larger, indirect implications for educators participating in professional development on for-profit social media platforms.

Introduction to the Problem

Theoretical Lens

We approach this study through a lens that suggests that the design of a medium shapes the communication activity that happens therein. Media in education have often been framed as tools—or neutral conduits—through which people create messages and participate in communities for educational and democratic ends (Mason & Metzger, 2012; van Dijck & Poell, 2018). However, Marshall McLuhan (1964) and subsequent communication, media, and technology scholars (e.g., Postman, 1985; Strate, 2017; van Dijck, 2013) have argued that we should understand media as forms that create new *environments*. McLuhan and McLuhan (2011) explained this environmental pressure as the *formal cause* of media forms. As more people use new media (e.g., print, television, social media), their use contributes to altering perceptions that can shift assumptions, beliefs, and practices in societies. Writing before the advent of social media, but still during a time of exponentially increasingly networked media availability online, Postman (1992) contended that "information has become a form of garbage" that "appears

indiscriminately, directed at no one in particular, in enormous volume and at high speeds, and disconnected from theory, meaning, or purpose" (pp. 70-71). He argued that the intended use of networked computers was to increase the availability of information, but it may have had the unintended consequence of creating an environment in which information is devalued and decontextualized.

Recently, education scholars—including us—have touted the participatory potential of social media as a medium for informal teacher professional development (Greenhalgh & Koehler, 2017; Greenhow et al., 2020; Krutka et al., 2014). While there is little doubt that some educators have benefitted from participating in these spaces (e.g., Nochumson, 2020), important questions remain about the formal causes of social media for teachers. Such inquiry is complicated by differing platforms (e.g., Facebook, Instagram, Twitter, TikTok) that frequently change both the interface users see and the algorithms they don't.

Social media platforms create environments that delimit certain types of participation, reward certain types of behaviors, and often offer only limited context. As Sarah Frier (2020) stated, "Facebook is for getting likes. YouTube is for getting views. Twitter is for getting retweets. Instagram is for getting followers" (p. 234). Social media environments can nudge users to value a quantity of attention over a quality of content (van Dijck, 2013), and platform algorithms then amplify that content. Moreover, companies typically have little incentive to clean up the pollution of racism, outrage, or spam because their business models profit from increased use and attention and they would lose money from paying content moderators and dedicating resources to cleaning up online toxins (Roberts, 2019). Unfortunately, this approach has allowed bad actors to exploit vulnerable groups as platform algorithms amplify hate groups,

misinformation, and division (McNamee, 2019; Tufekci, 2017; Vaidhyanathan, 2018), which can also impact uses of social media in education.

Twitter as a medium lends itself to short bursts of digital text, images, GIFs, or videos that appear to users quickly from a large number of accounts. The short 280 character count of Twitter combined with quantitative metrics of "likes" and "retweets" can reward users who, for example, make more outrageous claims. New tweets, notifications, and replies during a synchronous chat allow little opportunity for pause, even to consider to whom a user is replying at any particular moment. Identifying an unfamiliar user requires one to hover over or click on their account to evaluate their profile and discern the information they provided. If the user maintained some level of anonymity then this might make verifying them more challenging, not worth the effort, or impossible. Social media thus tends to be more similar to the felt and emotive experience of television than the analytical and reflective experience of reading (Mason, 2018).

Literature Review

Teachers have been using social media professionally for over a decade (Greenhow et al., 2020), often using them as part of *professional learning networks* (PLNs) that supplement or replace formal professional development (Trust et al., 2016). Although these PLNs often span multiple platforms, much of this research—like social media research generally (Tufekci, 2014)—has focused on Twitter in particular. Although teachers use Twitter in multiple ways and for multiple purposes (Carpenter & Krutka, 2014; Forte et al., 2012; Visser et al., 2014), *hashtags*—key words or phrases preceded by a hash (#) sign and used to index conversations on Twitter—play a particularly important role. Educators tweet using a variety of emergent and stable hashtags (Carpenter, Tani et al., 2020; Greenhalgh, 2021) to participate in asynchronous posting or synchronous *chats*—or both (Greenhalgh et al., 2020).

#Edchat has now existed for over a decade (Anderson, 2012) and may therefore be the most well-known and enduring teacher-focused hashtag. Correspondingly, it is one of the most studied teacher hashtags (e.g., Britt & Paulus, 2016; Forte et al., 2012; Gao & Li, 2017; Staudt Willet, 2019; Xing & Gao, 2018). Research also suggests that it sees some of the most teacher traffic. For example, Staudt Willet et al. (2017) demonstrated that the hashtag can see as many as 7,500 #Edchat tweets in a day, more activity than some teacher hashtags see in a month (e.g., Carpenter, Tani et al., 2020; Greenhalgh & Koehler, 2017). However, the rate of activity in a hashtag may sometimes be problematic or overwhelming for users (Britt & Paulus, 2016; Krutka & Damico, 2020; Luo et al., 2017; Mullins & Hicks, 2019; Staudt Willet, 2019).

