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ABSTRACT

Class discussion can be a valuable way to meet educational standards and make student ideas visible. Tools like Twitter can be used to encourage discussion both in and outside of class. In this article, we provide (1) a concise explanation of Twitter and its use (including a comparison to similar digital communication tools); (2) a brief overview of educational gains and experiences in using Twitter; and (3) a step-by-step introduction to conducting Twitter discussions using hashtags. We conclude with an introduction to #scistuchat, a monthly Twitter discussion between scientists and students that addresses many of the core ideas in the biological sciences. We invite instructors to join this ongoing discussion series or use the ideas within this paper to begin their own discussion groups on social media.

Key Words: Social media; Twitter; education; science; connections; connect; scientists; hashtags; discussion.

○ What Is Twitter? How Do I Use It?

Twitter is an online application that permits users to post 140-character status updates, or “tweets,” to their “Twitter timeline.” These can be posted directly from the Twitter website, from applications on mobile devices, and from third-party websites and applications. Tweets are displayed in real time and in an information-stream format, viewable on the web even without an account. Users can “follow” other users to see the specific tweets that they post, without needing to form any sort of personal relationship between those who follow and those who are followed.

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a combination of # and a specified group of letters/numbers (e.g., #scistuchat or #biology101). A hashtag is added to a tweet when someone wants to make the tweet searchable by other people on Twitter. Searching for a particular hashtag will allow you access to more tweets that have been written for a specific purpose or on a specific topic (for a detailed diagram with explanations of Twitter’s features, please see <http://bit.ly/abttwitter>).

○ Can Twitter Be Used for Education?

Aside from the increasing prevalence of digital communication in everyday life, recent work has found Twitter to be an effective educational tool, used by students to ask questions as teachers instruct (Young, 2009) and by teachers to reinforce student memory of important class concepts (Blessing et al., 2012). Evidence has shown that students want to use Twitter for educational purposes (DeGennaro, 2008; Spires et al., 2008), even for learning outside of the classroom (Manzo, 2009). Such digital technologies are believed to deepen content understanding and provide students with needed skills, while offering a diverse form of instruction that teachers can leverage (Heafner & Friedman, 2008; Journell & Dressman, 2011; Reich et al., 2012).

Twitter has several advantages over other social media and connectivity platforms. Compared to “heavy” platforms like Facebook, Twitter is light and quick: accounts and connections to others can be made quickly, and answering questions through Twitter is as fast as an instant messenger, particularly because responses are limited to 140 characters (a key advantage compared to Facebook; Wang, 2012). Links with more details or multimedia can be shared in real time (and are searchable later if necessary), and the brevity of tweets also makes it easy for teachers to evaluate or monitor the communication of

several students at a glance (Junco et al., 2011). Students can see which questions are common, and teachers can archive and retweet responses, alleviating the need to repeatedly answer the same question. Students can also “like” a tweet, which allows for a customizable feed that students can use to take notes. Additionally, Twitter appears to eliminate the concerns expressed about privacy on Facebook, as Twitter easily allows the creation of multiple accounts (Hew, 2011; Dyson et al., 2015). Multiple accounts give users a chance to separate personal from professional. Compared to discussion via video conferencing, not only is Twitter free, faster to set up, and unlimited in terms of the number of students who can participate, but the technology behind Twitter is also much more reliable than that of video conferencing. Twitter can be used through multiple websites and phone applications, and the data usage is comparatively smaller than for other forms of communication.

Thus, Twitter is an excellent resource for teachers. It gives every student a voice in class, which translates to higher levels of engagement, learning, and personalization (Junco et al., 2010). Because Twitter is already used by scientists worldwide, it offers teachers a way to easily connect students directly to real-world perspectives of professionals working in the industry on a regular basis, and allows these lessons to continue at home (Journell et al., 2014). Furthermore, the nature of online communication can empower shy students and diversify the viewpoints that are heard (Journell et al., 2014). The use of this social networking tool can increase the social presence of students in a course and enhance their learning experience (Dunlap & Lowenthal, 2009). For example, students have expressed that tweets about courses help them focus on important information, condense expansive material, and access information outside of course times (Trueman & Miles, 2011). However, because students’ online comments may not be productive and could lead to a noninclusive classroom environment, rules and structure need to be established for how to engage on Twitter educationally (Hinduja & Patchin, 2011).

Although teachers can create their own rules, depending on how they manage their own classes, we suggest the following ground rules:

1. Teachers and students should stay positive and stay professional. School discipline rules still apply when we chat on Twitter.
2. Do not click a link from someone you do not know. If it is from someone you know, do not click the link if there is no description of the contents of the link.
3. If someone is bothering you on Twitter, tell your teacher immediately and block the individual who is bothering you.
4. If you are using Twitter in a damaging or malicious way, depending on the severity, you will be banned from Twitter participation. From then on, your assignments will be done on paper.

