

# Tweeting and Friending in the Graduate Classroom: Can Social Media Tools Work?

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## Abstract

The authors of this paper investigated the use of social media tools to enhance learning in the graduate classroom and created a dialogue about social media as educational tools. This paper examines some possible uses of social media tools like Twitter, Facebook, and Google Apps for mid-to senior –level government students. The design and methodology included looking for examples of social media tools in higher education; selecting faculty at the Information Resources Management College at National Defense University (NDU iCollege) to include these tools in their courses; and surveying faculty and students through focus groups and interviews. The authors found that social media tools may facilitate student collaboration but it must be purposeful and not complicated. Students reported they learned a lot about the tools but sometimes found the experience frustrating. Faculty members said that creating and using the tools was time consuming. Because social media are changing the way people interact with each other, the authors concluded that learning how to use them is an important skill for students of the NDU iCollege and social media may facilitate creativity among students and provide experiential learning for adult students. Further studies are necessary to show a cause and effect relationship.

**Keywords:** social media, Web 2.0 technology, Facebook, Twitter, Google apps, learning tools, student collaboration, teaching methodology

## Introduction

Social media are technologies and tools that facilitate interaction and collaboration among users. They not only allow users to read and disseminate information, but also to create and share content with others. Social media are changing the way people interact with each other by providing a platform for interaction and collaboration online between groups of people. While the concept is not really new (people have been blogging, using wikis, and playing online games for quite some time), the tools are changing and becoming more dynamic. This paper focused on two primary social media tools, Facebook and Twitter. Facebook is a popular social networking site where users can connect with friends, post pictures, and play games. It has also become a mar-

keting tool for businesses. Twitter is a microblogging application, allowing users to message individuals and groups (a maximum of 140 characters) on multiple networks and devices. These tools have educational applications and are being used in a variety of classroom settings. Social media allows students to interact before, during, and after class and facilitates collaborative learning in a variety of ways. Social networking sites

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(like Facebook) hit the mainstream in 2003 with the advent of sites such as Friendster and MySpace and went global around 2007 with new sites catching on in countries such as the UK, Sweden, Brazil, and China (Boyd & Ellison, 2007). Unlike the majority of social networking sites; however, Facebook was created in 2004 as a Harvard University site designed for students only (Cassidy, 2006). Facebook quickly began supporting other institutions and in 2005 expanded to include high school students. Facebook grew quickly and continues to push well ahead of the other social networking sites such as MySpace with a year-over-year growth of 190% and 144.3 million unique users. Twitter grew 1,448% since May 2008, making it the fastest growing web brand (Nielsen, 2009). How do we account for this popularity? According to the Twitter website, people want a simple way to stay connected with friends and family. Since Twitter accepts messages from several messaging sites (sms, web, and mobile web, etc.), it is easy for users to connect in a variety of ways (<http://www.Twitter.com>, 22 November 2009).

At the Information Resources Management College at the National Defense University (NDU iCollege or The College), located at Fort McNair in Washington, D.C., students are mid-career government leaders and managers. Since the NDU iCollege is funded by the Department of Defense (DOD), the students are largely military and DOD civilians as well as senior leaders from other government agencies, foreign military officers and civilians, with a few private sector students who are doing business with the government (contractors). Since the NDU iCollege student body consists of mid-level government employees who are at mid-career, the challenge is to create activities that appeal to 35-40 year old students. According to a recent study (Mediabagger, 2009); it is the 30+ segments of the population who are driving social media technologies. People 30-40, according to the study, use social media for work and play and are more open to trying new services. With this in mind, the authors collaborated with faculty members to create several activities using both Facebook and Twitter to supplement the current classroom environment at the NDU iCollege. The College offers over 250 offerings each year so participating courses were carefully chosen. NDU iCollege faculty already use social media tools in their classrooms in the form of blogs and wikis and the College uses Blackboard as its Learning Management System which is also a form of social media. This paper explores ways in which NDU iCollege faculty can bring social media tools into the classroom. The focus is on Twitter and Facebook because of their popularity among a diverse population, their ease of use, and they are free.