The design of Twitter allows for a range of inauthentic accounts and activity to swarm the environment. Inauthentic accounts range from spam to bots to trolls to state-sponsored accounts dedicated to information operations. For example, Brunton (2013) described spamming as "the project of leveraging information technology to exploit existing gatherings of attention" (p. xvi), and the amount of attention gathered around the #Edchat hashtag makes it a prime target for exploitative uses of Twitter. Staudt Willet (2019) coded #Edchat tweets to determine whether tweets were self-oriented, other-oriented, mutually-oriented, or miscellaneous and raised concerns about the prevalence of self-oriented, self-promoting behaviors in #Edchat. Similarly, Carpenter, Staudt Willet et al. (2020) have used spam metrics to identify #Edchat participants "engaging in excessive self-promotional activity" (p. 466). This is further complicated by Kerr and Schmeichel's (2018) finding that male teachers were more likely than female teachers to self-promote in another Twitter hashtag. While spam accounts may be transparent about their intentions, they remain inauthentic in that they exploit the #Edchat hashtag to garner clicks and profit from the activity.

#Edchat's high levels of activity also mean that Twitter's algorithms and interface are more likely to describe the chat as "trending" and that those outside education are more likely to see it. Studying other, less tweeted hashtags, Greenhalgh and colleagues (2016) identified "tweets [with] malicious intent" from "accounts on Twitter [employing] commonly used or trending hashtags in order to force themselves into a conversation" (p. 94). Given greater levels of activity on #Edchat, it is likely that this phenomenon also exists there.

Although state-sponsored information operations are a widely studied and socially-important problem on social media, and although they correspond with other findings related to inauthentic accounts, there has been scant research on their polluting of social media environments used by educators. Two events have resulted in increased Western mainstream awareness of coordinated social media information operations. First, the June 2016 "Brexit" referendum in the United Kingdom saw the emergence of networks of automated "bot" accounts on Twitter (Bastos & Mercea, 2019) among other instances of state interference. Second, the Kremlin-sponsored Internet Research Agency sought to interfere in political discourse, impact voting, and sow division in the leadup to the November 2016 presidential election in the United States (Mueller, 2019). These efforts spanned multiple social media platforms (DiResta et al., 2017; Lukito, 2020); however, Twitter has been a particular focus of both the IRA itself and subsequent scholarship on this phenomenon (e.g., Bastos & Farkas, 2019; Linvill et al., 2019; Linvill & Warren, 2020).

The Present Study

State-sponsored accounts can be particularly challenging for educators and scholars to identify, understand, and research because they often use long-term strategies aimed at deception (DiResta, 2017; Tufekci, 2017). Yet, Twitter and its hashtags offer an environment where state

actors can blend in with identifier-free accounts and make dishonest, deceptive, or malicious contributions more easily than they could on other media forms. Traditional media literacy approaches aimed at decoding messages can fail to capture information operations strategies that may seek to first focus on building community online and only later advance their agenda. Thus, our purpose here is not only to determine any direct, observable impact of state-sponsored accounts on participation in #Edchat but also to consider what the presence of such accounts tells us about the broader environment in which #Edchat takes place. In short, we used these accounts to ask the broader question of what can we learn about the media ecologies in which Twitter professional learning takes place. If social media are polluted environments, what are the implications for educators and education?

Purpose and Research Questions

The purpose of this study is to explore the activity of state-sponsored information operations accounts in the #Edchat hashtag as a means of better understanding both the Twitter environment and the inauthentic activity that it allows. In particular, we examine tweets (and associated metadata) containing the #Edchat hashtag that were included in a Twitter-provided dataset of posts associated with state-sponsored information operations. We ask three specific questions about these data:

1. What types of accounts are present?
2. Who are these accounts amplifying?
3. What are these accounts sharing?

Methods

Research Ethics

Although this social media data was publicly available and therefore not subject to institutional review, we note the importance of remaining attentive to ethical responsibilities (e.g., Fiesler & Proferes, 2018). We take an ethics of care approach to internet research that is attentive to "relationships with uneven power relations" (Suomela et al., 2019, p. 7). We limited the inclusion of data that could be traced back to *low power accounts* (i.e., those unwittingly implicated by malicious state actors) in order to preserve their privacy and anonymity.

Data Collection

In early February 2020, we retrieved the initial data for this study from 33 datasets collectively containing tens of millions of tweets in multiple languages and on several topics. Although each tweet was associated with approximately 30 elements of metadata, our analysis ultimately considered only the text of the post itself, the unique identifier associated with each post, the screen name and unique identifier associated with each account, and the profile associated with each account. As described below, the language associated with each tweet and the timestamp for each tweet were used for data cleaning and data description respectively. It is important to emphasize that these data were not retrieved directly from the Twitter API—a more typical approach—but instead were collected secondarily from official Twitter (n.d.-b) datasets publicly released because of the data's association with "potentially state-backed information operations" (para. 1).

Naturally, there are limitations associated with this dependence on Twitter. For example, although Roth (2019) and Twitter (n.d.-a, 2019) outline Twitter's multifactor process for identifying state-sponsored accounts generally, Linvill and Warren (2020) note that the exact process is not publicly shared and that it has sometimes resulted in errors. Furthermore, any data present in these datasets has necessarily been deleted from the main Twitter platform, precluding

any independent or additional analysis of these posts. Despite these limitations, we note that U.S. government investigation of state-sponsored social media accounts has relied on similar datasets for this kind of work (DiResta et al., 2017); more pressingly, the independent identification and analysis of state-sponsored tweets would require both methodological training (see Kimmons & Veletsianos, 2018) and access to internal Twitter data and other resources that are beyond what is available to most (if not all) education researchers. These data therefore present a unique opportunity to consider the intersection of inauthentic accounts with teacher Twitter.

