

A Window, Mirror, and Wall: How Educators Use Twitter for Professional Learning

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Abstract

Teachers and other professionals increasingly utilize Twitter as a medium for professional expression and professional learning. These types of Twitter exchanges often take place in formal chats which are moderated by professional organizations or other knowledge brokers in the field. As moderated public online forums become more common, educators may wish to understand the benefits and limitations of this type of professional learning. This paper reports on a study of educators' discourse in two hosted Twitter chats focused on global education and analyzes the ways in which these types of chats align with research on high-quality professional learning. Results indicate that Twitter chats provide multiple components of high-quality professional learning, namely a focus on content, collaboration, and teacher agency; to a lesser extent, they may provide peer coaching and allow for conversations across a sustained duration. However, other components of meaningful professional learning are not possible in this context, as it is not job-embedded and does not provide active learning or supported opportunities to practice.

Keywords: Professional learning, Social media, Twitter, Educational technology, Global education

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Introduction

Teacher professional learning that is relevant, collaborative, and involves active teacher participation has been linked to both educator persistence and student learning, two valuable goals in education (Darling-Hammond, Hylar, & Gardner, 2017). With the advent of professional online social networking, platforms such as Twitter offer possibilities for professional learning on topics selected by teachers themselves, in a community of committed educators from various locations. However, Twitter can also serve as an echo chamber for ideas and might limit professional growth due to a loss of available time for job-embedded professional development. In this paper, we use a content analysis of educator Twitter chats to evaluate the possibilities and barriers of Twitter as an avenue for teacher professional learning.

Below, we discuss research on professional learning and its importance in educator retention and student learning, as well as controversies in this field. We then consider how Twitter and other online learning communities can facilitate teacher professional learning. In the subsequent sections, we describe our rationale for focusing on two different Twitter chats centering on global learning, our content analysis of these chats, and the ways that educator participation in these Twitter chats relates to teacher professional learning.

Teacher Professional Learning

Professional learning for teachers has historically been a main lever to focus on and improve the quality of educational systems (Guskey, 2002). When grounded in communities of practice (Lave & Wenger, 1991), teacher professional learning develops teacher practice in meaningful and sustainable ways. Indeed, studies of professional models have shown increases in student achievement indicating that teacher engagement in quality professional learning can result in a year of additional reading growth and improved science learning among their students as compared to a control group (Greenleaf et al., 2011). Although a substantial amount of resources are invested each year by educational institutions, returns from professional learning in the form of student outcomes are varied and minimal (TNTP, 2015). Research indicates that the most effective professional learning processes involve a focus on content, active learning and collaboration, teacher coaching and feedback, coherence, and sustained duration (Darling-Hammond et al., 2017; Desimone, 2009). Below, we discuss each of these components in detail.

Content and Pedagogical Knowledge in Professional Learning

Across syntheses of research on effective professional learning, researchers have come to some agreement that meaningful professional learning focuses on both content that teachers will teach to students and pedagogy directly related to teaching this content (Darling-Hammond et al., 2017; Desimone & Garet, 2015; Swan Dagen & Bean, 2014). As an example of these types of programs and results, Johnson and Fargo (2014) studied a professional learning experience for 21 teachers across two elementary schools focused on both science and linguistically relevant pedagogy, and showed its impact on Hispanic student performance on science

assessments, as students of participating teachers showed higher growth in science knowledge over time as compared to students of non-participating teachers. The efficacy of this program was determined to be in part due to its inclusion of science content, conversational Spanish, and strategies for using culturally relevant pedagogy in science. The type of content included in professional learning should involve ways of understanding and teaching content known to increase student learning (Garet et al., 2016) and include an explicit link to classroom lessons, involving not only what to teach but also how to teach it (Desimone & Garet, 2015).

Overall, changing teacher procedural classroom behavior is easier than improving content knowledge or inquiry-oriented instruction techniques (Desimone & Garet, 2015). Supporting growth in both content knowledge and pedagogy requires engagement in a community of practice. The types of activities that result from this engagement are detailed in the following section.

Active Learning and Collaboration

Aligning with adult learning and social learning theories (Rohlwing & Spelman, 2014), effective PL for teachers involves active learning and collaboration with peers. Active learning activities might include seeing modeled practices that teachers can analyze, try out, and reflect on (Darling-Hammond et al., 2017). This reflection-on-action can then turn an informational experience, in which participants gain new knowledge and skills, into a transformational experience, in which teachers change their points of view or habits of mind (Mezirow, 2000). One main driver for the importance of active learning is understanding the mechanism of change in teacher knowledge, skills, beliefs, and actions. Research on this change process indicates that changes in teacher practices lead to changes in student outcomes (such as learning, participation, or motivation), and this then leads to a change in teacher beliefs about effective practices (Clarke & Hollingsworth, 2002; Guskey, 2002). Teacher commitment to a new idea develops after implementation takes place in part because most teachers derive their sense of professional success from student growth (Guskey, 2002). Once teachers agree that a practice does in fact lead to increased student growth, they incorporate it more regularly and shift their beliefs about the efficacy of the new or modified practice. The connections between knowledge, skills, beliefs, and actions are multidirectional and self-reinforcing (Clarke & Hollingsworth, 2002).

