Special Sections: Opportunities and Challenges of Online Instruction

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Twitter: More than Tweets for Undergraduate Student Researchers

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INTRODUCTION

A vital component of a CURE is feeling a sense of community. While our students often present to each other at the end of the semester, we have struggled with having them interact with a wider audience. A few students may present class results at a regional or national meeting; however, feasibility limits this opportunity to only a handful of students. Twitter has been used as a tool to disseminate scientific findings (1, 2). As a result of COVID-19, scientific societies have used Twitter to provide snapshots of research to be presented at their virtual meetings using "Twitter Posters" (Michael Morrison, https://osf.io/csxad/; https://www.youtube.com/watch?v=fQDL8r3r_d4). We modified this idea so that each student was given the opportunity to present their CURE findings to a broad audience using Twitter. The result was a flexible environment in which students learning both remotely and in-person could interact with each other.

The Cell Biology Education Consortium (CBEC, www.cellbioed.com) hosted a virtual poster session on Twitter and opened the event to faculty and undergraduate research groups. Our goal was to encourage our students to use Twitter positively, promote undergraduate research, and share their findings with the public to increase science literacy. In addition, students were reminded to share their work respectfully. For many students, this was their first time telling someone outside their campus about their research. In total, 19 institutions and over 100 students participated. This broad range of participants allowed us to create a list of best practices and ideas for helping others utilize this resource (see Appendix 1). While Twitter was used exclusively in this case, our approach can span across other social media platforms such as Facebook and Instagram.

Interestingly, the class Twitter poster format was used as a way to provide online and remote students a platform to present their research. However, as a result of having an organized poster symposium, this format was quickly integrated into in-person classes. Although these practices emerged as a necessity during the COVID-19 pandemic, the strategy shared in this paper is likely to remain and become widespread in the post-pandemic world due to the inherent challenges associated with in-person conference presentations.

PROCEDURE

The Cell Biology Education Consortium (CBEC, http://www.cellbioed.com) leveraged its membership to make this online symposium successful. The CBEC email Listserv was used to send the initial invites to member institutions (see Appendix 2). This email also included an interest survey to gauge participation and help with planning.

While the CBEC is focused primarily on using cell culture to develop CUREs, this event was created for everyone: from cell culture to synthetic biology, pedagogical ideas, independent research, and class or group projects were all welcome (Fig. 1). Once we had an idea of which groups were participating, we started organizing release days based on content. We planned to have every participant include the hashtags **#cellbioed** and **@CellBioEd**. However, we also wanted participants to include tags that would help their students be recognized at their home institutions (3).

The 2009 "Vision and Change" report lists the ability to effectively communicate science to a broad audience as an important competency for undergraduate students (https://

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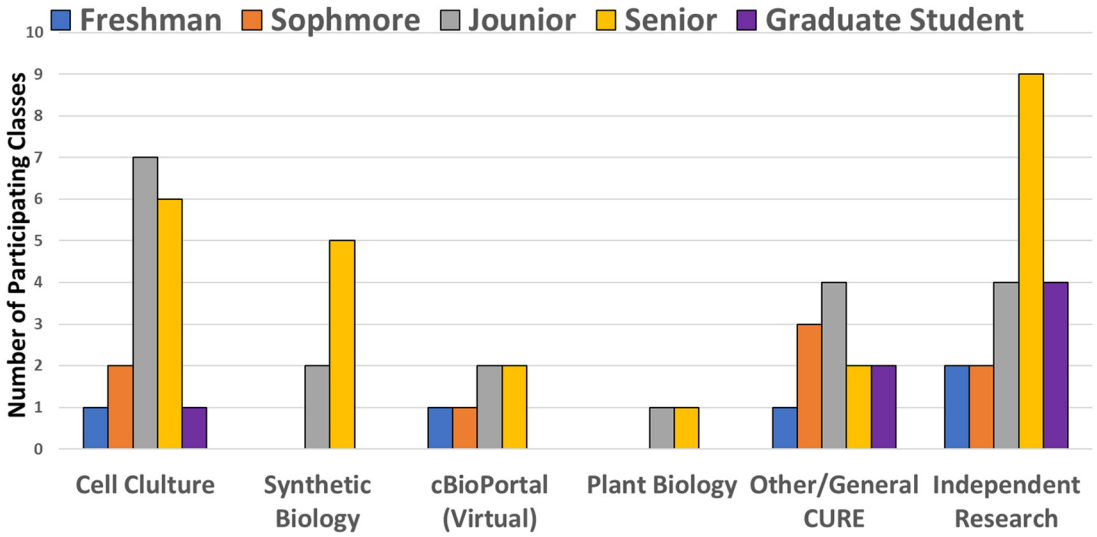