To clean these data, we combined them into a single dataset and removed all data for which the *tweet language* variable in the Twitter metadata was set to anything other than English. We then identified all tweets containing #Edchat. We note that #Edchat is only one of many teacher-focused Twitter hashtags (see Carpenter, Tani et al., 2020; Greenhalgh, 2021); however, its prominence (which we have previously described) makes it a particularly compelling case for studying inauthentic activity in teacher Twitter. During our analysis, we found that it was possible for a tweet to appear in more than one of the Twitter-released datasets. Whenever we identified duplicates, we removed them from our data. This resulted in 175 English-language tweets (and associated metadata) containing the #Edchat hashtag. As seen in Table 1, the vast majority of the state-sponsored tweets (and accounts) using the #Edchat hashtag were Iranian in provenance, though Russian- and Venezuelan-sponsored tweets were also included in the dataset. As seen in Figure 2, tweets were composed between June 2015 and August 2018, though most were concentrated in mid-2017. We note that although we retrieved our data in 2020, none of the data we analyzed dated after August 2018. This is likely due to both the considerable time required to identify state-sponsored tweets (Twitter n.d.-a) and to the

fact that #Edchat tweets ultimately make up a small proportion of information operations tweets; that is, accounts may have only focused on #Edchat for a short time.

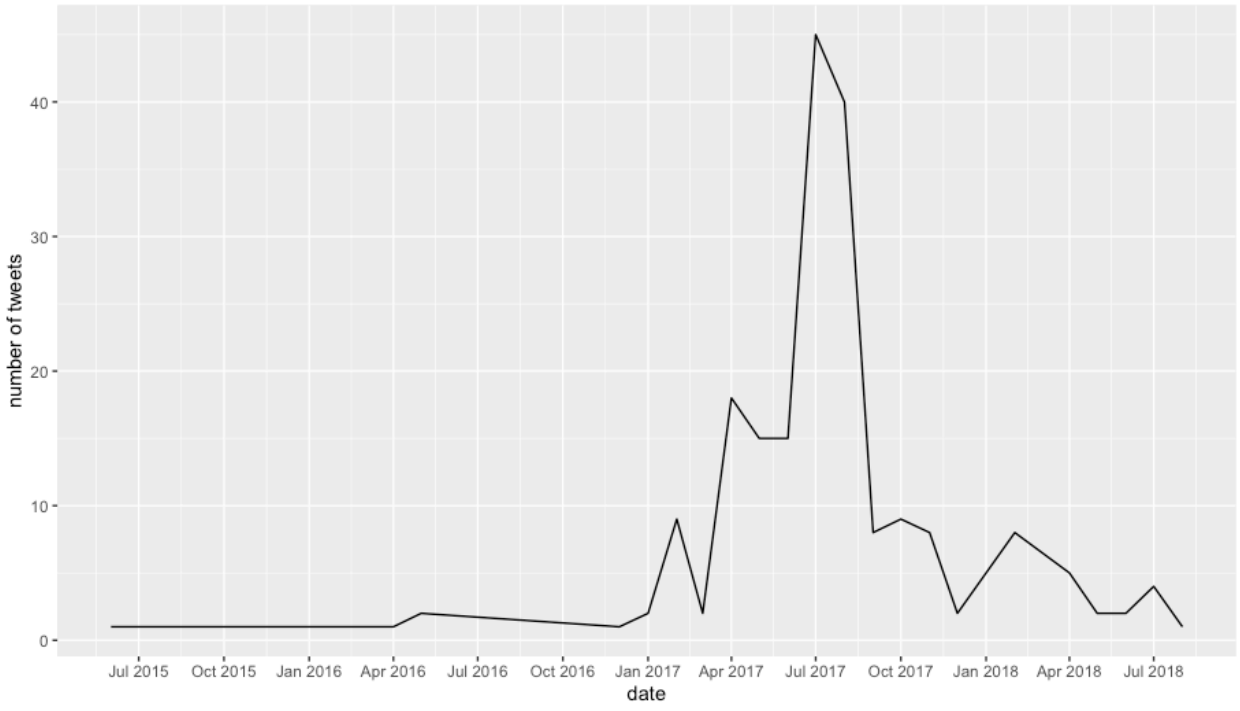
Table 1.

Countries of Origin of Analyzed Tweets.

Country of Origin	Tweets (n = 174)	Accounts (n = 83)
Iran	166	76
Russia	7	6
Venezuela	1	1

Figure 2.

Distribution of Dataset Over Time



We also collected additional data to answer our second research question. In particular, we identified the 37 *secondary* accounts retweeted by the accounts in our dataset and used Kearney's (2019) *rtweet* package for the R programming language to retrieve current profile

information (if available) for those 37 accounts. As we will describe below, some of these secondary accounts had been suspended prior to our data collection.

