

Connecting Scientists With Students Using Social Media in an Undergraduate Science Course

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Abstract

Social media tools like Twitter allow scientists and other technical subject area experts to interact with the public in previously-unimaginable ways. Here we present a lesson plan in which undergraduates in a non-majors science course (introduction to marine biology) are asked to follow experts on Twitter from a carefully curated list and then complete a series of follow-up activities and reflections. This assignment is not only popular with students, but also supplemented their formal learning, allowed students to engage more deeply with subjects of personal interest, and has created life-long learning opportunities while improving science literacy. The lesson plan guidelines shared here can be adapted to other branches of science.

Keywords

science education, social media, Twitter, non-majors, marine biology

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Introduction

The products and processes of science affect us all, whether we are scientists or not. Therefore, scientific literacy has been long prioritized as a vital component of science education at both the K-12 and undergraduate levels of education (e.g., AAAS, 2011; National Academies of Sciences, Engineering, and Medicine, 2016; National Research Council, 2012; OECD, 2016). This means not just memorizing facts from a textbook, but understanding the process of science, including the uncertainties and limitations of scientific knowledge, the role of evidence, and key scientific standards and institutions. This understanding can affect how citizens make a variety of everyday important decisions, including those related to vaccination, climate change, water fluoridation, artificial intelligence, biodiversity conservation, and energy usage (e.g., Howell and Brossard, 2021; Yacoubian, 2017).

There is an overwhelming amount of complex, nuanced, and often-changing information about science that is available across different media, and there is also a growing and distressing amount of misinformation (Howell and Brossard, 2021 and references therein). Therefore, there is a need to provide students with the necessary skills to navigate these complex issues. Given the inclusion of science literacy competencies in reports such as AAAS's Vision and Change (2011) that are used to construct undergraduate curricula, undergraduates majoring in STEM (science, technology, engineering, and mathematics) fields should ideally develop these competencies. The many students who major in non-STEM fields, however, also need to learn these skills and concepts. One place to reach these students is in a STEM course designed for non-majors, taken by students as part of general education requirements for their other degrees.

Social media and Web 2.0 tools can be an engaging way to expose students to the process and products of science by allowing students to hear directly from practicing scientists in their field of interest, allowing for the sharing of up-to-the-minute updates from labwork and field expeditions, expert personal opinions on the news of the day, and even the opportunity to ask questions directly to relevant experts. These online communications tools have long been recognized as a source of scientific information (Brossard, 2013; Howell and Broassard, 2021), but are increasingly recognized as pedagogical tools (Barrot, 2021; Malik et al., 2019; Tess, 2013). Twitter, a micro-blogging and social media site, has become a useful tool for both formal and informal science education (Malik et al. 2019 and references therein), and one that increases student engagement (Kunka 2020; Welch and Bonnan-White, 2012). Science Twitter is a particularly active and engaging corner of Academic Twitter (Collins et al., 2016), and offers the opportunity for the public to interact with expert scientists and practitioners active in STEM fields. This provides an interesting opportunity for students to engage with a scientific community that they might not otherwise have to. Biology Twitter, especially ecology, wildlife sciences, conservation, and marine science, are especially active compared

to other STEM disciplines (Collins et al., 2016; Darling et al., 2013; Ke et al., 2017; Shiffman, 2018).

Here we discuss a semester-long assignment in an introduction to marine biology course for non-STEM majors. Students follow experts in ocean science, conservation, management, and industry on Twitter from carefully-curated, instructor-supplied list. The students report weekly on what they have observed and learned, thereby integrating the assignment with the course's stated learning goals. We provide some preliminary analysis of results and student feedback received, and discuss potential ways that this assignment could be modified for other subject areas within STEM education.

