1. INTRODUCTION

Teaching statistics has always been a daunting task. The nature of its abstractness; heavy use of mathematics; requirements of problem solving, statistical reasoning and thinking skills; and challenges to access real data and apply those theories to real world situations are just a few of the many reasons this might be such a difficult task. (Chance, 2002; Garfield & Ben-Zvi, 2007; Moore, 1998; Moore & Cobb, 2000). Making matters even more complicated, those who are sitting in our statistics classrooms today, the Neomillennials, have a very different ethos about their instructors.

The Millennials by definition are the group of people who were born in or after 1982. They grew up with technology, fascinated by its new advancements, and have spent a great portion of their time online (Oblinger, 2003). Statistics show that the weekly time spent online among the Millennials is about 53 hours (eMarketer, 2016). Since 2003, the development and use of social media has been accelerated, as seen in Facebook, Twitter, YouTube, and Instagram. When combined with the advancement of smartphones, these developments have truly changed how they interact with the world. This is even more pronounced in the world of the younger Millennials, known as the Neomillennials. A Pew Research survey conducted in 2018 revealed that among the 18-24 year old age group, 94% used YouTube, 78% used Snapchat, and 45% used Twitter (Smith and Anderson, 2018; Pew Research, 2018). We can confidently speculate that social media usage for students in our classrooms is similar, if not higher.

Internet and social media comprise not just part of our students' lives, but have intermingled with almost all parts of their lives. These new technologies have subsequently molded them in terms of learning styles. Educators and researchers in diverse academic areas have universally identified the call for a new pedagogy to meet the Neomillennials' learning needs (Dede, 2002, 2005; Dieterle, Dede, & Schrier 2006; Dunlap & Lowenthal, 2011; Mitchell, 2003; Nevid, 2011; Oblinger, 2003; Siemens, 2005; Tapscott, 1998). Siemens (2005) pointed out the limitation of learning theories based on behaviorism, cognitivism, and constructivism, and introduced connectivism to the framework. He defined connectivism as the integration of principles explored by chaos, networks, complexity and self-organization theories which are driven by the fact that decisions are based on a rapidly altering foundation Dede (2005) reinforced this idea and stated that with the influence of social media, our students' learning is based on collectively "seeking, sieving, and synthesizing, rather than on assimilating a single 'validated' source of knowledge as from books, television, or a professor's lectures." In addition, students demonstrated "Napsterism," a phenomenon where they prefer recombining others' designs to make a customized configuration over creating something new. Dieterle, Dede and Schrier (2006) further specified the Neomillennials' learning style as "active learning based on both real and simulated experiences that include frequent opportunities for reflection," and summarized that the Neomillennials are "fluent in multiple media platforms, valuing various types of communication, activities, experiences and the expressions it empowers."

Educators from various disciplines have begun to explore this landscape and shared their experiences in various venues. Researchers have investigated ways to incorporate learning materials that cater to Neomillennial learners with a range of different learning modalities, backgrounds, and adoption of various technologies, especially the use of social media in courses (Dede, 2005; Dieterle, Dede & Schrier, 2006; Dunlap & Lowenthal, 2009, 2011; Everson, Gundlach, & Miller, 2013; Franz, 2011; Gray, Annabell, & Kennedy, 2010; Gould, 2010; Skiba, 2007; Schroeder & Greenbowe, 2009). The advancement and accessibility of the various forms

of social media provide educators with great opportunities and valuable platforms to connect, interact, and engage with students. Therefore, what these technologies are and how they can be used to better coach and engage this new generation of learners are definitely worthwhile questions for investigation.

In our research, we explored how Twitter could be used in the introductory business statistics course to achieve goals including improved student learning experiences, more interaction and engagement, stronger connection with the real world applications, and enhanced statistical literacy, reasoning and thinking skills among students. Statistical literacy, reasoning, and thinking are the goals for statistics education, and have been studied and promoted by many researchers (Ben-Zvi & Garfield, 2004; Chance, 2002; Delmas et al., 2007; Gal, 2002; Garfield & Ben-Zvi, 2007; Moore, 1998; Rumsey, 2002). Gal (2000) defines statistical literacy as "People's ability to interpret and critically evaluate statistical information and data-based arguments appearing in diverse media channels, and their ability to discuss their opinions regarding such statistical information." Garfield (2002) identifies the definition of statistical reasoning as "the way people reason with statistical ideas and make sense of statistical information (Garfield & Gal, 1999)." Chance (2002) notes the differences among statistical literacy, reasoning, and thinking, and states that statistical thinking is "the ability to see the process as a whole, including "why," to understand the relationship and meaning of variation in this process, to have the ability to explore data in ways beyond what has been prescribed in texts, and to generate new questions beyond those asked by the principal investigator."

In our research experiment, we designed weekly Twitter assignments to achieve the course goals by encouraging student engagement with the course, the professor, their peers, and the real world. These assignments required students to identify statistical Tweets in various assigned categories, follow statistics-producing entities on Twitter to build their individual "channels," and choose Tweets about which to write their own reflections. Each Twitter assignment focused on some specific statistical concepts that were covered in the lectures, and other relevant assigned topics. In addition, a weekly professor-led Socratic exchange was conducted in class to provide feedback from the professor and peers, and to spark more discussions and debates.

The course feedback showed that a majority of students felt very positively about this innovative approach and were attracted to the novel use of this social media platform for the study of statistics. Given the current and topical nature of the Twitterverse and through examples of statistical application to the real world, the students found the Twitter assignments particularly relevant to identifying real world uses of statistics. The end-of-course evaluations showed that active learning and student engagement were enhanced, and real life applications were appreciated.

The rest of the paper is organized in the following way: Section 2 conducts a literature review and identifies implications for statistical pedagogy; Section 3 highlights the Twitter features that can be explored and used in the statistics classroom; Section 4 records the step-by-step instruction of our approach, and maps the Twitter assignments to pedagogical innovation; Section 5 discusses the results of the Twitter adoption; Section 6 provides our recommendations and summarizes conclusions.

2. LITERATURE REVIEW

2.1 Pedagogical Innovation in Statistics

The field of statistics has experienced changes in pedagogical innovations over the past several decades. During the authors' early careers, the focus was almost solely on the math, with abstruse examples, and with limited real-world relevance or appeal of the exercises to their student audiences. That way of teaching would not pass muster in today's broadly accepted pedagogy reorganized around active learning strategies and real-world applications. Neomillennials grew up in a totally different technology-filled background from most of their professors, and their learning styles were influenced and molded heavily by the advancement of technology, Web 2.0 and the Internet.