Additionally, we encourage students to follow scientists and other professionals, while keeping in mind that they are people too and may post things that make students uncomfortable or cause parents to worry. Students are encouraged to unfollow those types of individuals. Self-aware scientists have declined invitations or self-filtered their tweets to prevent these types of issues during discussions with students.

○ Practice in Class

Today’s high school and college students easily understand tweeting, but the practices of how to chat on Twitter “for school” may be more elusive. Because Twitter chats may take place outside of class time, it is important to briefly explain not only your rules, but also how to use Twitter, so that all students are prepared for discussions. To do this, you may need to set up your own account for professional purposes (we suggest following the guidelines found here: <http://en2t.weebly.com/before-you-begin.html>).

To begin, show students your professional Twitter account. Let students investigate other professional Twitter accounts and ask them to find commonalities between the accounts (e.g., profile/bio information, location, picture or avatar, tweets from the user). Invite students to look at professional tweets from preselected scientists (e.g., Karen James, David Suzuki, Neil deGrasse Tyson). Have them discuss the theme, layout, tone, and content; emphasize the importance of maintaining professionalism and digital responsibility at all times. After a discussion about how a professional account should look, give students an opportunity to set up one of their own. Students who already have a personal Twitter account are strongly encouraged to create a second account for professional purposes, to increase their participation in classroom Twitter activities. Students appear more willing to share science learning when they are not faced with peer pressure from friends outside of class; a second, “professional” account alleviates this concern. For privacy reasons, we suggest that students use an abbreviation of their name and limit the amount of personal information they include in their bio. Students also need demonstrations of how to report and block other users whose behavior is inappropriate.

After students have created their accounts, ask them to do a Twitter search for a particular hashtag, for instance #scistuchat. When the search results pop up, tell them to change the “Top” option to “All” and to choose “Live” (Figure 1). This will allow students to see all tweets that have been shared on the hashtag.

Now, ask the students to write a new tweet. They should share their name and something they like to do as well as include the specific hashtag (#scistuchat). After the tweet is posted, it will be visible on the hashtag within a few minutes. If there is more than a three-minute delay in the student’s tweet appearing on the hashtag, it is likely the result of using a new Twitter account or network restrictions that schools may have in place to block Twitter; for these reasons, conduct the setup lesson approximately a week ahead of time. After posting a new tweet, if students are still unable to find their new post on the hashtag search, they may have errantly set tweets to private.

Students will be able to see the posts of other students on the hashtag, whether or not they are following that student. If they click the “reply” button, Twitter will initiate a tweet response, and all the student has to do is enter a comment and the hashtag being used. When students reply to each other using the hashtag, they will see the tweets pop up on the hashtag search. This will give students the chance to see how to use a common hashtag to communicate with others.

At this point, it would be beneficial for the teacher to post questions in the Q1 (i.e., Question 1) format, with corresponding answers by students labeled A1 (i.e., A1 = Answer 1) and so forth. For example, the teacher might post “Q1: How does the environment of a

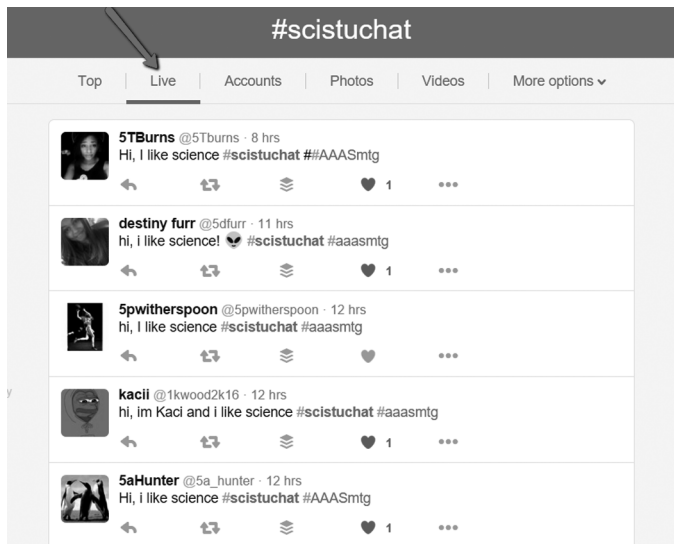


Figure 1. After starting a search for a particular hashtag such as #scistuchat, be sure to click “Live” as indicated in the image above. If you do, you will be able to see tweets posted with the hashtag from anywhere, by anyone.

population affect the expression and spread of different genes? #3rdtaysci” (#3rdtaysci = example of a hashtag that might be used for Mr. Taylor’s third-period science class). All participants then have a chance to answer (e.g., “A1: If an animal has a mutation of no fur, they will not survive in a cold environment. ##3rdtaysci”). With large volumes of students, it often helps if students retweet the “question tweets,” which gives others a better chance of seeing the question among many tweets, and then offer up their answer.