Active learning in an environment of professional collaboration is a key aspect of professional learning. In fact, teachers who work in isolation rarely change their practice (Swan Dagen & Bean, 2014). Harré (1983) applied the Vygotskian principles of social learning to the intersection between individual and social learning, and public and private displays of learning. This process involves a cycle of individual publication (communication) of information, the conventionalization of this information in public space, the appropriation of information by other individuals, and personal reflection and possible transformation prior to the next cycle of publication. This collaboration interacts with active learning as teachers work together as active learners. Such a connection between active learning and collaboration should take place in a

context where teachers have some agency in their own learning. Raphael, Vasquez, Fortune, Gavelek, and Au (2014) note that the success of professional learning will depend on the “buy-in, ownership, and agency of the participating teachers” (p. 157). This agency and buy-in are also related to peer coaching and feedback.

Teacher Coaching and Feedback

To support the content-based, active, and collaborative learning found in successful PL, peer coaching and feedback are critical features of professional learning systems. The incorporation of teacher leaders in coaching further supports a sense of teacher agency. In a study of professional development within high-performing educational systems, Jensen, Sonnemann, Roberts-Hull, and Hunter (2016) note the key role of teacher leaders in these systems. For example, in Shanghai, teachers will not be promoted unless they can demonstrate that they are collaborative, and mentors will not be promoted unless the teachers they mentor improve (Jensen et al., 2016). This type of coaching and mentoring increasingly has involved video technology (Desimone & Garet, 2015). One successful professional model leading to substantial improvements in student reading abilities included the work of literacy coaches, who worked intensively with peers to improve the ways teachers scaffolded student discussion of texts (Bryk, Gomez, Grunow, & Lemahieu, 2015). This type of peer coaching involves both a dialogical approach to professional learning as well as a recognition of the importance of a teacher’s role and a sense of teacher agency. In addition, such peer coaching required action over a sustained period of time, the peer leadership of the literacy coaches, and the support of school and system-based leadership.

Sustained Duration and Leadership

Current research indicates that time and leadership complement the above factors in allowing for effective professional learning. Professional learning that is able to lead to systemic change or a change in the outcomes of a system must be both systematic and sustained over time (Raphael et al., 2014). Some reports suggest that, in fact, a duration of three to five years is appropriate for systemic effort that results in increased student learning (Swan Dagen & Bean, 2014); others indicate that increases in student learning can be seen through 10 days spread over the course of one year (Greenleaf et al., 2011). In both scenarios, significant time must be allocated not only to learning but also to practicing and evaluating a job-embedded skill. Overall, current trends suggest that educational leaders are moving away from professional learning focused on short workshops and into longer-term initiatives (Desimone & Garet, 2015). Leaders, both at the school and district level, can be key gatekeepers to effective professional learning (Swan Dagen & Bean, 2014). Focusing on a particular initiative over a number of years on a systemwide scale requires leaders to balance multiple needs and choose not to undertake other competing initiatives (Jensen et al., 2016). Leaders can also choose to include professional learning, or not, in a teacher’s evaluation, and foster an environment in which teachers have time in their weekly teaching schedule to try and reflect on new skills (Jensen et al., 2016).

Teacher Professional Learning on Twitter

The Need for Alternate Models of Professional Learning

Traditional, formal models of professional learning face constraints of space and time (Lawless & Pellegrino, 2007; Smith, Wilson, & Corbett, 2009) and the lack of continuing support for participants (Alberth, Mursalim, Siam, Suardika, & Ino, 2018). Models of professional learning that bring all teachers in a system together for days at the beginning or end of the school year often are “inadequate, fragmented and superficial” (Thacker, 2015, p. 38) and do not meet the individual needs of the participants (Ball & Cohen, 1999; Borko, 2004; Wei et al., 2009) or are often something “done to teachers” (Carpenter & Morrison, 2018, p. 25) rather than a participatory and collaborative form of learning.

Educators hampered by the costs of professional learning due to a lack of investment by their educational institutions may look to social media as an affordable way of accessing professional learning (O’Keeffe, 2018). This may be heightened in discipline areas that are not considered to be high stakes, such as social studies. In a study of high school social studies teachers, Thatcher (2015) found that the limited funds available for social studies professional learning and a primary focus on literacy and mathematics in professional development creates an environment in which social studies teachers need to find alternative models for creating communities to improve their practice.