The Assignment

Overview

Author DSS teaches "Introduction to Marine Biology" at Arizona State University, an introductory STEM course for non-STEM majors that many students take as one of their required natural science courses, per general education requirements. Over the course of a semester, students are asked to follow a group of scientists and STEM practitioners from an instructor-provided list, check Twitter briefly every week, and find (at least) one post each week that they found interesting and relevant to class. These posts are shared via a weekly discussion thread on the course's learning management software (LMS) platform, where the student is asked to provide a reflection on why the thought the tweet they selected was interesting and relevant to the course. These reflections are the basis for the students' grades on this assignment, with students earning full credit if they pick a relevant tweet and thoughtfully explain what they found interesting about it. The first week and last week have slightly different discussion thread prompts, given their positions within the semester.

Student Learning Objectives

From this assignment, students should learn a variety of informal background information about the processes of science and the people who conduct science. Posts often reveal to students a typical day in the life of scientists and STEM professionals, introduce students to the real people behind scientific discoveries, and provide students with access to up-to-the-minute scientific content. Ultimately, students learn that science is a process involving real people with real implications for everyone's day-to-day life, not a mysterious black box that produces results randomly. This level of science literacy is not necessarily conveyed through traditional classroom approaches, such as lectures and exams. This assignment explicitly asks them to engage in science in a way that is accessible to the non-scientist, with the hope that Twitter provides a mechanism for them to stay engaged at a basic level beyond the course itself. This assignment

also challenges them to decipher information on social media and evaluate, at a basic level, its validity.

Creating a Twitter Account

In week one of the course, the instructor provides detailed instructions (see Supplemental Materials) on how to create a Twitter account (for students who do not already have one). Additionally, the instructor stresses that if students do not want to use their pre-existing Twitter account for a homework assignment, they are free to create a separate account just for the course.

It is important for instructors to realize that students may have valid reasons, including reasons they might not wish to share, for not having their real name and current location off of social media. However, Twitter's terms of service does not allow users to pretend to be a real person who they are not, as this is "impersonation." For this reason, we recommend offering students the option of making a pseudonymous account, one that is clearly not impersonating anyone, but also protects students' privacy and security concerns. A common template used in this Arizona State University marine biology course is "ASUMyFavoriteOceanAnimal," resulting in usernames like ASUManatee, ASUOrca, and ASUSeahorse. The instructor is grading student performance solely by weekly posts on the course LMS and is not monitoring how students use social media directly, so pseudonymous accounts like this have no impact on the assignment's feasibility or ease of administration.

Following Experts

After creating a Twitter account, students are asked to review the "bio" entry (the account owner's brief description of someone's background and expertise and what they post about) of experts from a list described below, and to follow at least 25 of the accounts on that list. A minimum number of accounts to follow is important to ensure there is always recent content available to students, because some users are occasionally inactive in a given week.

Author DSS has created a carefully curated list of Twitter accounts suitable for this assignment (henceforth, "the list.") This list is regularly updated, but can be viewed as it was during the time period covered in this paper in Supplemental Appendix 1.

For instructors seeking to create an analogous list of experts on Twitter for their own discipline, here we provide the inclusion criteria used to create the list (Figure 1). First and foremost, to be included one must be a credentialed, experienced expert in some area related to the subject of focus, which we stress includes graduate students who are some of the most active users of Science Twitter (Darling et al., 2013). There is a great deal of misinformation on social media, some coming from misleading or fraudulent accounts (Ford et al., 2021), and it is important to ensure that students are exposed to accurate information from credible sources. Some