According to Siemens (2005), it is important for educators to realize the significant trends in learning: 1) many learners change their job functions during their life time; 2) informal learning is a significant aspect of the learning experience; 3) learning is a continual process lasting a lifetime; and 4) technology is changing the way we think. Siemen helps us recognize that our students will face very different career challenges from those we educators faced, and they need to be trained to adapt to the new reality of continual learning, informal learning, and the new use of technologies. He also developed a new learning theory, connectivism, which is based on the assertion that people learn from their network, and need to connect with and engage in it. We believe the incorporation of social media and the adoption of various technologies to facilitate student engagement are essential to student learning, and can better prepare them for future careers.

Realizing the needs to advance teaching pedagogy, the American Statistical Association (ASA) sponsored an effort that created Guidelines for Assessment and Instruction in Statistics Education (GAISE). Part of the objective was to create widely idealized recommendations for the Introduction to Statistics class (Aliaga et al., 2005). Below are the updated GAISE recommendations (ASA, 2016):

- Teach Statistical Thinking
- Focus on conceptual thinking
- Integrate real data with a context and purpose
- Foster active learning
- Use technology to explore concepts and analyze data
- Use assessments to improve and evaluate student learning

Among these recommendations, we see the clear call for statistical thinking, application of real data, active learning environments, and a technology presence in the pedagogy. Similarly, a seminal article by Garfield and Ben-Zvi (2007) identified eight principles for learning statistics that we found quite applicable to evaluating the efficacy of Twitter usage in the introductory statistics class:

Principle 1: Students learn by constructing knowledge.

Principle 2: Students learn by active involvement in learning activities.

Principle 3: Students learn to do well only what they practice.

Principle 4: It is easy to underestimate the difficulty students have in understanding basic concepts.

Principle 5: It is easy to overestimate how well students understand basic concepts.

Principle 6: Learning is enhanced by having students become aware of and confront their

errors in reasoning.

Principle 7: Technological tools should be used to help students visualize and explore data.

Principle 8: Students learn better if they receive consistent and helpful feedback.

Gould (2010) emphasized the importance of having students get experience with real data. He claimed that real data experiences were not only essential for the current crop of statistics students, but critical of the very field of statistics itself. Additionally, advances in pedagogy regarding active learning and the teaching of critical thinking skills have been documented in business statistics classes. Brooke (2006) evaluates the use of the case method in online courses to promote Socratic dialogue and critical thinking skills. He found that higher order thinking skills were achieved through the use of Socratic dialogue. Similarly, in an article by Parr and Smith (1998), case studies were shown to take advantage of active learning strategies. Smith and Bryant (2009) have confronted the specific challenges of case teaching in statistics courses, and provided a "how-to" starter's guide for other instructors detailing their method of incorporating case discussions into statistics courses.

When evaluating the possible use of Twitter for the introductory statistics class, it becomes clear that many of these same pedagogical innovations could be implemented through a thoughtful application of Twitter assignments to achieve better learning outcomes.

2.2 Use of Twitter in Educational Settings

Educators can use Twitter to meet the challenges of teaching the Neomillennials by using its ability to connect and engage students. Although Twitter only allows 140 characters in a tweet, it can be used to share concise information with links that direct readers to content-rich articles. Moreover, Twitter links are condensed URLs with hash tools. Another advantage of Twitter, as opposed to Google search, is that many students are familiar with Twitter, and they can follow specific sources and entities to find articles in specific areas. It is no exaggeration to say that the way that the Millennials are interacting socially via Web 2.0 technology is nothing short of revolutionary when compared to the worldwide web of the 90s (Greenhow, Robelia, & Hughes, 2009). Thus, it makes sense to take these realities into consideration when designing curriculum (Baird & Fisher, 2005-2006; Barnes, Marateo, & Ferris, 2007; Gundlach et al. 2015; Nevid, 2011). We believe these connections created through various channels outside the regular classrooms could promote student engagement and deliver improved results from increased active learning.

Researchers in various fields have explored the usage of Twitter in their disciplines to improve connectivity, student engagement, and generate knowledge among other things. Evans (2014) used Twitter in a required undergraduate Business and Management course, where he encouraged students to use the social media platform to communicate with their tutor and with each other. At the end of the semester, a positive association between Twitter usage and student engagement in the university's social and academic activities was found. West, Moore and Barry (2015) also incorporated Twitter across different disciplines to provide 411 first year students in large classrooms the opportunity to connect with each other and their professor, in addition to the professional community. Their strategy has proven to be effective in promoting a sense of belonging among students, and by also connecting students in a way that could not be attained before. Blessing, Blessing, and Fleck (2012) used Tweets to deliver messages reminding students of important class topics within a psychology class. The study found that when students received

an informative Tweet once a day that they were much more likely to remember these topics in a testing situation. Thus, an intervention of this type appears to increase memory of important class concepts, and could thus help the literacy dimension of statistical learning. Kassens-Noor (2012) allowed students to choose either Twitter or diaries in a project on sustainable living. She found that Twitter was good for creating group knowledge. Rinaldo, Tapp, and Laverie (2011) investigated the use of Twitter in marketing courses, and argued that Twitter increases engagement through experiential learning by providing a channel for students and faculty to interact directly through online discussion.

Researchers in the statistics field also have explored social media usage in classroom settings. Everson, Gundlach, and Miller (2013) evaluated the popular social networking sites, such as Facebook, Twitter and YouTube, as means to enhance student learning in the introductory statistics course. Their paper reviewed prior research on the usage of social media within college curricula, shared their own experiences, and offered recommendations and considerations for those who want to further explore the usage of social media to enhance student learning. One thing that the researchers mentioned was the lack of extensive use of social media in the introductory statistics class, and their paper called for increased future research in this area. However, even though this was an innovative idea worth exploring, there were very few studies that followed their call, especially within statistical pedagogy. This paper attempts to fill some gaps in this important research area.

Even though there are very few studies specifically regarding the use of Twitter in the introductory statistics class, that does not mean that the characteristics that define Twitter have not been included in earlier lists of desirable traits by pedagogical mainstays (Moore, Cobb, Garfield, & Meeker, 1995). In particular, the recommendation to do more active learning outside of class time has been written about in other research (Everson, Gundlach, & Miler, 2013).