Twitter as a Platform for Professional Learning

As an alternate professional model, many educators have turned to social media platforms such as Twitter as a free, informal, communal space for professional learning in which participants can create personalized networks (Carpenter & Krutka, 2014; Gao, Luo, & Zang, 2012; Krutka & Carpenter, 2016; O’Keeffe, 2018). Social media platforms also break down spatial boundaries through real-time availability across geographical lines and time zones, provided that educators have digital connections (Adjapong, Emdin, & Levy, 2018). Although many educators use Twitter as a platform for professional learning, their social presence varies, much like in a traditional professional learning model in which some participants may engage in reciprocal sharing and others may prefer to listen without engaging in the dialogue. In examining thousands of educators’ tweets, researchers found that the majority of visible interaction on Twitter was through retweets and likes, with only a small percentage of original content (Greenhalgh & Koehler, 2017). O’Keeffe (2018) found that higher education staff who participated in Twitter had a variety of social presences, ranging from a small number with a high usage of interactive posting to those who used it as a one-directional resource without creating any form of social identity for themselves.

One method of professional learning on Twitter is the use of Twitter chats, planned virtual dialogues that are organized around topics and include the use of hashtags as their method of organization. According to Adjapong et al. (2018), Twitter chats can be identified as Virtual

Professional Learning Networks (VPLN). Within these chats, participants share and gain knowledge and tools to further their own professional learning (Krutka, Carpenter, & Trust, 2017). Venable and Milligan (2012) argue that the real-time engagement that is a hallmark of these types of scheduled Twitter chats may lead to transformational discussions. Although it is not possible to identify how many individuals use these chats without engaging visibly in the social sphere, several studies have attempted to capture the value of Twitter chats as a sphere for professional learning amongst participants interacting visibly through retweets, responding to questions, responding to other participants, and liking tweets. Researchers have also examined how different educational groups use Twitter chats as a method of professional learning. Recently, multiple studies have focused on preservice educators' participation in Twitter chats as a beneficial form of professional learning (Carpenter & Morrison, 2018; Delello & Consalvo, 2019; Krutka, 2014; Mullins & Hicks, 2019; Riech, Levinson, & Johnston, 2011). Adjapong et al. (2018) found that educational participants who took part in a #HipHopEd Twitter chat found a sense of belonging within the chat community and reported that the professional learning they engaged in as part of these chats had an impact on their instructional practice; additionally, a majority of participants self-reported that #HipHopEd chat participation "impacted their practice by specifically encouraging them to be more engaging educators, possibly by gaining tools that supported the teaching to the specific needs of their students" (p. 34).

This aligns with the findings by researchers in the social studies education community. Krutka & Carpenter (2016) surveyed 303 "self-identified social studies educators" (p. 44) to examine how and why these educators use Twitter. Seventy-four percent of those respondents listed using Twitter chats for professional learning and a high percentage reported sharing and collecting resources along with using Twitter as a tool for collaboration with other professionals. Like in the #HipHopEd study, the majority of Krutka and Carpenter's (2016) respondents also noted that participation in Twitter chats impacted their teaching through challenging their thinking and exposure to new ideas and materials.

Theoretical Framework

We used a sociocultural learning framework to understand the ways in which teachers engaged in Twitter chats. As discussed in Raphael et al. (2014), sociocultural approaches to professional development hold that learning proceeds from social interactions and is then individually transformative when an individual uses this idea in their private sphere. This cycle of public and private learning, based on Harré's (1983) description of the Vygotskian space, proceeds through four phases: publication or open discussion of information, conventionalization or making an idea normal in the public sphere, appropriation or using that idea in one's private sphere, and transformation of an individual's understanding. Grounding this study in a sociocultural learning framework necessitated a focus on dialogue and social interaction.

Research Question and Methodology

Given the proliferation of teachers' use of Twitter as a space for teacher-led, optional professional learning, in this paper we investigate the engagement of teachers participating in Twitter chats focused on global education. We particularly wished to understand the format of professional learning to complement previous analyses focused on the content of these chats (Quaynor & Sturm, 2019). The research question pursued in this study is: What types of exchanges do teachers have with each other in a hosted Twitter chat?