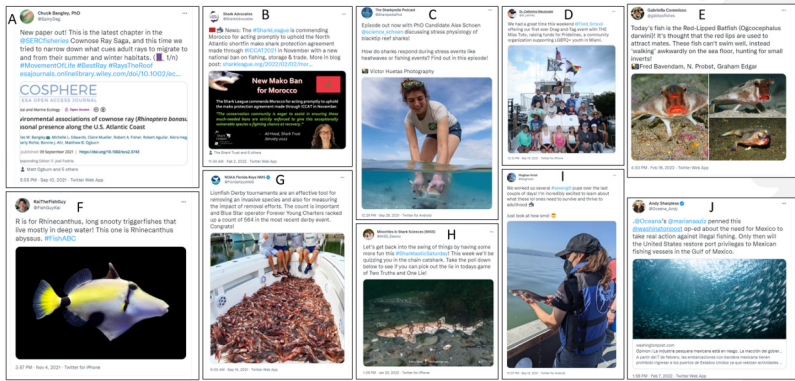


Figure 1. Some representative example tweets that students reported learning from in Fall 2021 and Spring 2022. These include (A) a scientist sharing news of a new paper (and explaining in subsequent tweets what they found and why it was important), (B) shark conservation policy news, (C) a new episode of a podcast in which graduate students are interviewed about their research, (D) an inclusive marine biology fundraiser, (E) fun facts about interesting fish species, (F) photography of interesting fish species (in this case as part of a game #FishABC where every day people had to tweet a photo of a fish whose scientific name started with a certain letter), (G) a government account sharing news of a recent event in which community members killed invasive species, (H) fun facts about sharks in the form of the “two truths and a lie” game, (I) an early career scientist sharing a field adventure with fun and informal language, and (J) an environmentalist sharing an op-ed about ocean policy.

instructors may wish to supplement this assignment with some kind of information literacy/fact checking exercise, but in our experience doing this is complex and time consuming.

For a broad introductory course, experts should include a mix of professional areas of focus related to that discipline. In this case, the list includes marine biologists studying a variety of taxa (we note that the relatively large number of shark scientists on the list is due to disproportionately high Twitter use by this subdiscipline, and that these scientists do not exclusively post about sharks), conservation advocates and policy experts, government natural resource managers, and representatives of various industries associated with the blue economy such as fishing, shipping, and wildlife tourism. Though Twitter is not used equally all over the world, a geographic diversity of experts is important because students have reported finding it especially fascinating to learn about places they have lived or places they have always wanted to visit. That said, due to expectations about student knowledge in an introductory non-science majors STEM course, accounts tweeting in English were the only accounts considered for this assignment. Demographic diversity of experts is also important, as it is always important for students to be able to see professionals in the field who look like them

(Lee, 1998; O'Brien et al., 2017); this is perhaps especially important in an introductory course where students may be discovering new areas of interest (i.e., a student may not previously have considered a STEM career prior to taking an introductory non-majors course).

In addition to professional expertise and geographic and demographic diversity, frequency and style of Twitter use should be considered. A famous “big name” scientist who rarely tweets is less useful for this assignment than an early career scientist who is an experienced and engaging communicator and frequent Twitter user. Additionally, some scientists act completely professionally on Twitter at all times, while others get silly and fun, and students have reported appreciating a mix of styles.

Additionally, while scientists are of course free to tweet about current events or whatever else interests them, someone with a PhD in marine biology who very rarely tweets about marine biology is not especially useful for this assignment's goals. Finally, there are many excellent Twitter accounts focusing on accountability of misconduct in science and improving the culture of science, and while these play a vital role in the Science Twitter ecosystem, they may be too advanced for students in an introductory course for non-majors where students may not know the context of misconduct and proposed reforms.

Things to Stress to Students

While much of this assignment is flexible and can be adapted to the needs of the educator and their course, we strongly recommend stressing the following points to students, as they have proven vital in making this assignment popular (see section “End of Semester Reflection”), successful, and essentially conflict-free.

Importantly, the scientists and other experts the students follow are real humans who have full and complex and nuanced lives, and therefore do not simply tweet about marine biology and conservation. DSS has stressed to students that if an expert tweets something that a student finds problematic, not to engage with them, but simply to unfollow them and report this to DSS. Twitter can sometimes lead to explosive arguments (by which we do not mean technical debates between experts, which can have significant educational value), and while these arguments may have their place, a homework assignment for an introductory science course is perhaps not that place.

Finally, while Twitter is full of wonderful people whose accounts can contribute to learning and inspiration, there are also trolls who seek out conflict and confrontation. Following the “Netiquette” guidelines used by Arizona State University <https://asuonline.asu.edu/newsroom/online-learning-tips/netiquette-online-students/>, DSS has stressed to students that if someone tries to pick a fight with them, to not respond in kind—someone else behaving poorly is not an excuse for you to behave poorly.