The pertinent question now is, does Twitter belong in the mainstream pedagogical toolkit for the introductory statistics course? What is it about Twitter that can be utilized to enhance the classroom experience of students and to achieve the desired education goals? Astin (1984) defined student engagement as “the amount of physical and psychological energy that the student devotes to the academic experience.” Junco, et al. (2011) and Kuh (2009) portrayed student engagement as representing the time and effort students devote to activities that are empirically linked to the desired outcomes of college education. Garfield (1993) further identified the advantages of small-group cooperative learning in the classroom. One of the characteristics of good group activities she identified required that all members of the group participate, disallowing one or two students to dominate. Students should be aware ahead of time that they are all responsible for the group results to achieve better student engagement. Roseth, Garfield, and Ben-Zvi (2008) provided examples of how those who teach statistics could extend a cooperative framework that included both classroom teaching and teacher collaboration across courses, while practicing active learning strategies. They addressed concerns regarding adopting more active learning strategies.

Seven dimensions of student engagement were first identified by Chickering and Gamson (1987) and include: (1) Student-faculty contact; (2) Active learning; (3) Prompt feedback; (4) Time on task; (5) High expectations; (6) Respect for diverse learning styles; and (7) Cooperation among students. From this list, the focus on the importance of student engagement should be predominant among desirable higher education objectives (Kuh, 2009).

Of the seven dimensions of student engagement identified, many match up directly with the structure and characteristics of Twitter. Twitter can increase student-faculty contact, provide a

platform for active learning, create an opportunity for faculty to give prompt feedback, respect different learning styles, and enhance cooperation among students.

Our focus in this research is on the specific social media platform of Twitter and its application to the introductory business statistics class. We took advantage of Twitter's power and flexibility and worked to enhance the students' educational experience by facilitating more connection with professors, peers and the real world; generating group knowledge; solving real-world problems, and improving statistical literacy and reasoning. We hope the lessons learned from our trials and errors can help others begin the journey of using social media to energize our classrooms.

3. WHAT TWITTER CAN OFFER STATISTICAL EDUCATION

Most readers are familiar with the basic characteristics of Twitter. It is part blog, part social networking site, and part cellphone messaging tool (Educause, 2007). Twitter has a broad spectrum of applications: information sharing, online advertising, sentiment analysis, job searching, etc. With these various applications, we believe Twitter can provide and/or link students to rich sources of real-world data, evidence-based applications, statistical analyses, and applied statistics training. Some Twitter users also take on an educational mission, producing news, reporting on research, and attempting to influence the conversations of the day through their arguments and supporting evidence (Ferris, 2015).

Some of the more popular Twitter accounts we suggested students follow included The Wall Street Journal, The Economist, The New York Times, The Guardian, Nature, Five Thirty Eight, Hans Rosling, and Pew Research. These accounts offer sound data and statistics related topics on a frequent basis. Each of these organizations or individuals Tweet out headlines daily with links to stories, articles, studies and research that often have a statistical aspect. It is this feature of Twitter that we tapped into for teaching students statistical literacy, reasoning, and thinking. Because of the nearly unlimited statistical material available, the challenge is one of culling those materials most applicable to the purpose at hand. Below are three highlights from the list of the Twitter entities that were particularly appreciated by the class:

FiveThirtyEight: A spinoff of the statistician Nate Silver, the account currently has 2.27 million followers and produces various content with respect to politics, economics, science, life and sports. What ties the diverse Tweets together is a commitment to using data and evidence to analyze situations, make arguments and draw conclusions.

HansRosling: Created by the late Dr. Hans Rosling, this account focused on evidence, data and visualizations. Dr. Rosling developed the software platform *Gapminder* for data visualization and analysis, and can be downloaded and used freely by all.

Pew research: Pew Research Center informs the public about the issues, attitudes and trends shaping America and the world. They conduct public-opinion polling, demographic research, content analysis and other data-driven social science research. It collects data, analyzes facts, demonstrates survey methods, and composes reports, making it a valuable tool for stimulating students' learning.

4. OUR APPROACH

4.1 Twitter Assignments Procedures

Moore and Cobb (2000) identified context as the key factor that separates statistics from mathematics. A widespread agreement in the statistical pedagogical literature concerned the importance of context in teaching activities and student assignments (Wroughton et al., 2013). Recently, there has been a push to make introductory statistics classes more relevant, with textbooks that contain more realistic, yet highly stylized examples of how statistics have been applied in both the scientific and business worlds. However, even with fresher material, we found that when asking freshmen and sophomores to apply those concepts outside the course, many could not. Our students were traditional college students, mainly freshmen and sophomores, with 3-5 juniors and seniors in each section of 45-55 students' class. We have a pre-requisite of college algebra or higher before entering the class. Although they were getting the math part, they were not yet getting the "statistics" part. We needed something more, and that is where Twitter entered the scene. Our Twitter assignment was designed with three areas of engagement: an online portion, an offline homework portion, and an in-class discussion portion.

First, we required all students to open a new Twitter account so that their focus would be purely academic. Second, we asked them to explore Twitter and follow entities that used statistics prominently in their Twitter feeds. We gave students several credible sources to get them started such as The Wall Street Journal, Pew Research Center, The Economist, Nature, and FiveThirtyEight. All of these Twitter accounts were highly active and frequently linked to content that used statistics as evidence, such as news articles or research studies. We then taught students how to find other credible sources to follow by looking at who these reputable sources were following.

Third, we gave a series of weekly assignments on Twitter, each consisting of several parts. In Part 1, students needed to find and post (re-Tweet) 6 statistical Tweets in various assigned categories, identify 10 new statistical producing entities to follow (until they reached 50), and build their individual Twitter "channel." Every week we assigned different topics to study and tweet about. By the end of the semester, students had produced an account with more than 50 statistical entities and around 100 statistical Tweets. Some recent student Tweets, for example, have linked to research on the mental health of college students and the costs and benefits of drinking alcohol.

In part 2, they chose one tweet and were assigned to write a well-reasoned and concise reflection. During our years of teaching, we found that when students are required to produce something tangible, they take the assignment more seriously. Therefore, we designed weekly written assignments, where students chose one of their weekly tweets and were asked to do the following: (1) write two sentences summarizing the tweet; (2) write two sentences evaluating/analyzing the credibility and biases of the article and its sources; and (3) propose two thoughtful questions about the article.

The list of the weekly Twitter topics and their corresponding statistical concepts are recorded in Table 1.