Methodology

As an examination of online exchanges among teachers, we engaged in qualitative content analysis (Schreier, 2012) complemented with code frequency analysis (Krippendorf, 2013) to understand the ways in which teacher Twitter chats served as a form of professional learning. We focused on two Twitter chats with the theme of global education conducted in February, 2016. The first, #sschat, is a weekly chat affiliated with the National Council for Social Studies (NCSS). The second, #gloaledchat, is a weekly chat hosted by the Center for Global Education at Asia Society. After downloading .pdf versions of the selected Twitter chats conducted by the hosting organizations, we uploaded these documents to the Dedoose (2018) platform for coding. Consistent with the process of qualitative content analysis (Schreier, 2012), we initially individually created descriptive codes for each tweet based on reading the first 20 percent of the Twitter chat transcript. These descriptive codes sought to describe the types of exchanges teachers had with each other, aligning to the research question. In research meetings, we discussed the reliability, validity, exhaustiveness, saturation, and mutual exclusiveness of the codes (Schreier, 2012). We then compared coding lists to identify similar codes, created one shared coding list, and coded 10 percent of the transcript jointly, ensuring over 80 percent agreement on codes and discussing any differences. Following this collaborative process, we collapsed codes into categories with parent and child codes, and completed coding of the transcripts. To move from codes to themes, we examined the prevalence of parent codes in each Twitter chat, shared the findings, and created descriptive themes based on the relationship between parent codes. Appendix A shares the relationship between child codes, parent codes, and themes.

Findings

The main ways in which teachers engaged in Twitter chats included: (1) forming community, (2) networking, (3) sharing resources, (4) dialogue, and (5) structured learning. In Table 1, we have shared the prevalence of these parent codes across each Twitter chat. The most common form of engagement was forming community, at 30% of chat engagement, followed by dialogue (24%) and structured learning (23%). Less common were sharing resources (17%), often in response to a specific query by the host, and promoting one's own personal, professional, or organizational work (6%).

Table 1
Parent Codes Across Twitter Chats

Chat	Parent Code				
	Dialogue	Forming Community	Networking	Sharing Resources	Structured Learning
#SSChat Global Perspectives in Social Studies	252	245	47	139	161
#GlobalEd Chat Local Global Connections	97	199	43	116	186
Totals	349 (23.5%)	444 (30%)	90 (6%)	255 (17%)	347 (23%)

Below, we describe the relationships among these activities in the chat, which we have narrated into three themes. In these hosted Twitter chats, the host leads participants to create community, and teachers connect as people and professionals. Both prompted and unprompted, teachers share resources and dialogue about these resources. Participant dialogue as professionals and learners involves networking and sharing resources they have used or developed.

Theme 1: The host leads participants to create community

In both chats, the host’s first question involved introductions. Participants largely provided professional introductions (e.g., I teach social studies in 8th grade), but some engaged in personal, “fun” introductions.

Figure 1. Screenshot from a #globaledchat session

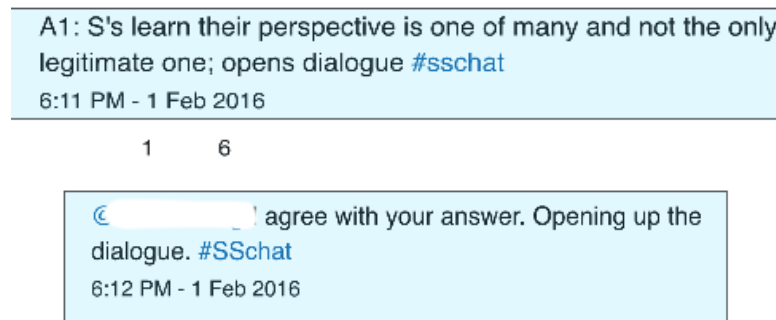


In the above example, the moderator asked participants to introduce themselves and mention their favorite beverage in honor of National Drink Wine Day. This participant shared his professional affiliation, personal information about parenting, and also humor about “not” drinking his favorite beer.

In their subsequent questions, engagement, affirmation, and agreement with others were common. During the #sschat, the participants showed affirmation and agreement in multiple ways, such as the following example of a participant directly stating her agreement with another participant. Although we did not include the number of likes of each tweet in this

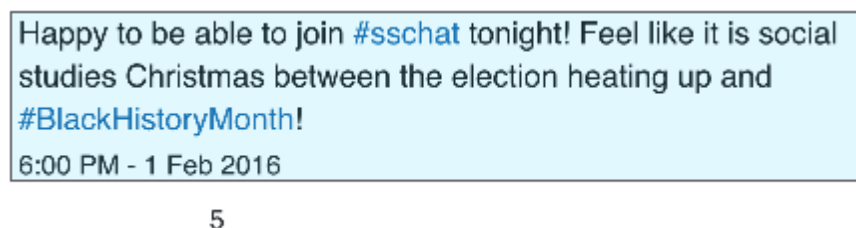
research, one can see that the answer to the first question received six likes along with one direct agreement response.