Week One of the Assignment

After creating a Twitter account and following at least 25 users from the list, students are asked to do two things. First, students introduce themselves to the experts they are following, using some version of instructor-provided suggested text that students can, but do not have to, modify: “Hey @ExampleUsername, I am following you on Twitter for my science class taught by @InstructorUsername .” This is done because some scientists, leery of online harassment, closely monitor their new followers and may be leery of a large group of newly-created Twitter accounts following them. Though this is not required, the experts that students introduce themselves to often reply with a welcome message, and students often report that they’re excited to get direct one-on-one engagement in this way. Instructors may wish to select an alternative introduction text, but we recommend using some introduction text.

Next, the first week’s class discussion thread on the course LMS asks students to choose 5 of the (at least) 25 accounts they’re following, and briefly explain why that account’s bio was exciting or interesting to them. A representative selection of responses to this prompt can be found in Table 1.

Responses show that what drew students to particular accounts was a mix of their areas of expertise, the locations where they work, humor and personality shining through, and drawing inspiration from people’s personal backstories (especially with respect to coming from historically underrepresented demographics).

Subsequent Weeks of the Assignment

Every week other than the first and last week, students receive the same prompt on a class discussion thread through the course LMS: “What’s something interesting that you learned this week from following experts on social media, and why did you think it was interesting?” We note that we have seen other instructors use versions of this assignment where students are graded on how often they ask questions of the experts they follow, and we recommend against this—it results in asking not especially insightful questions just to check a box on an assignment, which can frustrate the experts being followed. As this assignment is described here, students are free to ask questions if they sincerely are curious about the answer, but doing so does not affect their grade—a system which results in fewer but better questions.

Representative example tweets that students from Fall 2021 and Spring 2022 iterations of this course chose as examples can be found in Figure 2, demonstrating a mix of new scientific research, adventures from the field, personal stories from scientist and conservationists, and policy news.

To further illustrate the range of tweets students were interested in, a subset of selected tweets from one course (Fall B, 2021) were examined in greater detail. Posts about tweets of interest to students from the start of class, halfway through

Table 1. Representative Example Week 1 Posts on the Class Discussion Thread Explaining Why Students Chose to Follow the Accounts They Chose.

I chose to follow her (@BrynnMDevine) because her bio says she loves “deep-sea weirdos,” I took to mean creepy or weird-looking sea animals, and I am always fascinated by those kinds of things. She also labels herself as a “ichthyologist” (which I had to look up, but it’s someone who studies fish), so I thought it would be interesting to see if she posted about any unique fishes.

Another account @CoralCityCamera caught my attention right away because of the gorgeous and colorful pictures and videos they tweet about. This account posts underwater camera streaming live from an urban coral reef in Miami, FL which is super cool!

Christopher Mah @Echinoblog shares a lot of fun information and really cool pictures about Starfish. I think it’s really cool to read and see all the different types of Starfish that are in the ocean. He also shares a lot about the bottoms of the ocean and all that live there such as sea slugs and crabs and sea algae. His account it really just a different perspective from the usual beauty of the rest of the ocean.

Dr. Ayana Elizabeth Johnson @ayanaeliza- was followed because not only does she study marine biology but also policy! I’m hoping to gain some inspiration as I am a public service & public policy major who is also interested in marine bio.

I chose @MA_Sharks because they are located in Massachusetts (MA), which is where I am from! I grew up on shores of Massachusetts so it is cool to see someone tweeting about stuff from back home.

One of the first accounts that I followed was @dr_catmac. I followed Dr. Catherine Macdonald for a couple reasons. I followed a lot of women from the list because I want to support women in STEM, but I really liked Dr. Macdonald’s account because it looks like she sprinkles in jokes and memes into her tweets. She even was responding to other ASU students that have followed her

First, I picked @Curly_Biologist because I can relate to her as a black woman in a field that doesn’t foster as much diversity. Also she is getting her PhD, so maybe I could still relate to her as a college student

@RileyPollom Riley Pollom is a Global Marine Conservation Coordinator from my local zoo! And on top of that we live in Indiana in the middle of the country! So I am excited to see what kind of research and information he has that is going on right in my city!