Table 1: Twitter Assignment Topics and Statistics Concepts

Statistics Concepts	Weekly Topics
Descriptive Statistics	World Population Growth
Descriptive Statistics	Sports Statistics
Measures of Center	Gender Differences in Income
Causality	Obesity and Poverty
Probability	Auto Fatalities
Probability	Effects of Climate Change
Standards of Comparison	Changes in Crime Rates
Forecasting	Forecasting issues
Graphs	Data Visualization
Graphs	Employment Changes
Credibility and Bias	Alternative Facts
Statistical Inference	Confidence Intervals and Polls
Statistical Inference	Hypothesis Testing
Statistical Inference	An Example of Correlation Analysis in Research
Sampling, Surveys, Bias	Polling Problems and Cell Phones
Sampling, Surveys, Bias	Census Bureau
Perceptions vs. Data	Comparing Urban, Rural and Suburban Poverty

In Part 3, the students came to class and formed groups of three to share and discuss their Twitter reflections. After their small-group discussion, a professor led a Socratic exchange with the entire class. Students were called on by way of a random number generator, a mobile App, to minimize any bias when choosing students. This process took about 10 minutes, and started with the chosen students sharing their findings, which were followed up with the professor's questions, feedback, and peer response concerning the chosen topic. In addition, random cold-calling had the additional effect of providing discipline for students to complete the assignment on time, as being called on publically could be uncomfortable if they hadn't completed the assignment.

The design and format for each Twitter assignment was similar. One example of how Twitter was integrated into the different elements of class is our discussion about measures of center and dispersion. We started with a mathematical example of the different measures of center – mean, median and mode - and taught the properties of symmetry and outliers. Then we discussed conditions when a mean or median might be best used. After the discussion, the class watched an Against All Odds video entitled, "Measures of Center." Before watching the video, we provided questions from the Student Guide (See Appendix) that accompanied the video to get students engaged. After the video, we had small group discussions, followed by a class discussion. That week's Twitter assignment concerned the wage disparities between men and women, a subject which was covered in the video as an example of using the median to compare the different measures of center due to skewness. On tests, we always included a question regarding the appropriate use of the mean vs. the median to tie the material together.

In another example, we used Twitter to assist in students learning of how samples and surveys are conducted and interpreted. Each student polled 20 students to gather data on the president's approval rating, and utilized a sampling method that gave them a representative sample. When called on in class discussion, they needed to defend their methods. As part of the preparation for this assignment, the class watched the *Against All Odds* video entitled, "Samples and Surveys." Questions from the student guide were used as part of the follow-up class

discussion. The Twitter assignments for the next two weeks focused mainly on samples and polling. The Fall 2016 semester was especially interesting, as students got to see the poor performance of the polls for both the Brexit vote in Great Britain and the U.S. Presidential election. As part of their polling assignment, students were asked to assess the methods of two popular polling entities – Fivethirtyeight and Real Clear Politics. By integrating these materials with hands-on experience, the students showed insights about the performance of polling methods during the class discussion, in their write-ups, and on their exams. Thus, the Twitter assignments helped integrate and support the overarching topic of sampling and surveys.

One thing worth mentioning is that throughout the course, we modeled critical-thinking skills, while providing a rich tapestry of statistical facts and evidence about the world. We hoped that students would leave the course with a more nuanced and fuller understanding of the context in which statistics could be used while practicing evidence-based thinking.

4.2 Mapping the Twitter Assignment to Pedagogical Innovations

At this point, it is instructive to examine the particulars of the Twitter assignments, and consider how they match up with some of the different pedagogical innovations mentioned in the literature review. Perhaps the pedagogical innovations that are promoted in the structure of the Twitter assignments were the use of Web 2.0 technology to directly engage student with real data and its applications; foster an active learning environment which contributed to student engagement, and practicing skills in statistical analysis.

The Twitter assignments were based on the use of statistics in the real world where articles were chosen because they were interesting applications of statistical methods in areas such as the economy, healthcare, or sports. As such, the Twitter assignments could have been labeled as the statistical literacy assignments. Meanwhile, the use of real data and real analysis reports from Twitter fulfilled the second goal to use real data where possible. Additionally, statistical thinking was modeled in some of the articles that reported statistical findings from research journals. For example, findings from a study in the New England Journal of Medicine were reported in the popular press such as the Wall Street Journal or New York Times' Tweets. During our class discussions, the effects of bias were discussed which provided the opportunity to discuss good and bad statistical thinking with regard to issues such as bias, sampling frame or the nature of variation. These are also consistent with the students' learning by active involvement in learning activities.

Meanwhile, Garfield and Ben-Zvi (2007) state that students learn by constructing knowledge, and the key to this effort is incorporating new material and information to their existing knowledge base (Bransford et al., 2000). This goal was achieved by the in-class discussion sessions by the nature of the give and take within their small groups and during the Socratic discussion led by the instructor.

By having weekly Twitter assignments, students got a chance to practice and apply what they learned during class, which lines up with Garfield and Ben-Zvi's (2007) prescription - students learn to do well only what they practice. Through the individual searching, re-Tweeting and class-wide Socratic exchanges, students were able to practice and learn both independently and from each other, identify biases and raise good statistical questions. We also used small-group activities to encourage cooperative behavior and promote student learning as suggested by Magel (1998). One thing worth noting is that facilitating the activity also requires skills that include listening, probing, and summing up the conclusions (Potthast 1999). The Socratic nature of the Twitter assignment matches up with facilitating active learning in the classroom, which is

one of GAISE's recommendations.

Another advantage of using Socratic methods to engage students is that "Learning is enhanced by making students aware of their errors in reasoning and confronting them" (Garfield & Ben-Zvi, 2007). During the Socratic process, students were asked follow-up questions concerning their write-up, which could have the beneficial effects of clarifying their thinking. Also, students learn better if they receive consistent and helpful feedback (Garfield & Ben-Zvi, 2007).

Finally, the principle of encouraging student engagement is augmented by having students follow each other through the use of the hashtags for each section. Since it took students some time to master various aspects of Twitter, this task was assigned only during the second half of the semester. Students appeared to enjoy the sharing of ideas and content that took place due to additional interactions and connectivity.

