Purdue University
Purdue e-Pubs

2015

Statistical Literacy Social Media Project for the Masses

Ellen Gundlach
Purdue University, gundlach@purdue.edu

Clarence Maybee
Purdue University, cmaybee@purdue.edu

Kevin O'Shea
Purdue University, koshea@purdue.edu

Follow this and additional works at: http://docs.lib.purdue.edu/impactpubs

Part of the Scholarship of Teaching and Learning Commons

Statistical Literacy Social Media Project for the Masses

Ellen Gundlach, Purdue University
Clarence Maybee, Purdue University
Kevin O'Shea, Purdue University

Abstract

This article examines a social media assignment used to teach and practice statistical literacy with over 400 students each semester in large-lecture traditional, fully online, and flipped sections of an introductory-level statistics course. Following the social media assignment, students completed a survey on how they approached the assignment. Drawing from the authors' experiences with the project and the survey results, this article offers recommendations for developing social media assignments in large courses that focus on the interplay between the social media tool and the implications of assignment prompts.

Overview and purpose of the project

With the rise of mobile computing, learners are coming to campus equipped with powerful devices that are capable of farther-reaching engagement and interaction than prior generations. Harnessing those devices through the use of social media in a curriculum can be a challenge for any instructor, requiring thoughtful planning of purposeful activities, facilitation of discussion, and technical considerations for the scope and scale of the course. In this article, we describe a social media statistical literacy project used in a large, introductory-level course. We then analyze the results of a survey conducted to examine student work habits and attitudes on this project. Finally, we discuss the benefits and drawbacks of using social media, assignment writing and grading challenges for large classes with various delivery methods, and our university's solution for using social media for academic purposes.

The Goal: Statistical Literacy

Statistics and Society is an introductory-level statistical literacy course primarily for liberal arts majors but taken by other students to meet information literacy and science, technology and society core curriculum criteria. The goal of this class is to teach the students to become informed consumers of statistics and to understand how statistics are used in their daily lives. Statistical literacy does not involve lengthy calculations but is defined as "being able to take information and explain it, judge it, evaluate it, and make decisions based on that information" (Rumsey, 2002). Best practices for statistical education include using active learning and real-life situations (Aliaga et al., 2005). In this class, the students learn how to discuss mixed media (articles, videos, websites, and podcasts, for example) that use statistical results, determining whether the data were collected correctly, what lurking variables should be considered, the appropriateness of the analysis techniques and graphs used, and whether the author correctly interpreted the research conclusions (e.g., causation vs. correlation). Students learn how to use logical, critical thinking and to be confident and empowered when asking questions to authority figures (including physicians, politicians, reporters, and corporate leaders) about the detailed evidence for their claims. If statistical literacy is important, then effective assessments which give students opportunities to learn and practice statistical literacy skills are needed (Garfield, 1994).

The Challenges: Large Course and Multiple Delivery Formats

The statistical literacy course has over 400 students each semester, and these students are split between large-lecture traditional sections (over 300 students), fully online sections (approximately 80 students), and flipped sections (approximately 60 students). The traditional section students attend the large lecture class twice per week and smaller-group recitation once per week. The fully online section students only see their instructor for proctored exams—all lecture material and coursework are done online. The flipped section students have online lectures and some online work, but they meet with their classmates and instructor one day per week for group work and hands-on activities to reinforce the concepts taught in the online lectures. All sections are closely coordinated with the same lead instructor, lectures (whether online or in person), assignments, and exams.

Effective assessments should be well-integrated into the course and provide constructive feedback (including peer and self-review), opportunities for higher-order thinking, and clear guidelines with consistent and fair grading (Chance, 1997). The challenge lies in how to incorporate effective assessments involving writing and creativity into classes with hundreds of students. Equal opportunity for peer discussion for students in the traditional, online, and flipped sections was also an important consideration. For this course, graduate student teaching assistants, many of whom are new to teaching and to this type of assignment, are responsible for the grading. A clear rubric needed to be presented to students and the teaching assistants.