Students are ultimately responsible for their own learning, but the possibility of distraction is real. One method for eliminating the potential problem is to have a set time when students will be tweeting or reading tweets. Setting a time limit (e.g., 5 minutes to send a tweet before devices are put away) has worked in many classes to limit distraction, provided that the teacher is consistent in communicating expectations. If a student is inappropriate in some of their tweets, it is easy to catch and archive such a tweet to document the behavior with administration or parents.

○ In-Class Use of Twitter for Student Learning & Assessment?

Twitter can also be a powerful way to track student learning in the class. Here are some suggestions:

1. On-the-fly student learning and assessment.

During a typical day of class, students will have devices out for tweeting, and a live feed of the class hashtag will be displayed for teacher and student viewing. The teacher will ask a question of the students and give them 30 seconds to think about their answer, then ask them to share the answer by tweeting to the class hashtag. The teacher can see the answers as they are posted and thus get a general feel for the class’s basic understanding of the topic. If it appears that the students as a whole are not getting it, then the teacher can find another way to help them grasp the concept. This is effective because it

requires all students to share a response and thus gives the teacher a snapshot of student understanding.

2. On-the-fly with a link (evidence based).

When questions probe deeper, students can benefit by researching the question on the Internet. Students who already have an understanding of the question can share evidence from a credible site. Students who are still learning about the topic will be able to find a source of information. As a result of the class sharing links on the class hashtag, the class as a whole will have a stockpile of resources and thus have a better chance of finding information that might help them overcome misconceptions or gain deeper understanding of the topic (provided they do not all post the same source).

3. Tweets archived and assessed later by the teacher.

There are several simple, easy methods for archiving student tweets. Archiving the tweets will allow the educator more time to look back over student posts to the hashtag. This will also give the teacher a chance to sort tweets by student name, which will show the overall pattern of individual student answers. When the tweets are grouped by student, the educator will be able to see which pupil might need more time and activities to develop a better understanding of the topic.

○ What Is #scistuchat & Where Is It Going?

Like a somewhat organized question-and-answer session, #scistuchat is a discussion between high school students and scientists/STEM professionals from around the world. The hashtag stemmed from Mr. Taylor’s use of Twitter in class with his students; he happened to read in *Nature* magazine that scientists were on Twitter, tweeting about science (and not breakfast). After scientists were invited, the first chat took place in January 2011 with just three or four scientists and 15 students. The next month a class from Indiana joined in, and it has grown gradually from there. The chat continues monthly on the second Thursday at 9 p.m. EST.

Using the Q1/A1 format above, student moderators post questions to guide the discussion in real time for the student and scientist participants. Individual students are encouraged to satisfy their curiosity and ask questions of relevance directly to the scientists. In terms of positive learning outcomes, at the end of each chat, students and scientists share two things they learned from the discussion. Often students have misconceptions overturned, and scientists learn that some students actually like learning science (e.g., in discussions of “How does the brain change throughout our lifetime?” student @1MLuna responded, “A1 - Your brain adjusts to what you learn and what you experience in life. #scistuchat” and “I learned that we use more than 10% of our brains. #scistuchat”). Through chatting on Twitter, students benefit not only in learning and reevaluating scientific ideas, but also in learning to ask questions – as promoted by devoted instructors and scientists themselves.

○ Internet Equality

Mr. Taylor started #scistuchat in a school with 70% free and reduced lunch (Title 1). Although many students didn’t have Wi-Fi at home, most students or their parents had smartphones with data plans that allow access to the Internet. Students who didn’t have access to

either Internet option were encouraged to meet at a local fast-food establishment with free Wi-Fi. Students and teacher would bring Wi-Fi capable devices and connect to the Internet to participate in the evening discussion. Another educator made a party out of the night chat. Students met together at a particular location, ate pizza, and socialized while joining the discussion. Some educators require student participation in the evening discussion and provide an alternative assignment for those who have other obligations during the time frame. Other educators give extra credit for chat participation.

○ Using #scistuchat to Meet Educational Standards

The purpose of #scistuchat is specifically to start a discussion between students in a class and scientists, as well as between those students and other students outside of class. If students have comments or questions, they are encouraged to ask using Twitter and the #scistuchat hashtag. This allows students to voice their current understanding and questions, giving the teacher a chance to catch misconceptions or inconsistencies quickly.

As an instructional strategy, teachers may want to use such Twitter chats to gauge student knowledge of specific disciplinary core ideas as outlined in the *Next Generation Science Standards* (NGSS Lead States, 2013). Furthermore, the chats support the NGSS Science and Engineering practices by encouraging student to formulate questions about phenomena and engage in discourse (NGSS Lead States, 2013: Appendix F), and help communicate the cross-cutting idea that science is a human endeavor (HS-LS3-3). Scientists are often now seen as “real people” communicating their discipline from around the world, exciting students about science from diverse perspectives without needing to be physically present in a classroom. Scientists are challenged to avoid jargon and succinctly explain, while still being able to share the latest articles, videos, or other web links to supplement course instruction. Indeed, Twitter chats can be used to link practices, content, and cross-cutting concepts to give students an NGSS-supported, deepened understanding of the nature of science and those who conduct it.

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