The account that most appealed to me from the outset was @BobSluka, I found his bio to be very appealing since as a lifelong Christian, I always find the marriage between Faith and science to be interesting, Professor Sluka is the head of the marine department of a Christian conservationist society so I really enjoyed seeing that.

@smangubhai: I really wanted to get a global perspective on the marine biology field, so most of the people that I followed are from different parts of the world. @smangubhai is Sangeeta Mangubhai, a Fijian ecologist who works in conservation (and other fields) in the pacific. I’ve always been very interested in that part of the world and the flora and fauna there.

Next, I followed Johnathan Moore, a Canadian biologist with an emphasis on rivers and salmon. I mentioned in my introduction that I come from Alaska and I used to fish in the summers as a kid, so when I saw someone who specifically studied salmon I had to stay in the loop. Plus salmon videos are super interesting to watch.

(continued)

Table 1. Continued.

Halley E. Froehlich @DocFroehlich : I chose to follow her because she studies aquaculture, fisheries, & climate change. I am interested in learning more about aquaculture because I do not know a lot about it - so I thought by following her, I would learn more about it.

@DivaAmon. I followed Dr. Amon because she is a marine biologist focusing on the deep sea. I too am fascinated by our ocean floors which remain largely unexplored due to the pressure of the deep ocean. I chose to follow this account because it is important to support women in scientific positions and to learn more about the deep sea.

Dr. Luiz Rocha (@coralreeffish) caught my attention because in his bio he listed one of his interests as photography, which happens to be an interest of mine as well, I'm fascinated especially by the idea of underwater photography.

I followed @KjParton because in his bio I saw that he had Plastic Pollution and Sharks, two things I am very passionate about. I followed him with the hope that it will keep me updated with sharks and plastic pollution and what I can do to help.

Dr. Misty Paig-Tran, @FABBLab, caught my eye immediately as she focuses on whales as well as many other sea creatures. Whales are my favorite sea creature and would love to learn more about them as she tweets about ocean life

Minor typographical errors have been corrected to facilitate readability. See Supplemental Appendix 1 for the complete list of all accounts on the list and their bios.

class, and near the end of class were analyzed for their general content and area of focus.

Tweets were coded for two variables: Taxon or system of focus, and general type of tweet. Taxa and systems included marine mammals, sea turtles, sharks and rays, bony fishes, sea birds, plankton algae and plants, corals and coral reefs, other marine invertebrates, the deep sea, polar regions, and beaches and coasts. General types of tweets included reporting on a new scientific discovery, conservation threat or problems, conservation solutions, academia life (including stories from the field or lab), and “meet an animal” type posts that presented a little-known but interesting species and shared facts about it.

There were no trends in frequency of selecting either taxon/system of focus or general type of tweet among weeks. Bony fishes were the most common taxon of focus in students’ selected tweets—more selected tweets were about bony fishes (29.9% of all students’ tweets in this time period) than about the second-most commonly selected taxon (marine mammals, 13.8% of tweets) and the third-most commonly selected taxon (sharks and rays, 13.3%) combined. This was driven by “meet an animal” type posts, which often included beautiful photography of the fish species in question. Students reported that they appreciated learning about bizarre and beautiful wildlife and biodiversity that they didn’t otherwise know existed.