FIG 1. Distribution of course subject and academic classification of participants: The distribution of classes participating in the CBEC Twitter Poster symposium by project type and academic classification. Numbers represent the total number of classes in each category.

live-visionandchange.pantheonsite.io/wp-content/uploads/2013/11/aaas-VISchange-web1113.pdf). As such, the learning goals of the poster session were similar to those of other scientific communication projects (1). However, at least two goals were specific to this new platform (3): (i) students would communicate research findings by creating and delivering a Twitter poster presentation on their CURE projects, and (ii) students would engage with varied audiences and behave as informed, responsible citizens and science ambassadors on social media.

For poster design, we found that 4 to 6 slides worked the best. This translated to about 25 to 30 s for a finished presentation. Students were encouraged to use more pictures than words and to use large, formatted wording that contained the main point(s) and nothing else; this challenged students to distill their ideas down to demonstrate the big picture of what they were doing in their projects. Though the instructional video included the use of GIFs in PowerPoints, we found it easier to export slides with PowerPoint transitions as MP4s with 4 to 5 s per slide (Appendices 3–5). These MP4s were then saved at standard or non-HD resolution. Short and to-the-point presentations seemed to have the most impact when viewed by others on Twitter. These instructions, including an annotated screenshot showing how to convert a PowerPoint into a Twitter Poster, were sent to students and faculty (Appendix 6).

Posters were then split into groups based on their content, with a series of hashtags, and each group was assigned a specific date for posting: #SynBioCURE (April 27), #PlantCURE (April 27), #GeneralCURE (April 28), #BioinfoCURE (April 29), and #CellCultureCURE (April 29). All posters were tagged with three common tags: @CellBioEd, #CellBioEd, and #betterposter. In our experience, hashtags are a quick but semi-temporary way to track data. As more posts are made to a hashtag, older posts become harder to find. However, if the "@" symbol is included, the post is sent to a specific Twitter account and becomes a more permanent record. This is often referred to as "tweeting at" someone. Having students tweet at an instructor or a department account provided an easy way to track student submissions. Students were asked to include institution-specific "@" and "#" as ways to engage with their institution. One thing to consider is that the maximum number of characters allowed in a tweet is 280; students needed to include the assigned hashtags before they added extra ones.

By clicking on a specific hashtag, all of the posters that were submitted in that section could easily be viewed. Posters across all groups could be viewed with the common hashtags. Instructors could also have their students use an additional, class-specific hashtag to help them track their students' submissions. Posters were retweeted through @CellBioEd as a way to increase views. Some instructors had students comment or post questions on a set number of presentations to increase engagement. Students were encouraged to submit their individual posters through their own social media accounts. By doing this, they were able to interact directly with each other, as in a traditional poster session. If students did not have their own Twitter accounts, they could have another student or their faculty member submit their work.

It was important for instructors to check their students' hashtags. Hashtags are spelling and capitalization-specific. Often students would misspell or mis-capitalize the hashtag, resulting in a poster being lost to view for others. We recommend using hashtags which are as simple and concise as possible. It should be noted that no one person or entity owns a hashtag. Hashtags are a simple way to organize and view related content. While any hashtag can be used for this purpose, we recommend instructors look at previous posts under a given hashtag before utilizing it.

Each instructor decided whether they wanted to incorporate Twitter posters as a graded assignment or an extra credit assignment for their class. Many instructors chose to do the latter, requiring their students to evaluate at least three other

Twitter posters prior to submission. A grading rubric (Appendix 7) helped students to provide constructive criticism on the reviewed posters. Since this was done prior to submission, students could use the comments received on their posters to make changes. Students were graded based on their peer evaluations, whether or not they made changes based on peer comments, and the overall content of their posters. This strategy of evaluating three other Twitter posters ensures visibility and will work well even if the Twitter poster session is organized by one instructor in a small class setting, and not as a part of a network of collaborators such as CBEC.