5. STUDENT LEARNING RESULTS

The student response to the use of Twitter in the introductory statistics class was very positive. The spring 2015 semester was the fourth semester that Twitter was integrated into the class structure, and one of the keys to its success was that there was this weekly assignment that involved analytical writing, small-group discussion and classroom-wide Socratic interactions. We believe that the combination of these three methods contributes to the value of the approach, because they involve both active learning and student engagement. One of the students said it best with this quote concerning what he appreciated most: "The use of Twitter was a new form of learning." By tying together critical writing, small group sharing, and discussion along with a classroom-wide Socratic give-and-take, and integrating that into the different course topics, we believe we have provided a solid foundation for a significant pedagogical addition to the introductory course that improves statistical literacy, reasoning, thinking, and student engagement.

Most of the improvement on Twitter assignments was observed by the instructor in class and through grading the written reflections. In general, for the written portion, the instructor noticed that the students wrote longer sentences for the analysis part as the semester went on, and the analysis tended to give more details than during the first part of the class. Meanwhile, the students were challenged more on the credibility of the source, and the validity of the conclusions among the questions they raised as the semester progressed. During the class discussions, the instructor observed more voluntary student participation, better critiques, and more questions asked. Students also appeared to become more aware of the statistics issues, and seemed to dig deeper into questions such as what methods were used, what the sample size was, and whether there might be potential biases.

Students also showed appreciation of being able to use social media in a classroom setting. With its focus on the real world, Twitter does what no single text or website can do by engaging student interests in the world around them. Real world statistical applications were by far the most commonly cited reason for students' positive experience with the Twitter assignments in our classes. In effect, they have an unlimited cornucopia of statistical materials only a mouse-click away and organized to allow for access by multiple search queries. By focusing on different topics throughout the semester, students were able to appreciate the ubiquity and importance of statistical literacy and thinking throughout the world.

The evidence from four semesters' teaching with Twitter suggests a widespread approval

of Twitter adoption in the introductory statistics class. On Spring 2015's university standardized end-of-course evaluation, among the 150 students from 3 class sections, 116 students conducted the voluntary and anonymous survey. 82 of them voluntarily commented specifically on Twitter assignments in the last two questions on the survey that asked "What did you appreciate most and/or least about the course?" and "What recommendations for improvement do you have for the course and professor?" 68 out of the 82 comments demonstrated positive aspects of Twitter assignment on learning (83%); 2 comments were negative; 5 comments suggested for improvement; and 7 comments expressed that we spent too much time on Twitter assignment. All students' comments are included in the Appendix. The students who found Twitter assignments a positive experience commented about different aspects of the Twitter assignments as follows:

- ✓ "Loved Twitter - very thought-provoking yet fun."
- ✓ "Twitter gave me real world applications of statistics which I like."
- ✓ "The interaction between classmates and teacher in twitter assignments."
- ✓ "Appreciate how to use Twitter professionally."
- ✓ "The course ensured students were up to date on developments in the field and questioned them rather than accepting media/every study as truth."
- ✓ "I liked the Twitter assignment. Questioning credibility is a good skill to have."
- ✓ "Interactive; thought-provoking; taught me how to analyze things with a new perspective; highly engaging."
- ✓ "Twitter assignment was very insightful, good idea for our generation."
- ✓ "I enjoyed the Twitter assignments most. Prior to the course I had no plans on creating a Twitter account, b/c I assumed it was used by social butterflies to broadcast social Tweets. I had no idea so many notable organizations Tweeted so many thought provoking and engaging Tweets. "
- ✓ "The discussion time that was devoted to class. It allowed everyone to talk and share their opinion."
- ✓ "The use of Twitter was a new form of learning."
- ✓ "Twitter assignments provided opportunity to build professional social media profile."

In addition, among these comments, 22 students mentioned "real world" application, 28 students revealed that they like and enjoy the assignments, and 17 mentioned the interactive and engaging feature of the Twitter assignments.

However, not all students were supportive of this new concept, and some critical comments offered a different perspective which helped us to further modify the assignments to better serve their purpose as the semester unfolded. Some of the typical negative comments were that the Twitter assignments occupied too much time, and that it became a little repetitive. Below were some examples of the non-positive comments, and the two negative comments are listed on top of the list.

- ✓ "Twitter assignment - didn't improve my understanding of statistics."
- ✓ "I felt the class focused on Twitter more than it did statistics. We spent way too long discussing Twitter when we could be learning statistics."
- ✓ "Let more people volunteer before randomly selecting someone."
- ✓ "For the twitter assignments, it will be nice to have the class hashtag (#OPM) at the beginning of the course."
- ✓ "Involve Twitter more for class discussions on current topics."

- ✓ “Cut the Twitter assignments down to 4 instead of 7 a week so we can spend more time finding really good articles we can delve into.”
- ✓ “I didn't like that we spent so much time on Twitter in class.”

At the beginning of the course, we conducted an in-class online survey about students’ social media usage. Among the 122 students who took the survey in the first class, more than 80% had Twitter accounts. 74.6% had accessed Twitter at least once per month, and 48.36% had posted Tweets more than once per month. However, only 10 students stated that they had used Twitter to learn statistics, and 5 students said they were following analytics Tweets. The majority of our students were unaware of the rich statistical content available from Twitter. By applying the innovative usage of Twitter in our classroom, we hope that our students may be more likely to keep up with this aspect of Twitter as they move forward in their professional careers. In summary, the innovative use of the Twitter assignment was enjoyed and appreciated by a majority of the students, and its benefits could extend beyond the classroom.

6. RECOMMENDATIONS AND CONCLUSIONS

Over the course of the last several years of using Twitter in a substantive way in the classroom, we have learned several things along the way. The first thing changed from the initial trial of Twitter was increasing the weight of the grade from a relatively small 3% of the course grade to 10%. Following with the increase in weighting, a more diligent and focused effort by the students was observed.

Coupled with the increase in weighting of the Twitter assignments, we have dedicated more in-class discussion time to small group and Socratic discussion. Over the past two years, we have found that four to five minutes spent in groups of three discussing their different Tweets, followed by an additional eight to ten minutes of class-wide professor-led Socratic discussion is an ideal time allocation. Although this may seem excessive to some, it is worth reminding ourselves, that statistical literacy, reasoning and thinking are not easy skills to impart. We also found that the majority of the students enjoyed the class discussion time and felt they learned some valuable lessons through the discussions.

One of the more recent changes proven to be successful was the use of more focused and structured assignments, which might seem admittedly counterintuitive. Initially, the students were given great flexibility in choosing their own tweets every week. However, based on some student feedback, we found that they preferred a more structured assignment. Thus, during the most recent incantation of the assignments, more guidelines were included. The assigned topics included several regarding sports analytics (which were fairly popular across the gender and major divides), the environment, politics and the stock market.