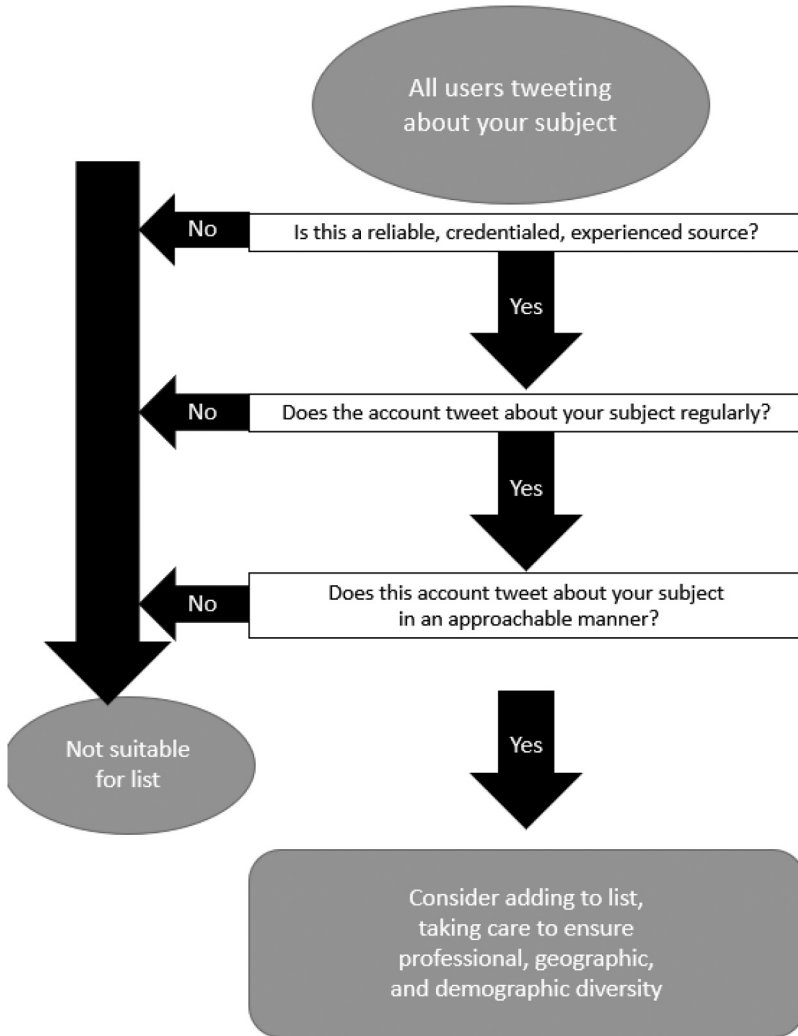


Figure 2. A flowchart to guide instructors in the process of creating a useful list of experts to follow for their course.

The most popular type of tweet, as measured by the number of students who selected a tweet of this type as their “favorite tweet of the week,” was “meet an animal” posts (41.9% of all tweets). These were often about bony fishes, but also had many posts about marine invertebrates. Conservation problems (20.1% of tweets) and conservation solutions (18.9% of tweets) were the second and third

most common types of tweets. Notably, while stories about academia daily life, including field expedition adventures, were only selected in about 5% of posts, these often had very enthusiastic student comments associated with them.

The Last Week of the Assignment/End of Semester Reflection

During the last week of class, students' class discussion thread asks them to reflect on this assignment. Any thoughts are welcome, but they are specifically asked about whether they found it valuable to be able to directly access professionals in this way. ["Please reflect on the Twitter assignment. What's something you've learned from following experts on social media that you didn't learn in your readings or in lecture? What is the value of direct access to experts like this? Did anything about this assignment surprise you?"]

Students often report some initial skepticism of the educational value of social media, but many report loving the experience. Some representative example responses are provided in Table 2.

Conclusions and Recommendations

While the assignment discussed and assessed here was assigned in an undergraduate non-majors marine biology course, we have also deployed this assignment in an undergraduate majors marine biology course, an upper-level majors course in ocean conservation and policy, and a masters-level course in shark biology. Anecdotally, students reacted similarly as those we included in the present study, although we have not formally assessed the assignment in those courses and do not report any of those student responses here.

We can also easily imagine modifying this assignment for other STEM fields, however the nature of Twitter users' activity in each field varies. We recommend that this activity be used for STEM fields where the tweeters are engaged heavily in public science education. For example, the number of life scientists participating in public engagement on Twitter is relatively high (Collins et al., 2016; Darling et al., 2013). Outside of the life sciences, astronomy in particular has an active Twitter presence that would lend itself well to this kind of assignment (Collins et al., 2016; Darling et al., 2013). On the other hand, computer Science Twitter is mostly aimed at other computer scientists (Ke et al., 2017) which may be inaccessible to introductory computer science students but appropriate for those further in their careers.