Social Media: Benefits and Concerns

Social cognitive theory suggests that peer review is important because it allows students to see other students doing the same work and allows discussion with those peers and introspection into the students' own work (Hall & Vance, 2010). Hall and Vance also commented on how the online environment is ideal for peer and self-review because even shy students will feel more comfortable participating fully. In our case, using social media to promote discussion would also provide equal access for students in the traditional, online, and flipped sections of the course.

Since the students are learning how to become statistically literate, informed consumers who will feel comfortable asking about the statistics they will see in their daily lives, it is important to give them an opportunity to practice conversations with their peers about these concepts in ways that feel natural to them. Social media is a part of the daily lives of the Millennial generation of students (Everson, Gundlach, & Miller, 2013). Typically, these Millennial students share interesting links and have discussions about those stories and videos on social media with friends and family already. We want them to develop habits of sharing and discussing the statistical concepts they encounter in the media, too.

Privacy is a major component to consider when employing social media in an academic setting. Teaching with social media requires a balance between the ease of use of technology and ensuring the protection of student information. Faculty should also consider the "creepy tree house" phenomena, an idiom that describes the unwelcome blending of academic and personal social media activities (Jones, 2010). Another concern about using commercial social media such as Facebook is that the students would be inundated with advertisements not endorsed by the university or the instructor while doing their academic assignment.

When incorporating social media into the classroom, faculty should consider how they can ensure that student information (intentionally or unintentionally) is not available and readable to anyone not enrolled in the course. The Family Education Rights and Privacy Act (FERPA) (20 U.S.C. § 1232g; 34 CFR Part 99), requires institutions to protect and safeguard student education records. Instructors interested in utilizing social media externally hosted from the institution should note that content created through those digital tools do not, typically, fall under protected FERPA guidelines. Due to the varying interpretation of

FERPA, it is important to review your institution's specific policy and guidelines related to social media use.

Mixable: One University's Solution to Social Media Concerns

Mixable is an online discussion tool that uses a social feed for user interaction and collaboration. Developed in 2010 at Purdue University, the idea for Mixable emerged from faculty and student feedback. Collaborative partners and instructors were dissatisfied with the limiting features and aspects of the traditional forum structure of learning management systems (LMS). Most LMS solutions allowed for class discussion, but with very limited mobile or multimedia functionality, making usage cumbersome for instructors and students.

Members of the central information technology organization, ITaP, conducted a focus group with students at Purdue. The team wanted to learn more about their mobile technology habits and the tools that they were using on their own time. Facebook was overwhelmingly the most used application and considered an essential part of their social contact (Bowen, Brown, Sparrow, & Young, 2011). However, when asked about the social connection, the same panel of students had no desire to connect with their instructors or their peers as friends or followers on Facebook. This feedback confirmed to our team that something in the flow and structure of Facebook was intuitive to users; however, it was very clear that students wanted to avoid the "creepy tree house."

Mixable uses Facebook's feed structure for social discussion for individual courses, but avoids the concept of "friends" altogether. Users can quickly write text, share links, or upload files through the status update box at the top of the feed. The feed is structured to sort by the latest post or comment. Each post in the feed can be commented or liked by all users of the group. Mixable automatically populates groups by a student or instructor's enrollment in courses through synched information from the Office of the Registrar. Each student or instructor will see the current courses for that specific semester in which they are enrolled, which provides a social connection for each student to their peers without the forced connection on personal applications or networks. Mixable also allows users to create their own custom study sessions, learning communities, or co-curricular groups as needed. Since Mixable is a purely academic tool, no ads appear on the screen while the students are working on the assignment.

To connect to a course, users have to agree to a FERPA privacy agreement, which ensures that users are aware that by creating posts, comments or likes, other users in the group will know that they are enrolled. This is meant to be a transparent method of privacy settings for our users.

The Mixable Statistical Literacy Assignment

To give students more experience researching and discussing statistical claims with their peers, an assignment was created (Appendix A) which had the students find an online article, video, or podcast that reported on either an observational study (similar to a survey) or an experiment (where a treatment is applied to the individuals). A goal of this assignment is to show students that both good and bad uses of statistics are present in their everyday lives in a wide variety of subjects. The students had to discuss eight key features of their link and make four "statistically intelligent" comments on their peers' posts to further the discussion (Appendix B). The key features included determining how the data was collected, if any lurking variables might be important even though they weren't considered by the researcher, whether a cause-and-effect relationship is present, what specific variables were measured, what the sample design was, and if there are any potential ethical or bias issues. Students are shown examples of "statistically intelligent" comments and unacceptable comments. A rubric for grading is included in the assignment instructions. A rule about no duplicate links allowed within a section is included so that there will not be

twenty copies of the first person's post. This rule encourages students who post early to serve as examples to their more timid peers because the early posters do not have as much concern about finding a link another student has previously found. The teaching assistants are required to make model posts at the beginning of the semester to show the students what to do and to start the online class discussion.