## Social Media in the Classroom

In a 2007 article in the *Journal of Computer-Mediated Communication*, Danah Boyd and Nicole Ellison, stated that “social network sites (SNSs) are increasingly attracting the attention of academic and industry researchers intrigued by their affordances and reach (pg.1).” Boyd and Ellison concluded that online social network sites build on existing social networks and that the use of such sites is ripe for research topics, including privacy and relationship issues (Boyd & Ellison, 2007). There can be no doubt that social networking sites like Facebook and Twitter are bringing people together. These sites are also places where the commercial community can reach millions of people for relatively little money. It doesn’t cost anything to set up a site on Facebook and tweeting provides a platform for people to send out short bursts about topics, issues, or products. It too is free of charge if users stick to using the web and if they already pay for unlimited text messages on their phones. In short, social media provides a social outlet for a disbursed population while allowing commercial entities to advertise to many slices of society at the same time. Millions are out there on some type of social media and reachable and the user population continues its exponential growth.

Twitter seems to be the most popular method of social media in the classroom because students can text message on their own cell phones

Having the ability to follow each other's "tweets" and to build on running conversations, students create a community. One skeptical professor reported that twitter changed the dynamics in his classroom more than any other activity. David Parry, an assistant professor at the University of Texas at Dallas, encourages his students to follow his own twitter feed and requires them to post their own as part of a course writing assignment. Students took to it quickly and kept up the momentum throughout the course. Another experiment with twitter at Pennsylvania State University at University Park involves students chatting on twitter during class. Students tweeted their ideas and posted links to related material or asked a question. The tweets were projected onto a screen in the front of the room and discussed when something interesting caught the instructor's eye. At first students were reluctant to tweet, according to the instructor, Cole Camples, but soon they got into it and really started to post interesting and important tweets (Young, 2009). Another professor at the University of Texas at Dallas, Dr. Monica Rankin, created the twitter experiment (watch the video on YouTube at <http://www.youtube.com/watch?v=6WPVWDkF7U8>) for her history class of 90 students. She used twitter to solve the problem of how to give every student an opportunity to communicate ideas or talk during class. Students posted their opinions about what was being discussed during class or about what they had read and the posts were projected for everyone to see. According to Dr. Rankin, the 140-character limit for Twitter forces students to focus and to share only what is important. She does admit that the process is "messy" but does not consider that to be a bad thing.

What is the attraction of Twitter as a teaching tool? Clive Thompson at *Wired Magazine* offers one explanation (as quoted in a blog, *academhack*, (<http://academhack.outsidethetext.com/home/2008/twitter-for-academia/>). He says that twitter creates awareness about our friends and co-workers in a society that is dispersed. "Twitter," he says, "substitutes for the glances and conversations we had before we became a nation of satellite employees (pg.2)." Thompson cautions, though, that following strangers does not have the same impact (although it can be fun). Conversely, tweeting with friends (and classmates), creates unity and expands social reach. The value of twitter, or any social media, is that it allows interaction on many different levels simultaneously. Professors who use social media in the classroom are changing the educational climate by encouraging students to share perspectives and ideas in a more democratic way (Cassidy, 2009).

As popular as Twitter appears to be, Facebook may be the number one social media of choice today. According to Nielsen Online (June, 2009), of the top ten social media sites, based on number of minutes used, Facebook is rated at the top (Twitter is rated number 5). Unlike Twitter, Facebook is a revealing and sometimes very personal medium. People who regularly use Facebook are more than willing to share their profiles and post personal information on the site. Of course, they can block others from seeing what they post, individually or as a group, but that seems to violate the purpose of the site. The idea is to share information with friends and family, to interact routinely, and to post pictures for all to see. The site provides unlimited opportunities for people to stay in touch. Users can be as involved as they want to be.