Data Analysis

To answer our three research questions, we inductively coded the profiles of 83 accounts that (re)tweeted posts in the dataset, the profiles of 37 accounts retweeted by these first accounts, and the content of the 174 tweets in the dataset. This coding focused on qualitative content analysis: "categorizing qualitative textual data into clusters of similar entities, or conceptual categories, to identify consistent patterns" (Julien, 2008). The authors first reviewed each collection of data together through a process of *initial coding* (Saldaña, 2009) that identified emergent trends without any *a priori* codes. This initial coding resulted in the development of codebooks for each of the research questions (see Appendices A, B, and C). We then reviewed the data to confirm—through consensus—the codes assigned to each item. Each account or tweet was treated as a codeable unit and received just one of the mutually-exclusive codes.

Results

We analyzed the profiles of state-sponsored inauthentic accounts, the profiles of the accounts they retweeted, and the tweets that were posted or retweeted.

RQ1: What Types of Accounts?

Table 2.

Types of Accounts.

Account code	Accounts	Tweets
Relatable	45	90
Indiscernible	23	54
Professional	10	22

Political	5	8

Relatable

We coded four different types of accounts in the dataset (see Table 2). We identified the most common type of account (n=45) with the most tweets (n=90) as that which sought to be *relatable* to other Twitter users on the platform. These account profiles were designed to make reference to common interests and blend in with the larger internet culture without providing identifiers such as name, location, affiliations, or any other information that might allow people to identify the account holder.

The most common subtype of relatable account drew on general aspects of *identity* (n=11) to often include a formulaic list of non-controversial daily (e.g., 6 accounts mentioned coffee) or niche interests (e.g., 4 accounts mentioned zombies), activities (e.g., travel), or pseudo-expertise in popular topics (i.e., accounts used terms like "expert," "guru," and "maven") to generically relate to other users. The following examples of these accounts' profiles shows a formulaic approach:

- Food buff. Amateur explorer. Student. Evil coffee scholar. Hipster-friendly entrepreneur.
- Future teen idol. Wannabe student. Award-winning webaholic. Zombie evangelist. Troublemaker.
- Coffee-Drinker, eReader Addict, Mom, Blogger. I'm very busy and important.

These accounts did not reference more sociopolitical aspects of identity (e.g., race, sex, orientation, religion), personal information (e.g., location, affiliations), or professional information (e.g., employer). Instead, accounts sought to more generally relate to frequent social media users.

Another type of relatable account used brief *comedic* (n=12) phrases in their profile (e.g., "My blood is made of coffee."; "Don't you just hate it when a sentence doesn't end the way you octopus"; "Trying to elevate small talk to medium talk.") without including any other information. Ironically, one such account simply read, "You can tell a lot about a person by reading their bio," thus revealing the method of creating relatable accounts that reveal no identifiable information about the account holder.

We also coded eleven accounts as seeking to be relatable through *motivational* profile bios. These codes ranged from offering inspiration, (e.g., "Either you run the day, or the day runs you. –Jim Rohn"), tough love (e.g., "Let me bitch at you every day until you sort your shit out."; "Show me you're different and i won't treat you like you're typical"), or advice (e.g., "Don't make a permanent decision for your temporary emotion"; "The best time to plant a tree was 20 years ago. The second best time is now."). Less common relatable subcodes included *playful* (n=5; "Acts like summer & walks like rain"), *self-deprecating* (n=5; "Total computer geek. Married to a computer geek. Raising two future computer geeks."), and *sexual* (n=1; "hello my sexy armadillo. I'll follow back esp if youre irish") bios. These profile subcodes were similarly interesting while remaining vague and non-identifiable.

Professional

We coded a smaller subset of account bios as professional (n=10). Professional bios included accounts presented as working in journalism (n=3), business (n=2), or other fields (i.e., academic, actor, athlete, art/humanities, web). These accounts ranged from vague job mentions (e.g., "Job Opportunity Promoter") to making more specific employment claims (e.g., "Initiator&producer of @NirbhayaThePlay"), including as journalists for specific outlets (e.g., "Journalist @WIONews," "Staff Editor @nytopinion").

Political

Only five accounts were explicitly political in their bios. One account was explicitly Islamophobic, and two were Christian conservative accounts:

- "I believe that OUR COUNTRY needs to BAN ISLAM and #DeportALLMOSLEMS! Islam is pure evil! STANDUP, FIGHTBACK, SPEAKUP TAKE OUR COUNTRY BACK .. #INFIDELFORLIFE"
- "Christian; grateful husband of a loving wife; retired pastor; LEO Chaplain #bluelivesmatter; #prolife; VETS; #1A; James 5:17-18 #MAGA Follow me"
- "Christian, Pro American, Anti-Rino Conservative, Boxing affianado, organic healthful nutrition"

Another account emphasized political skepticism and religion (i.e., "My first rule: I don't believe anything the government tells me. I trust no living man on this earth, only me! Too many liars/devils! God is great!"). The final account concisely affiliated with a progressive non-profit (i.e., "Global Campaigner at Avaaz").

Indiscernible

Finally, we coded twenty-three accounts as indiscernible. These accounts either had blank bios, stated some variation of "follow me," or had an unclear meaning (i.e., "chancey").

RQ2: Who are They Amplifying?

Because the majority of tweets in our dataset were retweets of other accounts' posts, an analysis of those other accounts lends further insight into the possible objectives of state-sponsored inauthentic accounts and the ways the Twitter environment functions. As seen in Table 3, the majority of the 37 unique secondary accounts that we coded expressed an explicit connection with education. Six accounts were commercial in nature; these included a book author's professional account, accounts that expressed connection with particular companies, and even automated accounts that regularly tweeted links to products that could be purchased.