Figure 2. Screenshot from a #sschat session



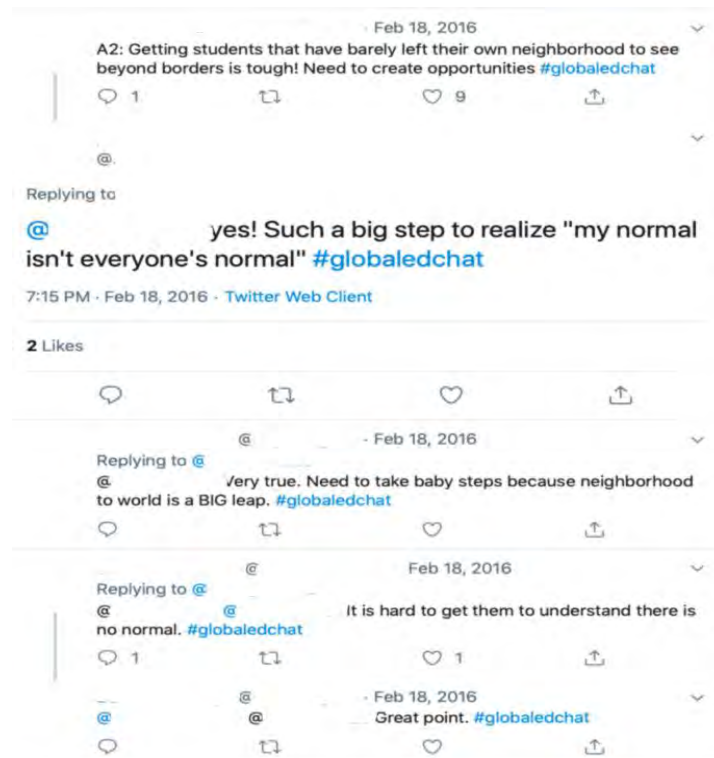
Humor and sharing emotion were also part of this process, with some participants sharing emotion through words such as “happy” and the use of exclamation points, as shown in the tweet below. This participant also showed emotion by comparing the events of the month to a holiday.

Figure 3. Screenshot from a #sschat session



Finally, participants shared experiences and perceived challenges, such as the challenge of teaching students who have had few experiences traveling beyond their community borders. The @ sign is used to respond to participants who share a common challenge, and the responses reflect a shared experience.