The entirely open nature of Facebook makes it full of possibilities for the classroom but also may lead to too much exposure for both students and their professors. Some faculty may "friend" their students but don't initiate the interaction. And students are not always happy to find their faculty members or their parents on Facebook. One instructor, though, made it a requirement for his students to "friend" him on Facebook on the first day of class. Peter Juvinal, a business instructor at the Illinois State University, thought the best way to reach his freshman business students was to conduct most of his course where they spend their time anyway--on Facebook. Mr. Juvinal used Facebook as a course management tool with a central message to his students was what they post on Facebook is with them forever. Students can post questions on his "wall" and submit assignments about their profiles. Mr. Juvinal will even "chat" with his students online if they happen

to be there when he is. Privacy issues are addressed and Mr. Juvinall works with students to set their privacy settings, but at the end of the semester, he "unfriends" all of his students (Parry, 2009). Another example of the use of Facebook as an educational tool comes from Stanford University. In an effort to share projects with the world, Stanford University provides access to faculty and student projects on its Facebook page. Users of Facebook who tap into Stanford's page can view videos and pictures of previously completed projects. Since the University has a number of Facebook pages, this method makes it easy for information to be stored in one place. In addition, Stanford offers Facebook office hours, a certain time in which faculty are available to answer questions. Facebook has become the subject of college courses as well. Barbara Nixon teaches a course titled Making Connections: Facebook and Beyond, at Georgia Southern University. The course goal is to teach communication and networking skills. Students communicate online using Twitter and Facebook as well as other social media sites (bestonlineuniversities.com, August 11, 2009).

These examples of how social media tools are used in classrooms are not from scholarly journals or books. Nor do they represent a comprehensive review of the literature. However, they do show that educators are embracing social media as a way to enhance learning in their classrooms. The authors of this paper seek to bring some of these ideas into the graduate classroom at the NDU iCollege and to develop a follow-on study that answers the questions, does social media enhance learning and how. By devising simple and focused experiments with a small selection of faculty and students, the efficacy of social media in the classroom can be examined. The authors believe this is a relevant topic because education is an inherently social enterprise and if social media can facilitate learning, especially for graduate students, it will contribute to the existing literature on learning theory.

## Social Media in the Government

In June 2009, Iranian protestors took to the streets of Tehran when President Mahmoud Ahmadi-nejad was reelected. Tech-savvy protestors, armed with nothing more than their cell phones, were able to communicate among themselves as well as to expatriates outside Iran. By using their cell phones to "tweet" the growing drama on the streets of Tehran, Iranian citizens were able to cover the unfolding events when foreign news media were barred by the Iranian government. When Twitter announced that their system was going down for routine maintenance, a State Department official asked them to delay maintenance so that transmissions from Iran could still be monitored. The number of tweets coming from Tehran could not be pinpointed but there was no doubt that Iranian citizens were able to send information to the mainstream media during this crisis. This move illustrates the growing influence of social media as a communication tool (Morozov, 2009).

President Barak Obama, on his first full day in office in January, 2009, issued the *Memorandum of Transparency and Open Government*. There is an open government blog on which the Federal Chief Information Officer, Vivek Kundra, and Beth Noveck, Deputy Chief Technology Officer for Open Government, can communicate updates about the Open Government Initiative (<http://www.whitehouse.gov/Open>). From the government's homepage (<http://www.whitehouse.gov>), citizens can learn about how our government works, watch videos on events as they are happening, and read about current legislation. Making full use of Web 2.0 technology, the Federal Government also has a Facebook page (<http://www.facebook.com/WhiteHouse>) to which any visitor to the government homepage can link (there is also a link to Twitter). On Facebook, citizens can become "fans" and watch streaming videos of current events. They can also make comments on the "wall" and join a discussion on a variety of topics. Facebook allows a level of interaction between government and citizens that is unprecedented.

Vivek Kundra, the Federal Chief Information Officer (CIO), wants to leverage the power of technology for the public sector. Yet adoption of tools and platforms that can provide a single platform for openness between government agencies and allow information sharing in real time is not there. Mr. Kundra likes Facebook and sees it as a possible model for the federal government. Facebook users, he said, "have been able to self-organize on issues, on policy, on problems and create a movement so people can be heard (pg. 2)." (Thibodeau, 2009) Kundra would like to see that happen in the federal government as well but issues of security, privacy, and acquisition make it difficult for the use of social media and web 2.0 technologies in a government space. Some of the problem stems from cultural attitudes about what constitutes secure computing and information sharing. Other parts of the problem have to do with IT acquisition and the federal government's reliance on contractors (Thibodeau, 2009). But it also has to do with policy and until recently, there has been little guidance on how to use social media. In September 2009, the CIO Council released a document titled, *Guidelines for Secure Use of Social Media by Federal Departments and Agencies*. This document points out that embracing social media technology must be based on a strong business case developed by each agency and considering individual missions, threats, and technical capabilities. But more importantly, the guidelines states that policies "should not be based on specific technology...but should be created to focus on user behavior, both personal and professional..." (CIO Council, 2009). Social media, by its very nature, deals with human behavior and mitigating risks can be difficult and complex.