The real-world aspect was the characteristic most appreciated by the students. Just by the breadth of applications, students’ statistical literacy expanded. Since part of the weekly assignments also included writing on possible biases, that led to an observed improvement in critical thinking development. Statistical reasoning has also been addressed through students’ self–interpretation of the statistical results (Garfield, 2002). Finally, student engagement was increased due to the designed mechanisms. The class-wide discussion gave students a sense of being part of something bigger, especially as all students did participate equally.

In conclusion, we began the Twitter assignments back in the Fall of 2013, and continued through the current time (Spring of 2017) making various adjustments and improvements along

the way based on students' feedback. Using this pedagogical approach, instructors observed improvement in students' statistical literacy, reasoning, and engagement in student discussions and written assignments. Twitter has much to recommend it for inclusion in the introductory statistics course by virtue of its potency in expanding statistical literacy and improving their evidence-based thinking as the result of the new knowledge. In addition, the format that includes writing, small-group-discussion, random-calling and Socratic discussion provides a rich tapestry of methods that engage students on many different levels and provide them opportunities for further enhancing their thinking skills along with statistical literacy.

Nevertheless, all pedagogy has its limitations. A future improvement could include an experimental design applied to the current setting to study the impact of the pedagogy in detail. For example, by using a control group in an experimental design, we can compare and contrast the specific improvement in terms of statistical literacy, reasoning and thinking between student groups with and without twitter assignments. Meanwhile, we can separate students under each treatment of the pedagogical design: analytical writing, small group discussion, and Socratic discussion, and find the more granular impacts from each treatment, and possibly interactions among them. Another limitation is lack of direct objective measures on student learning outcomes, especially on the improvement in statistical literacy, reasoning, and thinking skills through in-class discussion and reflection papers. Future research can use assessment instruments with established validity and reliability to evaluate the above student performance to obtain the objective measures.

In addition, our student body has a higher Twitter usage than that of the population in the Pew research study. This could be due to several reasons: (1) Pew research had a stricter definition of "Twitter usage" (such as defining a Twitter user as anyone who accessed the app at least once a week); (2) college students in general have a higher Twitter usage than their counterparts within the 18–24 age group; (3) students in our school might be heavier Twitter users than the norm. Readers should be reminded about this fact when trying to implement this pedagogy to avoid any potential bias.

Currently, we only rely on the instructor's observation on the length and depth of the reflection papers and more active participation in discussion as objective evidence of learning improvement attributable to Twitter. Some of the other areas to be improved include more emphasis on statistical thinking. The reading of journal articles that use statistical methods could also be more of a focus, since what is reported in the popular press does not always accurately represent the statistical findings, which offers great opportunities to further instructional improvement.

Future research regarding the use of Twitter in the introductory statistics course might further investigate this study's observations of improved statistical literacy, reasoning, and student engagement. Applying this pedagogy to a different course and/or with different class sizes to test the validity of its impact on student learning will also be beneficial. We believe that there is enough flexibility in Twitter's DNA that it could be sculpted into various unique experiences that enhance student learning, which take into account any instructors' dedication and imagination.

REFERENCES

Aliaga, M., Cobb, G., Cuff, C. Garfield, J., Gould, R., Lock, R., et al. (2005). Guidelines for assessment and instruction in statistics education: College report.

ASA (2016) (American Statistical Association), Guidelines for Assessment and Instruction in Statistics Education (GAISE) Reports. http://www.amstat.org/asa/education/Guidelines-for-Assessment-and-Instruction-in-Statistics-Education-Reports.aspx

Astin, A. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Personnel*, 25, 297–308.

Ben-Zvi, D. and Garfield, J. (2004). Statistical literacy, reasoning, and thinking: Goals, definitions and challenges. *The Challenge of Developing Statistical Literacy, Reasoning, and Thinking*, Eds. Ben-Zvi and Garfield, J., Springer.

Blessing, S. B., Blessing, J. S., Fleck, B. K. B. (2012). Using twitter to reinforce classroom concepts. *Teaching of Psychology*, 39(4), 268–271.

Baird, D. and Fisher, M. (2005-2006). Neomillennial user experience design strategies: Utilizing social networking media to support "always on" learning styles. *Journal of Educational Technology Systems*, 34, 5–32.

Barnes, K., Mareteo, R., and Ferris, S. (2007). Teaching and learning with the net generation. *Innovate Online*. http://www.ajhepworth.yolasite.com/resources/Teaching_and_Learning_with_the_Net_Generation.pdf

Bransford, J., Brown, A. L., Cocking, R. R. (Eds) (2000). How people learn: Brain, mind, experience, and school, Washington, DC: National Academy Press.

Brooke, S.L. (2006). Using the case method to teach online classes: Promoting Socratic dialogue and critical thinking skills. *International Journal of Teaching and Learning in Higher Education*, 18(2), 142–149.

Chance, B. L. (2002). Components of statistical thinking and implications for instruction and assessment. *Journal of Statistics Education*, 10 (3). http://www.amstat.org/publications/jse/v10n3/chance.html

Chickering, A. W., and Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin*, March, 3–7.

Dede, C. (2002). Vignettes about the future of learning technologies. *2020 Visions: Transforming Education and Training Through Advanced Technologies*, (Washington D.C.: U. S. Department of Commerce), 18–25

Dede, C. (2005). Planning for Neomillennial learning styles. *Educause Quarterly*, November, 1. https://net.educause.edu/ir/library/pdf/eqm0511.pdf

Dieterle, E., Dede, C., Schrier, K. (2006). Neomillennial learning styles propagated by handheld devices. In M. Lytras and A. Naeve (Eds.), *Ubiquitous And Pervasive Knowledge And Learning Management: Semantics, Social Networking And New Media To Their Full Potential. Hershey*, PA: Idea Group, Inc.

Delmas, R., Garfield, J., Ooms, A., Chance, B. (2007). Assessing students' conceptual understanding after a first course in statistics. *Statistics Education Research Journal*, 6(2), 28–58.

Dunlap, J., Lowenthal, P., (2009). Horton hears a Tweet. *Educause Quarterly*, 32.