Although fewer in number, these accounts are associated with nearly as many #Edchat tweets in our dataset as educational accounts. Similarly, the two accounts we coded as *indiscernible* (because they had since been deleted or suspended—possible indications of spam behavior) were responsible for a disproportionate number of the posts ultimately retweeted by state-sponsored accounts.

Table 3.

Types of Accounts Retweeted.

Account code	Accounts	Tweets
Education	25	68
Commercial	6	59
Indiscernible	2	40
Political	2	3
Academic	1	1
Personal	1	1

In contrast, political, academic, and personal accounts were amplified much less frequently, both in terms of number of unique accounts and number of total posts. Nonetheless, it is notable that retweeted political accounts include both a member of Donald Trump's 2016 presidential campaign and one of the "rogue government" accounts that emerged to protest the new Trump administration (see Oltmann et al., 2020).

Given the number—and significance—of educational accounts, we also report on some of the education-related subcodes that emerged from our analysis. These subcodes add important nuance. For example, Table 4 shows that relatively few of these accounts are associated with schools or professional organizations, with the Library of Congress and Phi Delta Kappa as exceptions. Rather, nearly half of the accounts retweeted by government agents are education companies, who may be using #Edchat to sell products rather than participate in professional conversations.

Moreover, the largest number of individual posts comes from *education influencers* who tend to use their accounts to promote their own work and online presence. We coded a smaller number of accounts as *education "thought leaders,"* who shared influencers' strategic social media presence but did not appear to be as commercially-focused. Thus, despite the broad emphasis on education related accounts in this data, many of these accounts also have commercial undertones.

Table 4.

Types of Education Accounts Retweeted.

Secondary account code	Accounts	Tweets
Education Company	12	24
Education Influencer	7	33
Education "Thought Leader"	3	5
Education Organization	2	4
School	1	2

RQ3: What are They Sharing?

We coded three types of tweets shared by state accounts: education, spam, and commercial (see Table 5). The vast majority of the time, state accounts did not post original tweets using the #Edchat hashtag but instead retweeted posts from other accounts. We identified only two original tweets (i.e., not retweets) in the dataset:

- "3 missing/1 dead after natural gas explosion at #Minneapolis High School https://t.co/t1P32JRFBH #MinnehahaAcademy #Edchat …"
- "Looking for something easy to set up and fun for students to do at the end of term? Have a go and getting them to make some foldables! #ukEdchat #revision #gcse #science #asechat #nqtchat #ittchat #aussieED #Edchat https://t.co/hL3EbRdGLx"

However, after searching these tweets, we determined that both of these tweets were copied from other accounts. Therefore, it does not seem that the state accounts actually composed their own tweets using the #Edchat hashtag. The influence of state accounts was thus in amplifying posts from other (often inauthentic) accounts.

Table 5.

Types of Tweets.

Tweet code	Unique tweets	Total instances
Education	45	75
Spam	45	89
Commercial	6	10

State accounts shared 45 unique *education* tweets a total of 75 times (i.e., some tweets were retweeted more than once). Education tweets primarily involved *resource sharing*, a subcode applied to 37 tweets shared 64 times. These tweets often consisted of text with a link to a resource (e.g., article, lesson) along with the #Edchat hashtag and others. These tweets included resources for educator professional learning (e.g., "10 Habits of Positive Educators"), professional topics (e.g., "Why global education rankings don't reveal the whole picture"), or classroom use (e.g., "Great printable picture that shows what we do with every element on the periodic table"), including a disproportionate number of science posts. There were a far smaller number of *education* posts shared that addressed topics we coded as *political* (4 instances of 3 tweets), *teacher sharing* (3 instances of 2 tweets), *news* (2 instances of 2 tweets), or *support* (2 instances of 1 tweet). Of the political tweets, one praised Donald Trump's opposition to the Common Core State Standards adopted by many U.S. states, another (retweeted twice) encouraged people to oppose Betsy DeVos's nomination as U.S. Secretary of Education, and a third critiqued caste system disparities.

We coded other posts as either spam or commercial in nature. There were 45 spam posts (i.e., as many as education posts) that were shared 89 times overall (i.e., more than the total instances of education posts). These posts were unrelated to educational topics (e.g., "Obama can bench press an impressive 200lbs," "Dogs and cats consume almost $7 billion worth of pet food a year") and came primarily from two since-suspended accounts: @GoodStuffToSee (n=54) and @CoolStuffToSee (n=28). Finally, there were 6 posts shared 10 times that advanced commercial interests in education by promoting products, events, or even a supposed book giveaway.

Discussion

Our findings offer lessons that scholars and educators might put into practice. It is evident that social media scholars should attend to the direct impact of state accounts, which we found in this case to be minimal. However, it is arguably more important (if less evidently so) to attend to the systemic and collateral implications of the mere possibility of inauthentic pollutants within platform environments, including the (often collateral) consequences of such noise, media form, and formal cause. While social media participation can surely afford important opportunities, these online spaces come with the types of downsides not present in face to face environments. We offer several themes from our analysis of inauthentic state accounts along with recommendations for educators and scholars.