Regardless of the particular STEM field, we also recommend that the instructor curate a list of appropriate Twitter users for students to follow (see earlier section on "the list" for our advice and guidance). Twitter users vary considerably in their frequency of posting content, the type of content they post, and their tone and accessibility. Ideally, the curated list should include users that post fairly frequently, whose

Table 2. Representative Student Reflections From the Assignment at the End of the Semester.

At first I was not thrilled about the Twitter assignment... And this ended up being the thing I looked forward to the most in this class. I loved the discussions to see what everyone else was finding and loving on Twitter and I even loved being on a couple times a day checking out what the scientists and aquariums and other accounts that I followed were up to. I think it was extremely beneficial to see scientists out in real time doing their part to study and help conserve the ocean and all that reside in it. It ended up being really important to see what current events these scientists genuinely cared about and had a passion for too! It was a really great addition to the course and I loved it!

Through the use of social media and following these Twitter accounts, I have seen real life findings or facts that go beyond the lectures and readings from class. These marine biologists are a great way to stay updated with real life and to keep up with these biologists and all the super cool things they share on social media... This is a great way to stay connected to the world of marine biology and to get a daily dose of all things regarding the ocean, for fun!

I think the best thing about following these accounts is that I got to follow along with scientists every single day and see new discoveries. Getting these live updates about new or cool findings in the ocean is something that lectures and readings cannot give. I think there is a lot of value in being able to follow scientists because no amount of textbook readings, blog posts or videos can truly detail the day to day actions of these scientists, as their day to day findings are changing every minute. Twitter gives them a platform to instantly update their followers, which I find really valuable since every single day is different.

It is valuable to be able to follow scientists on social media because it is a super accessible way to find interesting, informative news stories and other information. I have seen a lot of fascinating things throughout this Twitter assignment that I would not have otherwise seen. The value of being able to follow scientists directly on social media was being exposed to so many real-world discoveries, and to be able to see high-quality pictures of organisms that we would not have seen otherwise. Seeing pictures helps make the marine bio class experience feel more real, and it connects us to the organisms and environments we are learning about.

It's like the entire marine biology Twitter community is its own club (or family?) – with inside jokes, heated arguments, camaraderie, all of it. Being able to follow scientists on social media is really cool because it humanizes them so much more than just watching their lectures or reading their research.

Out of the marine scientists that I followed for this assignment, some included marine ecologists, spatial ecologists, oceanographers, wildlife educators, marine paleontologists, marine conservationists, and aquarium workers. I find it shocking and fascinating just how diverse the study of marine biology is, since I grew up thinking of it as a general profession with no real specialties under it until this class! As someone who isn't a science student or future scientist, I wasn't really aware of how many different jobs and studies there are within science, and how scientists can either focus on a large field of expertise or an incredibly specific one, such as a certain species or area. My experience with following so many marine scientists and organizations on social media has been truly illuminating to the fact that scientists, like all other professions, are also normal people

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Table 2. Continued.