Instructors need to be mindful of limitations and concerns with the Twitter poster format. It should not be assumed that every student has a Twitter account or that they would be comfortable making one. A departmental or class Twitter account to which student posters can be uploaded alleviates personal privacy concerns for individual students. A 2011 study showed that privacy and integrity are the two main concerns faculty express in using social media for teaching purposes (4). A more recent study acknowledged these concerns, but found that faculty still wanted to use social media because of the many advantages it provides, including the following: "student feedback from multiple sources," "more engaged students," "information sharing," "stronger classroom community," "higher quality student collaborative work," "discussion opportunities," "improved creativity," and "preparation for the work environment" (5). Additionally, instructors must facilitate an equitable environment by addressing the digital divide caused by lack of access to an Internet connection or a digital device.

While the enhanced visibility presents an excellent opportunity for students, there is a risk of prematurely sharing research findings on Twitter. However, presenting data on Twitter is similar to presenting unpublished data at a research conference (6). For many, there can be inherent discomfort in expressing and receiving productive criticism on a social media platform. Often, criticism on social media can become a portal for cyberbullying (7). It is critical to have clearly laid-out instructions and expectations related to conduct.

However, Twitter poster sessions can be a compelling instructional opportunity to engage students in ethical scientific communication and consumption (2), while at the same time training students to convey the big ideas related to their research to people from around the world.

CONCLUSION

The result of this first attempt to host a Twitter poster session for undergraduate CURE students was successful. Overall, posters received over 1,300 direct views. While Twitter does not differentiate between direct views and unique views, the number of views is still a reflection on overall engagement. Some data were hard to track, and total views are likely higher than indicated. For example, thirty-five students in a freshman biology class at Ouachita Baptist University analyzed open-source data collected from Gorongosa Nation Park in Mozambique, Africa (8). Students included additional hashtags specific to this project. As a result, Gorongosa recognized their research by retweeting their work (Fig. 2). Retweets are a method of quickly sharing a tweet with all the followers of that Twitter account. The Gorongosa retweets were sent to over 4,000 accounts all over the world. This was especially exciting to our students and showed the outreach potential of Twitter posters to a broad, international audience, something not possible when using a traditional poster at a local or regional meeting.

FIG 2. Screenshot of a retweet of a student's posters from Gorongosa National Park's Twitter account.

As in the Gorongosa retweet example, once a post went viral, it was nearly impossible to track the number of views. Additionally, views cannot be tracked for GIFs as they are for the MP4 format. Capitalization is important and, if students made a mistake in their hashtags, their data were lost. In some instances, if a poster was tweeted "@" at faculty member, it could then be retweeted with the corrected hashtags. Perhaps most importantly, students affirmed that the learning objectives were reached. One student at Jacksonville State University summarized this: "Typically, when I explain any of the research we do in the lab, I tend to speak for a long time and go into some depth about the material. Presenting in this fashion challenged me to really narrow down the research to the most important topics, an ideal tool to maintain someone's attention and not take up too much time."

Our hope was that all participating students would academically engage as informed and responsible scientific ambassadors. This event allowed them to begin or add to their scientific portfolios as young investigators. Responsible and ethical science communication is a crucial skill set, as it can help to debunk misinformation, affect complex societal changes, increase appreciation for science, and influence decision-making and policy (2, 5, 7). Additionally, we hope that this served as a way to increase the visibility of undergraduate research for policymakers and administrators. This platform allowed faster communication and interaction, with instant responses from a large and varied audience. Our students were able to engage with both scientific and non-scientific communities at a time when such communities could not meet in person. What started as a way to reach students in an online or remote environment has now modified the traditional learning environment. While most instructors who participated in this year's Twitter session utilized this as a one-time extra credit opportunity, this activity could certainly be expanded into a full-semester science communication course or a certificate.

SUPPLEMENTAL MATERIAL

Supplemental material is available online only.

SUPPLEMENTAL FILE 1, PDF file, 0.6 MB.
SUPPLEMENTAL FILE 2, PDF file, 0.4 MB.
SUPPLEMENTAL FILE 3, MOV file, 0.3 MB.
SUPPLEMENTAL FILE 4, MOV file, 0.1 MB.
SUPPLEMENTAL FILE 5, MOV file, 0.2 MB.

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