No Patterns of Overt State Interference in #Edchat

Educators turn to the #Edchat hashtag on Twitter as a space for online professional development (Britt & Paulus, 2016; Gao & Li, 2017; Staudt Willet, 2019; Xing & Gao, 2018), and this study explored the activity—and implications—of state-sponsored inauthentic accounts in this space. While it is noteworthy that state-sponsored accounts chose to engage with content associated with #Edchat, it is perhaps even more noteworthy that we identified minimal evidence of attempts to overtly influence hashtag conversations for particular political aims. Only five of the state-sponsored accounts were explicitly political, and they amplified only a small number of political tweets. Although we cannot rule out that the tweets in our data set are part of larger covert campaigns (DiResta et al., 2017; Tufekci, 2017), we note that we identified no discernable patterns for political aims. Moreover, depending on which client educators use to follow the #Edchat hashtag (e.g., Tweetdeck, Twitter.com, the Twitter app, Twitterfall), they may not have even viewed the retweets of state actors. This is good news.

Nonetheless, the presence and activity of these state-sponsored accounts in the #Edchat hashtag raises questions about the larger Twitter environment—and broader patterns of inauthenticity—that educators and researchers should consider. That is, our analysis speaks not only to the nature of inauthentic activity within #Edchat but also to the features of the Twitter environment that allow it to happen. To illustrate the importance of the latter, imagine a formal, in-person teacher professional development in which bad actors were found to have: a) joined the event under a false identity, b) promoted vendors and influencers in a way that interfered with the expected agenda, and c) thrown their support behind certain ideas presented at the event. Even if a worst case scenario was avoided and even if participants generally found value in the event, we would expect teachers to think twice about the environment in which this learning had taken place, including demanding changes to the design of that environment or leaving that environment for others. How, then, should educators and researchers understand Twitter environments where inauthentic accounts persist?

Inauthentic Accounts Illustrate Downsides of Anonymity and Pseudonymity

Tufekci (2017) detailed the affordances for identity and reputation that are affiliated with social media company's design decisions around anonymity, pseudonymity, or real name policies. State accounts took advantage of this environment to create formulaic profiles that might be relatable (n=45) to other users and blend into the larger environment. We did not find evidence that these state accounts intended to target education hashtags or educators or that they had any direct impact on the #Edchat hashtag; they more likely retweeted #Edchat posts as part of their identity formation or due to the chat being highly visible within the platform.

Nonetheless, state-sponsored accounts provide an opportunity to consider how "anonymity could present both opportunities and challenges for educators" (Staudt Willet &

Carpenter, 2020, p. 218). In the case of Twitter, the company has made possible pseudonymous user accounts where users can largely determine what identifiable information—if any—they share. While some more core participants in chat communities may know each other well (Britt & Paulus, 2016), a hashtag with the volume of #Edchat means that it can be common for involvement to be more peripheral among those who do not know other users (Lave & Wenger, 1991). This is further complicated by the various populations (beyond classroom teachers) that participate in teacher-focused Twitter hashtags (Greenhalgh & Koehler, 2017; Rosenberg et al., 2020)—it is typically more difficult to evaluate the authenticity and credentials of people outside one's own professional discipline.

In short, educators may be tasked with teaching social media literacy to students (Livingstone, 2014), but they also need to develop their own social media literacy to effectively participate in spaces like Twitter (Nagle, 2018). If a primary affordance of professional learning is the social interactions with other people (Trust et al., 2016), teachers need to carefully consider how anonymity and pseudonymity limit teachers' ability to "interpret their peer's posts and assess user's expertise and credibility" (Staudt Willet & Carpenter, 2020, p. 219). Likewise, Staudt Willet (2019) highlighted the need for #Edchat participants to engage in social media literacy to consider whether a "tweeter [has] a hidden, vested interest" (p. 285); the same environmental design that allows for the state-sponsored accounts identified in this study also allows for this form of pollution, which teachers are more likely to encounter. Nonetheless, educators participating in #Edchat should still work to recognize accounts lacking identifiers or educational ties and develop a healthy skepticism and social media literacy in their interactions with anonymous and pseudonymous accounts.

Researchers should also consider how anonymous and pseudonymous accounts affect #Edchat and other interactions online. That state disinformation accounts could interact in #Edchat without much notice should invite caution when making claims of online hashtags serving as "communities," tweeters as "members," or platform metrics (e.g., retweets, likes) as necessarily representing participants' views. Researchers especially should remember that a hashtag space is permeable and capturing participation is necessarily imprecise.

Inauthentic Accounts Amplified Accounts Seeking Attention

The business model and design of Twitter (e.g., infinite scroll, notifications, brief posts) seek to capture as much attention and time on the site as possible. Our results suggest that state accounts most often retweeted posts from more attention-seeking accounts already within the #Edchat space, such as education influencers (n=33), companies (n=24), and "thought leaders" (n=5). These findings suggest that inauthenticity begets inauthenticity; that is, even if state-sponsored accounts had little direct impact on #Edchat, it is noteworthy that they recognized and amplified other inauthentic behaviors that are more directly influencing this hashtag experience. Indeed, we did not find that state accounts retweeted any K-12 educators who did not participate in some level of self-promotion. We suggest that it is not just the influence of bad actors but also the design of the Twitter environment more broadly that encourages *transactions* rather than *relational* activity.