Statistics educators value students being able to read about science in the media, but learning which topics students find compelling and engaging is also valuable. As Rumsey (2002) pointed out, the students may not be interested in the same topics as their instructors. The instructor can even use what the students post as future lecture and exam stories.

Student Feedback on the Assignment

After completing the Mixable statistical literacy assignment in the Fall 2013 semester, students were sent a link to a Qualtrics online survey, which asked them questions about their thought processes at different stages of the assignment. Students who completed the Mixable assignment were given class participation points for doing the survey, which counted for less than 0.5% of their overall course grade. The purpose of the survey was to understand how students approach the Mixable assignment. Out of the 421 total students taking the course that semester, 405 students (96.2%) completed the survey.

The survey included yes/no, Likert-scale type, and open-ended questions about the students' experience of the Mixable assignment. The answers to the open-ended questions were examined using thematic analysis. This procedure involved familiarization with data, generating initial codes, and searching for and reviewing the themes among codes. For the open-ended questions, multiple answers were allowed.

Question: When did you start working on the Mixable assignment?

Students generally (90.2%) waited until at least the third week of the semester to start the assignment. The statistics concepts necessary for the assignment were taught in the first three weeks of the semester. "Starting the assignment" might mean the first time they read over the assignment instructions, when they started looking for a suitable online story, when they did their writing, or when they made their post in Mixable. Only 7.6% of the students admitted to starting the assignment the day it was due. When asked why they chose their starting time for this assignment, students were generally most concerned (69.6%) with managing their time for this project and their other coursework.

Question: What search terms did you use to search for articles for the assignment?

Over half (53.2%) of the students searched generally for "research studies," "observational study," or "experiment," while 33.2% of the students chose a specific topic (like breast cancer or chocolate). Only 2.2% of students casually browsed news or other sites.

Question: What did you learn or find interesting from reading other people's posts?

Many of the students (40.4%) mentioned learning more about statistics, either conceptually or simply due to prevalence in many applications. In other words, they learned about the many ways that they will see statistics used every day in the world around them. A quarter (25.1%) of the students were interested in the article topics posted by their classmates, and 19.5% of the students were impressed with the variety of comments given by their classmates.

Question: Did you feel comfortable correcting other people's conclusions?

Almost half (49.6%) said that they felt comfortable or very comfortable making comments. A third of the class (33.7%) was neutral. Only 16.1% of the students expressed that they felt uncomfortable or very uncomfortable correcting the posts of their fellow students. Of the students who were uncomfortable, their reasons included worry about offending others (18.8%), not liking to criticize others (17.2%), not having enough confidence (17.2%) or feeling unqualified to judge the work of their peers (14.1%).

Question: Did you go back and read the comments others made on your posts?

While all students were required to make four "statistically intelligent" comments on each other's posts, the students were not required to read or respond to what other students wrote on their own posts. However, the majority of students (75.9%) did read what their peers wrote. To some degree, this may be related to the students' timing on doing the assignment.

For the students who did read the comments that other students wrote about their posts, many of them (28.9%) found others' perspectives on their posts interesting, and 23.4% of them said that others found errors in the original post. While 17.2% of the students learned new information from what their classmates commented, 21.1% found that their classmates agreed that they had done well. While each student was required to make four comments on other students' posts, 4.9% of students found no comments on their post.

For the 24.1% of students who did not look at what other students had commented on their posts, almost half (48.4%) either forgot or did not have time to check due to other time constraints. Only 18.7% of students said they weren't interested, but 11.0% said that since the assignment was done there was no reason to look at the comments. Interestingly, 7.7% were afraid of reading any criticism of their work. The students who did not check their fellow students' comments are missing out on the opportunity to learn from their peers' perspectives.