Figure 4. Screenshot from a #gloaledchat session

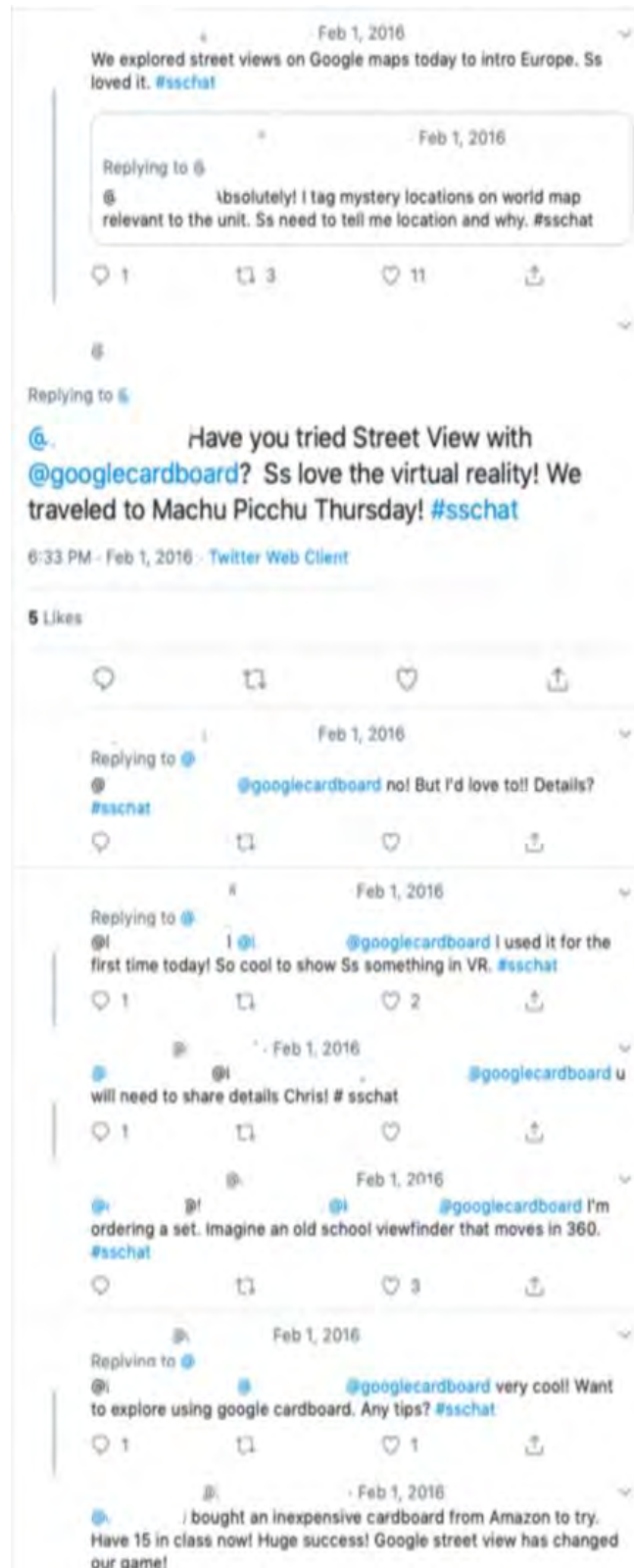


Theme 2: Prompted and unprompted, teachers share resources and dialogue about these resources

In both the #sschat and the #gloaled chat, hosts asked questions that required participants to share resources such as lesson plans or pedagogy ideas. Appendix B contains the questions asked during both chats used in this study; four questions in each chat ask participants to share resources. The #sschat question prompts specifically ask participants to share teaching methods (Q4), curriculum (Q5), classroom successes (Q6), and trusted resources (Q7), which is similar to resources (Q3), strategies (Q5), interdisciplinary project examples (Q6), and ideas for student action (Q7) asked for in the #gloaledchat. The resources shared in the participants responses ranged from links to movies and websites, to tested classroom ideas such as curriculum and informal pedagogy strategies.

Participants also shared resources unprompted by the host. For example, when asked how they think about global education, a participant shared a philosophical resource for the promises and dangers of thinking globally if it reinscribes colonialist/white supremacist power dynamics. Teachers then responded to the sharing of resources with affirmation, encouragement, and occasional questions or critiques. Below, we provide an example of an extended informal exchange about using street views on Google Maps for teaching about international locations.

Figure 5. Screenshot from a #sschat session



Theme 3: Participant dialogue involves networking

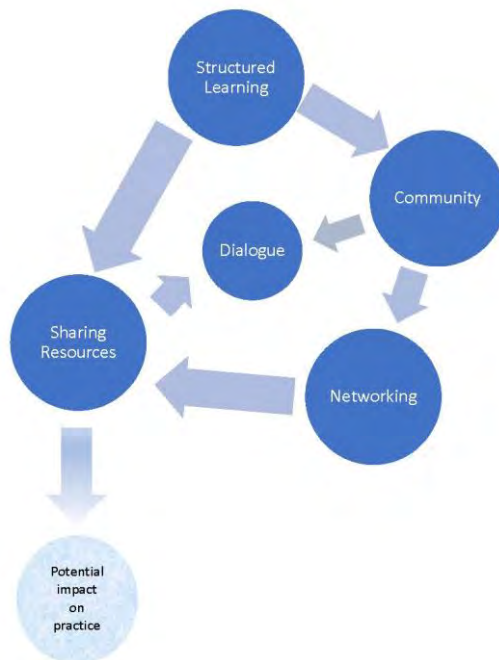
Although less prevalent than other types of engagement, networking was a consistent activity in both of these chats. As organizations have Twitter accounts for marketing and public relations, individuals from these organizations promoted their own initiatives as part of their engagement in the Twitter chat. In the #gloaled chat, the Asia Society (whose member hosted the chat) as well as the Global Exploration for Educators Organization (GEEO), the Longview Foundation, the Global Oneness Foundation, Global STEM Classroom, and IREX International all participated as organizations and often tweeted answers or resources related to their organizational brand. In this example, we see the Global Oneness Project replying to another participant with a link to materials created by their organization.

Figure 6. Screenshot from a #gloaledchat session



As noted within the individual themes, participants' engagement via sharing resources, providing encouragement or affirmation, networking, engaging in structured learning, and informal dialogue are related and mutually reinforcing activities in a learning community. In Figure 7, we provide an initial concept map demonstrating the relationship among these activities as engaged in by participants during the chats. This pathway of engagement held for both the #gloaledchat and the #sschat.

Figure 7. Concept map of parent codes



Discussion

As discussed above, educator engagement in online professional learning communities hosted on Twitter involved multiple avenues for personal and professional connection. In this section, we discuss how this type of engagement maps onto key components of high-quality professional learning: a focus on content, active learning and collaboration, teacher coaching, feedback, and sustained duration (Darling-Hammond et al., 2017). By drawing together educators interested in social studies learning, activity within the chats connected to scholarship on situated learning, teacher agency, and marginalized voices. These connections are detailed below.