The presence of attention-seeking inauthentic accounts (including commercial and spam accounts that exploit teacher spaces) should at least give educators pause as they (re)consider which social media platforms (and opportunities within those platforms) are suitable and sustainable as professional learning spaces. Krutka and colleagues (2017) contended that educators should regularly reflect on the people, spaces, and tools in their PLNs. What an

educator should do in response to such a reflection is context-dependent, and it would be inappropriate to be overly prescriptive in this setting. However, such a reflection should help an educator identify inauthentic attention-seeking behaviors, accounts that practice them, and spaces and platforms that allow (or encourage) them; in response, an educator might consider filtering posts, unfollowing users, leaving spaces, or even abandoning platforms.

Educators should also understand that value-laden platform metrics (see van Dijck, 2013) are not necessarily indications of quality—and that they can be influenced by inauthentic accounts and for-profit algorithms which pollute the medium environment. van Dijck and Poell (2018) go so far to suggest that "the instantaneity of recommendations and likability of perceptions… may be squarely at odds with long-term pedagogical values of curriculum-based education" (p. 584), and teachers should make sure to place values first and metrics second. Particularly important in this context is the case of edu-influencers—"individuals who have achieved microcelebrity status in [social media] spaces… by promoting certain education-related products, philosophies, or practices" (Shelton et al., 2020, p. 530). Edu-influencers are not necessarily inauthentic, but are by definition attention-seeking accounts that may navigate the Twitter media environment using strategies not dissimilar to those employed by the state-sponsored accounts in this study. That is, both recognize that "Twitter is for getting retweets" (Frier, 2020, p. 234) and may be driven by that goal. Teachers must critically evaluate edu-influencers despite (or perhaps because of) their success on a particular platform—and may need support doing so (Shelton et al., 2020).

Along these lines, researchers would benefit from considering the economic incentives of social media platforms that teachers are active on—and the inequitable economic undercurrents of many teacher-focused online spaces (e.g., Koehler et al., 2020). To be clear, we do not

begrudge #Edchat participants for sharing their own helpful resources or attracting a deserved following, but scholars must consider whether there are teacher online spaces that are driven by a desire to monetize one's work at the expense of more important educational values. While there are arguably benefits to education influencers' work (Dousay et al., 2018; Shelton et al., 2020), there are also many edupreneurs who seek to profit from products and advice that may be aesthetically pleasing but otherwise problematic (Rodriguez et al., 2020).

Inauthentic Accounts Exhibit Twitter's Information Glut

Our dataset also showed the kind of attention-grabbing, low substance content that values easy education answers over complex or nuanced considerations. Retweeted accounts promised products and progress without providing the basis for such claims—and these accounts were already engaging with #Edchat prior to state accounts' intervention. Furthermore, state accounts amplified a lot of (also pre-existing) commercial and spam content that has little presumed value for a teacher-focused hashtag. Thus, as in previous cases, even if state accounts had little direct impact on #Edchat, they did draw attention to an information glut already existing within the hashtag.

Of course, educator professional development requires more thoughtful pedagogical approaches than these tweets can answer. Postman (1992) might have characterized such tweets as "a form of garbage" that appear "indiscriminately directed at no one in particular" (pp. 70-71). In education, context is critical. Educational theorists and researchers have long contended that educational decisions need to be responsive and sustaining to the students and communities they serve (Ladson-Billings, 1995; Paris, 2012). Even though teacher Twitter surely has better content than the tweets above, the nature of means of communication (notably its 280 character limit)

makes it difficult to consider context as tweets, retweets, and likes often are directed at no one in particular.

The problem of indiscriminate tweets should encourage #Edchat participants to seek out more purposeful and focused interactions online and offline. They may find this in intentional chats (i.e., #Edchat synchronous chats over asynchronous tweeting); however, we also note that research has even described some focused chats as overwhelming in terms of content (Britt & Paulus, 2016; Krutka & Damico, 2020; Luo et al., 2017; Mullins & Hicks, 2019). It therefore becomes all the more important to find more purposeful and focused interactions in other social media environments and also through in-person professional development.

Researchers should also do more to consider context when studying activity in educational social media spaces. While social media trace data offers considerable opportunities for educational technology researchers (Greenhalgh et al., 2021), context is critical (Rosenberg & Koehler, 2015), and context-sensitive methods may be needed to fully understand these online spaces.

If social media platforms are going to be environments where public dialogue, professional development, and other activities occur, the educators engaged in those spaces should consider pressuring social media companies and legislators for design and business reforms for the common good. This is a less immediate response than any of the implications we have previously described. However, while (social) media literacy strategies are crucial in that the *formal causes* of social media forms engendered by short text, GIFs, images, and videos are unlikely to change in the short term, media literacy strategies can be much less effective at remediating polluted environments when compared to even slight changes in platform design and rewards (Frier, 2020; McNamee, 2019; Vaidhyanathan, 2018; van Dijck, 2013). If strategic

engagement is rewarded over authentic participation then platforms might change their design, rewards, and business model, which may result in healthier public-facing activity on those platforms Researchers can support this work by giving more critical attention to how social media design tilts behaviors in undesirable directions on the aggregate.