Recommendations for Developing Social Media Assignments in Large Courses

Biggs (1990) outlines the difference between surface and deep learning. The motive for surface learning is extrinsic with a strategy of doing what is necessary to get a good grade on an assignment. The motive for deep learning is intrinsic with a strategy of learning for greater understanding and wanting to discuss and reflect on what has been learned. Biggs discusses intrinsic motivation as an "ownership" of an idea by the student so that the student has an urge to share this idea with others. This deep, intrinsic learning is the goal of this assignment. The instructor wanted students to not only understand the basic concepts but to seek out their use in the general media and want to discuss what they have learned with their peers. Social media provides an environment that may afford this kind of learning. While some of the same considerations may come into play in small courses, we recognize that making use of the benefits of social media may be challenging in courses with a large number of students. Drawing from our experiences of the project and the student feedback from the survey, in this section we will discuss aspects to consider when designing a social media assignment, particularly focusing on the implications of implementing this type of assignment in a large course.

As outlined in Table 1, developing an effective social media assignment for use with large classes requires consideration of the interplay between the social media tool and the assignment prompts. Of particular importance is the selection of the social media tool, which we argue needs to allow the discussion to be limited to those involved in the course, such as the students, teaching assistants, and instructor. However, the tool also needs to provide a structure that allows for the communication to take place in a similar way to social media tools the students may be familiar with in their everyday lives. The

Mixable system provides the necessary privacy protections, while also simulating the type of social media environment the students typically experience outside of academia. Many educators may not have access to social media tools through their institutions. While it is possible to use open access tools for such assignments, it is essential to explore a tool's capabilities regarding privacy, security, as well as understanding the policies of the organization providing the tool, before committing to use a tool in a course.

The second set of criteria to consider when developing a social media assignment focuses on the prompts that guide students in completing the assignment. While less of an issue for smaller courses, evaluating if requirements have been met may prove challenging for an instructor or teaching assistant if doing so requires identifying key information within the type of freeflowing conversation that may occur when students use social media outside of coursework. A related consideration has to do with the degree to which students are encouraged to explore topics of their own choosing versus locating materials that provide the information necessary to show they understand the concepts covered in class. In our case, having difficulty finding an article, video, or podcast that describes statistical concepts from experiments or observational studies on a topic of interest can delay students posting to Mixable. However, Bruce (2008) suggests that students engaging with information while learning about a specific topic are more likely to recognize the role that information plays in shaping their understanding of the topic. A balance must be struck that encourages students to engage in topics of their own interest, while also fostering students' ability to complete each part of the assignment in a reasonable amount of time. The results from the survey administered in this study showed a difference in the ways the students approach the assignment—some are finding a topic (like chocolate or weight loss) that interests them first, but others are searching for specific statistical terms. While further investigation is necessary, we suspect the students who start with a topic that interests them will have more intrinsic motivation and ownership. If a student starts their search by looking for specific statistical terminology, that appears to be more extrinsic and doing what is necessary to earn a good grade on the assignment. In the future, the instructor will specifically tell the students to find an article, video, or podcast that interests them and will include a graded question asking the students to explain why this particular link was interesting to them.

Table -1: Considerations for Social Media Assignments in Large Courses

	Tool	Assignment
Pedagogic strategies	Feed structure similar to tools the students may use in their daily lives, such as Facebook and Twitter	Appropriate balance between: 1) Simulating a social media setting like those students may use in their daily lives: • Free-flowing conversation • Students select topics of personal interest and 2) Assignment management: • Students are able to complete each step • Students clearly understand what is required in posts and comments • Teachers or TAs are able to evaluate posts and comments in a timely manner
Privacy	Closed to anyone not involved in the course	Students agree to respect privacy of peers (FERPA privacy agreement)

The survey suggests that most students in this class found the assignment to be a positive experience where they learn about uses of statistics in the world and constructively discuss statistical concepts with each other. With careful consideration, it is certainly feasible to design successful social media assignments for large courses.