Situated Learning

In reporting on meaningful professional learning that translates into changes in practice, Raphael et al. (2014) note that learning should be situated within teachers' professional contexts. In the collective space of a Twitter chat, teachers are able to share and gain what Guskey and Yoon (2009) call "just-in-time" information that they can integrate into pedagogy. As pointed out in Adjapong et al. (2018), the Twitter chat serves as a third space (Babha, 1994) in which practitioners can dialogue with each other and organizations that serve as knowledge brokers in their fields (Cooper & Shewchuk, 2015) regarding problems of practice. Although limited, this type of engagement begins to fulfill the need for teacher active learning and collaboration (Darling-Hammond et al., 2017) in professional learning.

In the hosted Twitter chats studied, students were found to be present in practitioner stories and suggestions; this only partially meets Margolis, Durban, and Doring's (2017) proposal that high quality professional learning requires the presence (either metaphorical or physical) of students. As participants are not engaged in real-time collaboration, the chats do not allow for experiencing a new idea in practice and evaluating if it makes a difference in student outcomes, which is a key component of professional learning (Guskey, 2002).

Teacher Agency

Professional organizations focused on professional learning consider teacher agency to be a key ingredient for teacher professional learning (Calvert, 2016). Participating in a Twitter chat is an example of independent engagement in professional topics, and a way in which teachers demonstrate their agency as developing professionals. These chats are self-selected by teachers and are an insertion of their voices as experts on their own practice in a public forum. This is often displayed in their introductions, such as through participants identifying the courses taught in the area of social studies, or international teaching expertise. Development as professionals is also shown in the ending tweets, which often stated a variation of being able to take a piece of learning from the chat into their classroom. One participant in the #sschat ended the session with this tweet: "I won't be as chipper at 4:30am, but I'll have new ideas to plan out and that's always a great time #sschat -until next time!" In the #gloaledchat, one participant signed off with: "Wow! Thanks for the fabulous ideas! My head is swimming with info!"

The majority of the chat questions for both chats focused on participants sharing their expertise with each other. Vella (2002) suggests that adult learning needs to be relevant, meaningful, and embedded, with the learners acting as subjects and making their own decisions rather than behaving as objects having decisions made for them. Generalized chat questions, while focused on a broad theme, provide space for "participation of the learners in naming what is to be learned" (Vella, 2002, p. 4). The facilitator releases multiple questions at regular intervals during the hour and participants select what, to whom, and when to share information, affirm others' responses, or ask additional questions. Being in a dialogic space where participants have the ability to be both learners and experts increases teacher agency and active learning (Vella, 2002).

Through sharing expertise and providing both feedback and some questions or critique of each other, teachers provide and receive coaching, which has been found to be an effective element of professional learning (Darling-Hammond et al., 2017). Unfortunately, the nature of the fast-paced chats, with seven or eight questions posed within a 60-minute chat, does not appear to provide a forum in which coaching could be sustained. While analyzing both chats using archived material and revisiting several of the tweets that showed responses from other participants, there was no evidence that the conversation threads extended past the duration of the initial chat. Analysis of extended connections or coaching, as well as how teachers

incorporated discussed ideas into their own practices, is a possible avenue for further research in this area.

A Space for Marginalized Voices?

As noted by Adjapong et al. (2018) in their study of #HipHopEd chats, some participants in hosted Twitter chats note that the online community allows for collaboration, innovation, and enjoyment of public space by members working in the social justice sphere. In the wake of testing regimes focused on reading, writing, and mathematics, teachers report limited amounts of curricular time in school focused on social studies topics (Fitchett, Heafner, & VanFossen, 2014; Gilles, Wang, Smith, & Johnson, 2013; Kalaidis, 2013; National Center for Educational Statistics, 2011-2012). Within social studies, the field of global education or a focus on global issues is sometimes under critique from nationalist groups or cautious administrators. As an example of these critiques, one participant in the #globaled chat shared that their school board had cancelled a planned course on World Religions at the high school level.

In the chats studied, participants were able to come together with a group of self-identified global educators to discuss not whether global education was a good idea, but how to put global education into practice. Being a global educator may not be oppositional to all school settings, but because of the limitations on teaching from a global perspective in some school settings, teacher participation in these types of Twitter chats connects to previous research, in which tweets and Twitter chats can be examples of Babha's (1994) third space where individuals can create oppositional, multifaceted identities (Adjapong et al., 2018; McArthur & White, 2016; Yadlin-Segal, 2017). The ability to share resources and promote one's own or one's recommended work, as well as the utilization of a Twitter handle and connection to other Twitter users, all serve to promote and define a teacher's professional identity in the digital age.

Within the chats, global aspects of power and equity were not a central topic of discussion. However, in each discussion, participants brought up the legacies of imperialism or colonialism and considered ways to teach about these legacies and power imbalances. In a community of practice with other global educators, participants also discussed challenges to teaching with a global lens and reflected on limitations to their own practices.