Conclusion

In this paper, we present findings from our analysis of the profiles of 83 state-sponsored inauthentic accounts and the profiles and tweets they retweeted from the #Edchat hashtag between 2015 and 2018. Our analysis suggests that, save a few exceptions, these inauthentic accounts were intended to be relatable and appear innocuous. However, we did not find patterns of overt state interference in #Edchat. Instead, the accounts retweeted posts from commercial accounts, education companies, or education influencers, not everyday educators participating in more authentic professional conversations. Considering social media as environments, we see these state-sponsored accounts as a noteworthy pollutant that amplifies other, pre-existing ones, including spam, self-promotion, and other more inauthentic activity. The presence of such pollutants should invite further reflection by teachers on the social media spaces in which they participate and researchers on the metrics and platforms they analyze.

Of all the accounts we considered, one stood out in particular for its profile message: Y*ou can tell a lot about a person by reading their bio*. While creators of state accounts have been shown to often have a sense of humor (DiResta et al., 2017), the (surely intentional) irony of this message is worth taking to heart. Educators, scholars, and citizens should be carefully "reading bios"—and be wary of the downsides of the design and form of online communication tools that nudge users toward more inauthentic interactions. Social media spaces may require remediation and regulation if they are to be the environments we need.

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Appendix A

Types of Accounts Codebook

Account code	Description	Example(s)
Relatable	Profiles that presented as easy-to-connect with, blending in with the larger Internet culture, and lacking identifiable information about the person. Subcodes included: identity, comedic, motivational, self-deprecating, playful, and sexual.	"Internet buff. Reader. Prone to fits of apathy. Zombie guru. Lifelong travel fanatic. Amateur coffee specialist. Twitter expert." "Don't you just hate it when a sentence doesn't end the way you octopus" "The best time to plant a tree was 20 years ago. The second best time is now." "do not judge me before u know me, but just to inform u, you won't like me" "Why talk when you can mock? Why hide your Face like I got Mace? Is it all an act or just a Fact. Maybe if you didn't drool, you'd be cool. Ran out of room boom" "hello my sexy armadillo. I'll follow back esp if youre irish"
Professional	Profiles that provided specific, purportedly identifiable information about a person that attests to professional affiliations or credentials. Subcodes included: journalist, business, arts/humanities, academic, web, academic, actor, and athlete.	"Basharat PeerVerified account @BasharatPeer Staff Editor @nytopinion. Author, Curfewed Night, Former @foreignaffairs, @nytimes and @nytindia" "I have a dream to gain the freedom to help people Through new products, helping then grow through experiences and achieving their dreams and their

		freedom” “LA-Mumbai based actor+producer. Initiator&producer of @NirbhayaThePlay, series reg on HBO's #TheNightOf & @Netflix upcoming #Gypsy, #DelhiBelly, @HouseOfCards” “Spreading hydrocephalus awareness one stroke at a time! Nadador en el CTD de Madrid y recordista nacional de 200 IM p. 25m.”
Political	Profiles that specifically signaled political affiliation or causes. Subcodes included: conservative, Islamophobic, justice activism, and skeptic.	“I believe that OUR COUNTRY needs to BAN ISLAM and #DeportALLMOSLEMS! Islam is pure evil! STANDUP, FIGHTBACK, SPEAKUP TAKE OUR COUNTRY BACK .. #INFIDELFORLIFE” “My first rule: I don’t believe anything the government tells me. I trust no living man on this earth, only me! Too many liars/devils! God is great!”
Indiscernible	Profiles that were either blank or sparse enough so as to not be codeable.	“chancey” “just follow me…” “Must follow this!”

Appendix B

Types of Secondary Accounts Codebook

Account code	Description
Education	Profiles that made an explicit connection with education. Subcodes included: education company, education influencer, education "thought leader," education organization, and school.
Commercial	Profiles that promoted companies' or individuals' work.
Indiscernible	Profiles that had been deleted or suspended, making it impossible to judge their intended purpose.
Political	Profiles that indicated an affiliation with a political party or movement.
Academic	Profiles that indicated academic affiliations or credentials.
Personal	Profiles that did not include any broader affiliation and only reported on personal details.

Note. We have elected not to include examples of profiles coded in these ways. We acknowledge that this may be less helpful for the reader; however, as described earlier, we limit the inclusion of data that could be traced back to accounts unwittingly implicated in these data in order to preserve their privacy (see Fiesler & Proferes, 2018; Suomela et al., 2019).

Appendix C

Types of Tweet Codebook

Tweet code	Description	Example(s)
Education	Tweets that directly referenced educational processes, events, or issues. Subcodes included news, political, resource sharing, support, and teacher sharing.	"Science teachers sacrifice to provide lab materials for students [link] #teaching #education #edchat #science" "URGENT: Pressure your senators to vote NO on DeVos. Education & enviro protection go hand-in-hand. #edchat #learning" "Think statistics are scary? Think again. [link] #edchat"
Commercial	Tweets that promoted educational jobs, resources, or products.	"FREE WEBINAR: Learn how #ELGizmos meet #NGSS! #edtech #edchat #futureready #scichat #science"
Spam	Tweets unrelated to the discipline of education.	"Quebec City, Canada, has about as much street crime as Disney World. https://t.co/TTItCMCmOF #edchat #science #usa" "Galactic Marines [link] #Kindle #books #Ebook #kids #science #education #edchat #edtech #Ebooks #fiction" "101 Things You Didn't Know Poster! - Zelophobia is the fear of jealousy. #education #edchat #science [link]"