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- By following scientists directly on social media, you can learn what the daily lives of scientists is like rather than just seeing science in its best moments.
- Something that I learned from following marine biologists on Twitter was even though people are all over the world, you can always see what people are discovering and learning. I never realized how many opportunities there were out there for marine biologists and how cool it looks to be on the ocean tagging sharks and recording data. For me I valued being able to see people actually doing what we were learning about so I could see how it related to the real world.
- The value of following doctors and other professionals who work in the animal field on social media is the ability to check in to see what their day to day life is like. I don't have to imagine anymore. I know. I really appreciated this assignment. And I will continue to use my Twitter account to stay informed on what's going on in the ocean after the course ends.
- I learned a lot about what type of research there is out there. I've seen many biologists update their Twitter feed to let us know what their students are up to and where their research is. I think this was the most beneficial part of this assignment. I was able to get a more personal view of what people are researching and what step in their research they were in rather than the final product of their research.
- Something I've learned about marine biology is that a lot of different types of people have interest in the field. While scientists and conservations obviously do, governments and businesses are also often very conscious of developments in the field, in case any effect their policy/bottom line. The value of being able to follow scientists directly, in my opinion, is that it allows scientists to report their findings and conclusions without having to go through an intermediary, like a news outlet.
- This is a very broad observation, but I was impressed at just how active marine biologists/ocean conservationists are in their communities. When we think of researchers, we often think of people who do research by themselves and publish papers that are confusing to anyone except highly specialized marine biologists (no offense to the scientists out there!). However, the Twitter assignment demonstrated that marine biologists not only make efforts to include their communities in their research (I saw several organizations hosting trash cleanups and doing research about the amount/type of trash they found) but also make efforts to share their findings with their communities (nearly every tweet I saw during this project was an attempt for a researcher to share what they know). This type of engagement is not something that can be captured in lectures/textbooks, and it was really cool to see firsthand how excited scientists are to share their work. Following scientists on social media creates a way for us to learn more about science without reading through dense research reports. Twitter is an awesome platform, and I'd be interested in finding scientists from other disciplines and seeing if they interact with their communities in the same way that marine biologists do.
- I think the value of being able to follow scientists directly on social media is live-time updates and interactions. Yes, the internet exists and anyone is more than capable of doing a simple search if they have questions. However, having the capability of asking a specialist directly had not always been an option until social media. This opportunity of following the scientists provides just that, and allows growth and retention through self-exploration.
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Table 2. Continued.

Without following these Twitter accounts over the course of the semester, I wouldn't have been exposed to the true passion that marine biologists have for their work. Not only do they come into work to get paid and make a living, but they genuinely care about the well being of the ocean, and will do whatever they need to to help it. To me, I could only imagine how amazing it must be to single handedly be a driving force in the conservation of an animal or species. Marine biologists must feel so much pride in what they do and get such an amazing sense of achievement from their work. Unlike a lot of ours, their progress is clearly trackable, and one marine biologist at a time, is helping to protect one of our most valuable assets- the ocean.

I have learned SO much from following these Twitter accounts that I wouldn't have learned otherwise, such as sperm whales eating sharks, marine bacteria being used to treat brain cancer, the sighting of an Angel shark off Whales, and more. I have also learned a lot about science communication, like how to write scientifically accurate statements in 280 characters or fewer, and what works well and what doesn't in a post to get it to spread the information further. I really liked that there were some people I followed who talked about the process of being a student in science.

One thing that I learned from following marine biologists on Twitter is getting a better idea of how marine biologists actually study ocean life. Like I would learn this from lectures but seeing it in live-action like through videos and learning more about actual marine biologists gives me a better understanding overall of what a marine biologist does

The Twitter assignment was very cool, in my opinion, because I've never had a course utilize social media like that. I learned a lot about new kinds of marine life, often rare. One specific thing I found interesting was the length many scientists work on a single project. The scientists and organizations I followed provided a lot of insight into what is currently being worked on. Similarly, it was great to see so much activity around conservation, and ways scientists are helping, and ways ordinary people can help

content is at a level that is accessible by the particular student population, and who represent a variety of interests and identities.

Finally, in recent months the future of Twitter has become uncertain, but Science Twitter has remained vibrant. We believe that using these guidelines, students can benefit from the expert community of Science Twitter in a safe and productive manner, and if Twitter does go under, some of these guidelines can be adapted to a new platform.

We have found this assignment to be educational, engaging, and popular. We hope that it can be useful to instructors elsewhere.

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Authors' Note

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Declaration of Conflicting Interests

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Supplemental Material

Supplemental material for this article is available online.

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Lara Annette Ferry is a President's Professor in the New College of Interdisciplinary Sciences at ASU. Most of her research has focused on the evolution of jaws and novelty from a functional morphological perspective. She has taught myriad courses in the field and lab, as well as the more traditional large lectures, for both science majors and non-majors.