References

Aliaga, M., Cobb, G., Cuff, C., Garfield, J., Gould, R., Lock, R., …Witmer, J. (2005). *Guidelines for assessment and instruction in statistics education: College report.* Alexandria, VA: American Statistical Association. Retrieved from http://www.amstat.org/education/gaise/

Biggs, J.B. (1990), Teaching: Design for learning. In B. Ross (Ed.), *Teaching for Effective Learning: Papers presented at the sixteenth annual conference of the Higher Education Research and Development Society of Australasia* (HERDSA). Campbelltown, N.S.W.: HERDSA

Bowen, K., Brown, J., Sparrow, J., & Young, L. (2011, April). *Teaching and learning: Four perspectives.* Panel presentation given at *Mobile Computing: A 5 Day Sprint* webinar hosted by Educause. Retrieved from http://www.educause.edu/library/resources/teaching-and-learning-four-perspectives

Bruce, C. S. (2008). *Informed Learning.* Chicago, IL: American Library Association.

Chance, B. (1997). Experiences with authentic assessment techniques in an introductory statistics course. *Journal of Statistics Education, 5*(3). Retrieved from www.amstat.org/publications/jse/v5n3/chance.html

Everson, M., Gundlach, E., & Miller, J. (2013). Social media and the introductory statistics course. *Computers in Human Behavior, 29*(5), A69-A81. Retrieved from http://www.sciencedirect.com/science/article/pii/S07475632120037555

Family Educational Rights and Privacy Act of 1974, 20 U.S.C. § 1232g; 34 CFR Part 99.

Garfield, J. (1994). Beyond testing and grading: Using assessment to improve student learning. *Journal of Statistics Education, 2*(1). Retrieved from www.amstat.org/publications/jse/v2n1/garfield.html

Hall, S. & Vance, E. (2010). Improving self-efficacy in statistics: Role of self-explanation & feedback. *Journal of Statistics Education*, *18*(3). Retrieved from http://www.amstat.org/publications/jse/v18n3/hall.pdf

Jones, J. B. (2010, March 9). The Creepy Treehouse Problem. *Chronicles of Higher Education.* Retrieved from http://chronicle.com/blogs/profhacker/the-creepy-treehouse-problem/23027

Rumsey, D. J. (2002). Statistical literacy as a goal for introductory statistics courses. *Journal of Statistics Education, 10*(3). Retrieved from www.amstat.org/publications/jse/v10n3/rumsey2.html

Appendix A: Fall 2013 Mixable Assignment

Big picture: You will need to post 1 unique article/explanation about an experiment OR 1 unique article/explanation about an observational study. You also must make 4 statistically intelligent and valid comments on other people's posts. These comments should be split between observational studies and experiments. *Read over the entire document to get the details of exactly what is required.* Each article/explanation is worth up to 25 points, and each statistically intelligent comment that helps the discussion move forward is worth 5 points. The whole assignment is worth 45 points.

Statistics are everywhere in the media. Some are used well, and some are not. As part of the goal of this course, you will become a savvy media statistics consumer. This project is not meant to be completed in one night. You are expected to be keeping your eyes open for statistics in the media over the whole semester.

Please note that the articles must be news stories—they cannot be course materials designed to teach statistical methods. The stories do not have to be recent. Your posting has to be UNIQUE. It won't count if another student has posted a link to the same story or if Ellen has used it in her lecture notes. This means a Washington Post story about a research project will count as exactly the same as an MSNBC story about the same research. You will have to read what the other students have posted and written to make sure that your posting is unique. We will check postings across sections, too, to make sure you aren't sharing posts with students in other sections.

For your topic below, post the following on Mixable in the appropriate "Observational Study" or "Experiment" breakout group:

1. A link to the website or an upload of a relevant file.
2. The requested explanation or calculation. (See page 3.)
3. Format your post like this: "Observational study: In this article, Gallup polled 200 people about…" so that it is clear to everybody which topic you have chosen from the list."
4. Use the Tag feature on Mixable to tag your post (very important!). Tag with either "Observational study" or "Experiment" in the topic title (no quotation marks necessary). Then we can search for all the observational studies at one time and then all the experiments. This will help you check that nobody else has posted the same link that you have.