Conclusion

As demonstrated above, teacher exchanges within hosted Twitter chats focused on global education exhibit multiple characteristics of high-quality professional learning. These include a focus on content, active learning and collaboration, and teacher agency. However, the format of the Twitter chat does not allow for other aspects of professional learning, including a clear feedback cycle, sustained duration, the creation of a community of practice at a school, and a hands-on approach (Darling-Hammond et al., 2017).

Digital exchanges and digital dialogue are becoming more prevalent in teachers' informal professional learning (Lantz-Andersson, Lundin, & Selwyn, 2018) and promote participants' sense of belonging within communities of educators with similar interests (Adjapong et al., 2018; Krutka & Carpenter, 2016). The positive response received by participants through likes, comments, and retweets reflects a sense of affirmation, showing the participants reflections of themselves as members in the desired community. The comments and emotions about new resources become windows into different classroom experiences and practices, broadening the educators' knowledge base and providing validation.

While multiple studies have focused on participants' sense of belonging and the exchange of resources within the timed Twitter chats, there is room for additional research on the feedback cycle and on how the initial excitement and engagement with new resources translates into actual transformative classroom practices. Research that follows teachers into their classrooms after a chat to examine if transformation occurs would be of benefit to the educational community. It is still unclear if professional learning through Twitter chats increases curricular mirrors and windows (Style, 1996), or if the absence of sustained duration and deeper feedback cycles could serve as walls, where professional learning is left in the Twitter archive when the chat ends.

Appendix A

Child Codes, Parent Codes, and Themes

Themes	Parent Code	Child Codes
<p>Theme 1: The host leads participants to create community. Parent codes: FC, N, SL</p> <p>Theme 2: Prompted and unprompted, teachers share resources and dialogue about these resources. Parent codes: SL, SR, D</p> <p>Theme 3: Participant dialogue involves networking. Parent codes: D, N, SR</p>	Forming Community (FC)	<ul style="list-style-type: none"> ● Affirmation ● Agreement with other twitter user ● Emotion ● Greeting ● How to engage ● Humor ● Me too ● Parents don't ● Personal information ● Photo greeting ● Professional information ● Student limitations ● Thank you
	Networking (N)	<ul style="list-style-type: none"> ● Announcing connection ● Announcing participation ● Promoting/sharing own professional work ● Sharing group event
	Sharing Resources (SR)	<ul style="list-style-type: none"> ● Sharing pedagogy suggestion ● Sharing resource - theoretical ● Sharing resource - global content information and tech ● Sharing teaching challenges ● What we did
	Dialogue (D)	<ul style="list-style-type: none"> ● @ sign ● Adding information to other user's response ● Answering participant question ● Asking participant for example ● Disagreeing with other Twitter user? ● I will try that! ● Question to other participants
	Structured Learning (SL)	<ul style="list-style-type: none"> ● Answering host content question (about global ed.) ● Question - content ● Question from moderator

Appendix B

Twitter Chat Questions

Global Perspectives in Social Studies

SSChat 1/2/16 hosted by @Caranowou

Welcome to #sschat! Introduce yourself, where you're from & something "global" about yourself.

Q1: What does teaching global perspectives in social studies mean to you? #sschat

Q2: What are obstacles to teaching with global perspectives? How can you overcome these obstacles? #sschat

Q3: What are key issues/dimensions of a global perspective that students should learn? #sschat

Q4: What are methods to teach global perspectives to students who haven't been exposed to much diversity? #sschat

Q5: What curriculum best lends itself to teaching from a global perspective? Why? #sschat

Q6: Share success stories of teaching from global perspective? What is an instance that didn't go so well? #sschat

Q7: Share some of your "go to" resources for teaching a global perspective? #sschat

Making Global/Local Connections for Students

Global Ed Chat 2/18/16 Hosted by @Singmaster

Welcome to [#GlobalEdChat](#)! Please introduce yourself and, in honor of National Drink Wine Day, tell us your favorite beverage.

Q1: What are some issues that are relevant to both your local community as well as to the global community? [#globaledchat](#)

Q2: What are some challenges for students in making connections between local and global issues? [#globaledchat](#)

Q3: What are some current resources that can help teachers connect local issues to global issues? [#globaledchat](#)

Q4: How can travel help bring to life local and global connections?

Q5: What are some strategies teachers can use to integrate their travel experiences into student learning? [#globaledchat](#)

Q6: Do you have examples of interdisciplinary projects that make local/global connections? [#globaledchat](#)

Q7: How can students take action on global issues in their local communities? [#globaledchat](#)

Q8: How does incorporating authentic issues, audiences, and actions enhance student learning? [#globaledchat](#)

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