Dunlap, J., Lowenthal, P., (2011). Learning, unlearning, and relearning: Using Web 2.0 technologies to support the development of lifelong learning skills. In G. D. Magoulas (Ed.),

E-Infrastructure And Technologies For Lifelong Learning: Next Generation Environments, 292–315.
Educause (2007), 7 Things you should know about Twitter. https://net.educause.edu/ir/library/pdf/ELI7027.pdf
eMarketer 2016. Weekly Time Spent Online by US Affluent Internet Users, by Generation, July 2016 (hours), last accessed on May 2017, https://www.emarketer.com/Chart/Weekly-Time-Spent-Online-by-US-Affluent-Internet-Users-by-Generation-July-2016-hours/199150
Evans, C. (2014), "Twitter for teaching: Can Social Media Be Used to Enhance the Process of Learning?," *British Journal of Educational Technology*, 45(5), 902–915.
Everson, M., Gundlach, E., Miller, J., (2013). Social media and the introductory statistics course. *Computers in Human Behavior*, 29(5), 69–81.
Ferris, M. E. (2015, April 15). With twitter, Statistics 101 takes flight. The Digital Campus, Tech Innovators 2015, *The Chronicle of Higher Education*.
Franz, A. K. (2011). Organic chemistry YouTube writing assignment for large lecture classes. *Journal of Chemical Education*, 89, 497–501.
Gal, I. (2002). Adult's statistical literacy, meanings, components, responsibilities. *International Statistical Review*, 70(1), 1–25.
Garfield, J. (1993). Teaching statistics using small-group cooperative learning. *Journal of Statistics Education*, 1(1). http://www.amstat.org/publications/jse/v1n1/garfield.html
Garfield, J. (2002). The challenge of developing statistical reasoning. *Journal of Statistics Education*, 10(3). http://www.amstat.org/publications/jse/v10n3/garfield.html
Garfield, J. and Ben-Zvi, D. (2007). How students learn statistics revisited: A current review of research on teaching and learning statistics. *International Statistical Review*, 75(30), 372–396.
Gould, R. (2010). Statistics and the modern student. *International Statistics Review*, 78, 297–315.
Greenhow, C., Robelia, B., Hughes, J. E. (2009). Web 2.0 and classroom research: What path should we take now? *Educational Researcher*, 38, 246–259.
Gray, K., Annabell, L., & Kennedy, G. (2010). Medical students' use of Facebook to support learning: Insights from four case studies. *Medical Teacher*, 32, 971–976 .
Gundlach, E., Richards, K. A. R., Nelson, D., Levesque-Bristol (2015). A comparison of student attitudes, statistical reasoning, performance, and perceptions for Web-augmented, fully online, and flipped sections of a statistical literacy class. *Journal of Statistics Education*, 23 (1). http://www.amstat.org/publications/jse/v23n1/gundlach.pdf
Junco, R., Heibergert, G., Loken, E., (2011). The effect of Twitter on college student engagement and grades. *Journal of Computer Assisted Learning*, 27, 119–132.
Kassens-Noor, E. (2012). Twitter as a teaching practice to enhance active and informal learning in higher education: The case of sustainable Tweets. *Active Learning In Higher Education*, 13(1), 9–21.
Kuh, G. D. (2009). What student affairs professionals need to know about student engagement. *Journal of College Student Development*, 50(6), 683–706.
Magel, R., C. (1998). Using cooperative learning in a large introductory statistics class. *Journal of Statistics Education*, 6(3). http://www.amstat.org/publications/jse/v6n3/magel.html
Mitchell, W. J. (2003). *Me++: The Cyborg Self and the Networked City*, Cambridge, Mass.: MIT Press.

Moore, D. S. (1998). Statistics among the liberal arts. *Journal of the American Statistical Association*, 93, 1253–1259.
Moore, D., Cobb, G. (2000). Statistics and mathematics: Tension and cooperation. *Mathematical Monthly*, 107(7), 615–630.
Moore, D. S., Cobb, G. W., Garfield, J., Meeker, W. Q. (1995). Statistics education Fin De Sicle, *The American Statistician*, 49, 250–260.
Nevid, J. (2011). Teaching the Millennials. Observer, Association for Psychological Association, 24(5). http://www.psychologicalscience.org/index.php/publications/observer/2011/may-june-11/teaching-the-millennials.html
Oblinger, D. (2003). Boomers, Gen-Xers and Millennials: Understanding the new students. Educause, July/August, 37-47. https://facet.indiana.edu/events-programs/facet-retreat/docs/2007_session2gibau-handout.pdf
Parr, W.C., and Smith, M.A. (1998). Developing case-based business statistics courses. *The American Statistician*, 52(4), 330–337.
Pew Research, Social Media Fact Sheet. http://www.pewinternet.org/fact-sheet/social-media/
Potthast, M. J. (1999). Outcomes of using small-group cooperative learning experiences in introductory statistics courses. *College Student Journal*, 33, 1, 1–8.
Rinaldo, Tapp, and Laverie (2011). Learning by Tweeting: Using Twitter as a pedagogical tool. *Journal of Marketing Education*, August, 33, 193–203.
Roseth, C. J. , Garfield, J. B., Ben-Zvi, D. (2008). Collaboration in learning and teaching statistics. *Journal of Statistics Education*, 16(1). http://www.amstat.org/publications/jse/v16n1/roseth.html
Rumsey, D. J. (2002). Statistical literacy as a goal for introductory statistics curses. *Journal of Statistics Education*, 10 (3). http://www.amstat.org/publications/jse/v10n3/rumsey2.html
Schroeder, J., and Greenbowe, T. J. (2009). The chemistry of Facebook: Using social networking to create an online community for the organic chemistry laboratory. *Innovate: Journal of Online Education*, 5(4), Article 3.
Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology & Distance Learning*, 2(1). http://www.itdl.org/Journal/Jan_05/article01.htm
Skiba, D. J. (2007). Nursing education 2.0: YouTube. *Nursing Education Perspectives*, 28, 100–102.
Smith, A., and Anderson, M. (2018). Social Media Use in 2018. http://www.pewinternet.org/2018/03/01/social-media-use-in-2018/
Smith, M.A., and Bryant, P.G. (2009). Managing case discussions in introductory business statistics classes: Practical approaches for instructors. *The American Statistician*, 63(4), 348–355.
Pew Research (January 12, 2017), Social Media Fact Sheet. http://www.pewinternet.org/fact-sheet/social-media/
Tapscott, D. (1998). *Growing Up Digital: The Rise Of The Net Generation*, New York: McGraw Hill.
West, B., Moore, H., Barry, B. (2015). Beyond the Tweet: Using Twitter to enhance engagement, learning, and success among First-year students. *Journal of Marketing Education*, 1–11.