Commenting on other people's posts: You are also required to make at least 4 comments on posts from other people. (Note: Only 1 comment per person per post will receive credit, so don't try to do 4 comments on just 1 post. The goal is to get you reading and commenting on lots of different posts.) These comments must be thoughtful, indicate that you have thoroughly read the article and any previous comments on that article, and must add to the level of discussion on the statistical concepts. Balance your comments between the experiment articles and the observational study articles. The instructor may post articles also, and comments on those articles are acceptable for earning your discussion points. Just as with everything we do in this

course, please keep in mind that it's important to be respectful of each other and to engage in professional dialogue.

Examples of bad comments on posts which did not receive credit:
- *"This was an interesting article. It reminded me of junior high days."*
- *"I love everything that has to do with monkeys and I find the way they act to be fascinating. It is so crazy to me that they are such an intelligent species, and act SO similarly to humans."*
- *"This was a great experiment." (This is an especially bad comment if the article was actually about an observational study, and you didn't catch it! Not all the students who post articles will label them correctly, and you should be on the lookout for that.)*

Examples of good comments on posts which did receive credit:
- *"You didn't label this post, but I'm pretty sure you meant to label it "Experiment" based on your discussion. Anyway, this is definitely not an experiment. It is an observational study. No treatments were applied. It's true that they gave everyone a hearing test, but that was simply a method of collecting data since you can't just ask everyone if they have hearing problems and get reliable feedback. They didn't divide the people tested into groups and give them any sort of different treatment to see if there was an effect on the outcome. In other words, they were just looking for the data for a single variable as it was, as opposed to changing another variable to see what it's affect on the measured variable would be."*
- *"This graph is interesting, but pretty hard to read. I had to look very closely to see if red was used in more than one place. I like that it is interactive, but it is difficult to put your cursor over the extremely thin red lines. I wonder why it raised back up in the 1940's? I do find it interesting how drastically the name popularity has declined over the years. It hasn't become popular again. The graph shows that for the majority, the name has been on a decline."*

You should check back on your original posts periodically to see if your instructor or fellow students had questions/comments for you to answer.

See the course schedule for due dates. It is strongly recommended that you do not wait until the last minute to try to find these links to articles. Since your article needs to be unique (stories not posted by any other student) and your comments on other students' postings need to be thoughtful, it is to your advantage to work steadily all semester on these. With the uniqueness requirement, this assignment will be much easier for the people who get an earlier start!

Here are the details on the articles/discussions you need to post (choose only ONE):

1. **Observational study**:
   a. How was the sample collected? Use the appropriate statistics terminology (simple random sample, stratified random sample, voluntary response/convenience sample, etc.).
   b. What is the sample size?

    c. What was the response rate?

    d. What variables were measured? Are these variables categorical or quantitative?

    e. Were the results displayed in a graph? If so, what type of graph was used? If not, what type of graph would be appropriate for displaying this data?

    f. What are potential sources of bias? Use appropriate statistics terminology (nonresponse, response bias, undercoverage) and explain your reasoning.

    g. What could be done to improve this study?

    h. How could you turn this observational study into an experiment? Would it be appropriate?

2. **Experiment**:

    a. Who or what is in the sample? What is the sample size?

    b. What is/are the treatment(s)?

    c. What is the design of the experiment? Is it one we learned (completely randomized design, randomized block design, matched pairs) or something else? Explain your answer.

    d. Were the 3 principles of good experimental design (randomization, replication, comparison/control group) used? Give examples to explain your answer.

    e. What are the response variables? Are these variables categorical or quantitative?

    f. Were the results shown with a graph? If so, what type of graph was used? If not, what type of graph would be appropriate for displaying this data?

    g. What are some potential lurking variables? Explain your reasoning.

    h. Is there any indication that the researchers used the 3 principles of ethical experiments with humans (informed consent, confidentiality, review board) or the 3 principles of ethical experiments with animals (reduction, refinement, replacement)? Explain your answer.

(CHOOSE ONE TOPIC OR THE OTHER, NOT BOTH. An appropriate, unique article is worth 9 points, each question for that topic is worth 2 points, for a total of 25 points for your article post. Each statistically intelligent comment you make that furthers the discussion is worth 5 points, for a total of 20 points for your 4 comments.)

Appendix B: Example of Mixable assignment student work
(Note: names were changed to protect student privacy.)