Wroughton, J. R., McGowan, H. M., Weiss, L. V., Cope, T. M. (2013). Exploring the role of

context in students understanding of sampling. *Statistics Education Research Journal*, 12(2), 32-58.

APPENDIX

Example of Guided Questions

Questions in *Against All Odds* video on "Measures of Center" are as follows: Then a Twitter assignment was given about the comparison of wages between men and women.

1. What variable is examined in comparing men and women workers at the beginning of the video?
2. Would you describe the shape of the distribution of men's weekly wages as symmetric, skewed to the left or skewed to the right?
3. What is the most important difference between the differences of weekly wages for men and for women?
4. Would a few very large incomes pull the mean of a group of incomes up, down, or leave the mean unaffected?
5. Would a few very large incomes pull the median of a group of incomes up, down or leave the median unaffected?

End of Course Students' Comments

1. Twitter: It was good overall, maybe do more Tweeting at each other in class
2. Twitter - I liked creating a profile where the timeline is filled with statistical information.
3. Twitter was my favorite part of the class. Very useful and a great link to the real world. I appreciated the SAE and Twitter assignments most. They enhanced my understanding of the material because they related to the real world and I could share my views with my classmates
4. Loved Twitter - very thought-provoking yet fun
5. Relevant to the current (world) through twitter and SAE assignments
6. In depth discussion about real world stats
7. I appreciated that we did a variety of assignments and that it wasn't a lecture based class
8. Most liked twitter assignments
9. Learning about how statistics apply to real world applications.
10. Loved the way it's set up and how it applies to real life and discussion based
11. The interaction between classmates and teacher in twitter assignments.
12. The Twitter was very important aspect of the course and I liked it
13. The discussion that are in every beginning of the classes is pretty useful
14. Discussion of Twitter topics kept me interested.
15. Twitter: All Good, Improve nothing
16. Positive Attitude, great discussion, instructor actually seemed interested in our ideas, liked current events Twitter
17. I liked Twitter and how we discussed them and shared in class
18. This is one of the only classes I feel engaged in.
19. I thought the use of Twitter was a good idea, something to keep students active and was able to practice applying the content tonight in class
20. How the class differed from other. I liked the use of Twitter and SAE assignments
21. Homework was just the right amount and was valuable to the class

22. Appreciate how to use Twitter professionally
23. Continue using Twitter, I appreciated the application of statistics to current events. I enjoyed that the class actually showed real life applications of what I was learning.
24. Incorporated real world events and examples
25. The ability to connect what we are learning to the real world
26. I liked Twitter
27. We were able to apply what we learned to the real world
28. I liked the Twitter assignments and how they encouraged critical thinking on different topics
29. The use of Twitter was very useful and interesting; it helped me engage in the world of statistics.
30. I appreciated the real-world aspects of the course. It created clarity and relevance in reference to the course material
31. There is lots of class discussion which I appreciate most
32. The Twitter assignments were well done, and got students exposed to social media
33. I enjoyed the course assignments like our Twitter assignments because they were so interactive and informative
34. The course ensured students were up to date on developments in the field and questioned them rather than accepting media/every study as truth.
35. The discussion springing from Twitter and SAE assignments
36. Twitter assignments are very interesting and students like it
37. Twitter assignments were engaged and entertaining while relating to the course.
38. Twitter assignments provided opportunity to build professional social media profile.
39. The discussion time that was devoted to class. It allowed everyone to talk and share their opinion.
40. I liked the amount of discussion and how we could all argue our own opinions
41. I appreciate reading article that apply to statistics.
42. Real world application in all topics
43. Like Twitter assignment the most
44. The thing I liked the most: the nonmathematical content …. SAE, Twitter, etc.
45. I enjoyed doing the twitter assignments, but it would have been nice to have the class hashtag (#OPM) at the beginning of the course
46. He loves Twitter - it's nice to have a professor passionate about something
47. Twitter assignments and having choice of what we researched and looked up
48. Interactive; thought-provoking; taught me how to analyze things with a new perspective; highly engaging.
49. I liked being able to use Twitter to see stats in the real world
50. The Twitter assignments were fun to do.
51. He used other material than the book, such as the SAE, Twitter, etc. to help us to understand the subject better
52. Continue to refine the Twitter assignment - got a bit better as the semester progressed
53. I liked the Twitter assignments because it made me more up to date or current about past events.
54. Twitter kept me up to date on current topics
55. The twitter homework was very interesting
56. I liked having to research things that I didn't know about.

57. The use of Twitter was a new form of learning.
58. Questioning credibility is a good skill to have.
59. I liked the application of statistic to the real world through SAEs and Twitter Analysis
60. Twitter: Opportunity to learn about current news
61. Twitter gave me real world applications of statistics which I like.
62. I liked Twitter assignments. They were simple but interesting.
63. I enjoyed the Twitter assignments most. Prior to the course I had no plans on creating a Twitter account, b/c I assumed it was used by social butterflies to broadcast social Tweets. I had no idea so many notable organizations Tweeted so many thought provoking and engaging Tweets.
64. I liked when we got to decide on the Twitter topics.
65. Twitter assignment was very insightful, good idea for our generation.
66. I like Twitter assignment the most
67. I liked all the articles we got to read. It really give me some new things to think about
68. Twitter? A+++ Awesome :)
69. Cut the Twitter assignments down to 4 instead of 7 a week so we can spend more time finding really good articles we can delve into
70. I felt the class focused on Twitter more than it did statistics. We spent may too long discussing Twitter when we could be learning statistics
71. I think there was way too much effort put into the Twitter
72. More variety between Twitter and SAE's
73. Less busy work! There was always a lot due at one time and was overwhelming
74. I think it would be best to stagger back and forth between Twitter and SAE.
75. Twitter assignment - didn't improve my understanding of statistics
76. Let more people volunteer before randomly selecting someone
77. It got a little repetitive
78. Involve Twitter more for class discussions on current topics
79. Improvement: less Tweets per week or only 1 per subject w/ more subjects
80. The homework assignments, namely SAE and the Twitter, are interesting, but not the most enlightening on actual statistics; there should be more practical application
81. I didn't like that we spent so much time on Twitter in class.
82. For the twitter assignments, it will be nice to have the class hashtag (#OPM) at the beginning of the course