## **Social Media at the iCollege**

In the context of security and privacy concerns and the inability of government employees to use government computers for many social media and web 2.0 technologies, the iCollege has taken steps to create an implementation plan for the use of social media. This is relevant and necessary because government employees are not routinely exposed to these technologies and often find them confusing and difficult to use. Yet, government leaders need to be able to leverage social media tools for greater collaboration between agencies. This is an important step toward connecting the right people at the right time to enhance national security.

The NDU iCollege Senior Director has made a commitment to bring the power of social networking to iCollege students and faculty. He has provided strategic direction and created a new vision that elevates the iCollege to leading the government in social networking practices, processes, and tools. The College has created a number of laboratories focusing on Cybersecurity, Innovations and Simulations, and Emerging Technology to provide students with hands-on experiential learning in which they can apply conceptual knowledge to real-life situations. Additionally, the College has a Telepresence Center that will give students, faculty, and staff an intimate and cutting-edge tool for a broad range of applications. In conjunction with the NDU library, the iCollege is designing an experiential learning space called the C<sup>i</sup> Center. This classroom/workspace will use mixed realities including virtual worlds, telepresence, social media, and web 2.0 learning management systems.

While creating College policy and putting the technology into place are necessary steps, faculty members and their students would be better served by practical classroom examples of how social media may be incorporated into their lesson plans were demonstrated. Faculty members are looking for ways to apply social media tools to the classroom but want them to be purposeful and to enhance learning. There are a number of iCollege faculty who already use wikis and blogs and a few of them are experimenting with using Second Life (a virtual world). Several courses are discussing social media as technology tools or as topics for critical thinking. The iCollege recently experimented using Google Apps for communication and collaboration as a substitute for Microsoft applications such as Word or Powerpoint. A few new courses are developing full lessons to address the use of social media tools and social networking (Facebook, LinkedIn, YouTube,

Flickr). These lessons will also cover social media as a leader decision-making mechanism and discuss how to leverage the tools to build organizational social awareness and information sharing.

The authors of this paper believe that what needs to occur next is a comprehensive faculty development effort about social media and some applied learning experiments. The focus on Facebook and Twitter for the purpose of this paper is because of their current popularity and ease of use. Applied learning requires that faculty learn the tool and insert its use in lessons or courses and in turn teach students how to use it and encourage them to think of ways they can apply it to their workplace. The following applied experiments are examples of what can be done in the classroom with either Facebook or Twitter and are presented to stimulate discussion about the use of social media as an educational tool.

### **Twitter**

- **"Live tweet" during class:** Students would use College computers to tweet during class, commenting on readings, asking questions, or fielding answers. Student tweets could be projected on a screen for all to see. To manage the tweets, faculty would either start or close each lesson with a summary of what was covered, including the tweeting. Faculty and students will need to be educated on the process. A set of rules will need to be created and agreed by all involved to ensure that there is proper professional conduct. To evaluate the experiment, faculty will administer an end-of-course questionnaire to determine student satisfaction and perceptions about the experiment. Faculty and students will write short reflective reports at the end of class. NOTE: The iCollege in resident courses are normally held on five consecutive days for 37.5 hours of contact time.
- **Communicating with Twitter:** Students will use Twitter to communicate about assignments by looking for a set number of twitter feeds related to leadership/management/social media/government.
- **Twitter Analytics to extract data.** Twitter has several tools that can help users analyze Twitter streams (Twitter Analytics or just Analytwits). The tools can aggregate, rank, and slice data to provide some insights into trends and activities. First, faculty would expose students to a variety of tools that can be used on Twitter. The purpose of this experiment is to develop student curiosity about analytics and what they say about human behavior and how they inform opinions. After students learn the tools, they would be given a scenario to follow and would be free to choose which Twitter analytic to use (they may choose more than one). Throughout this experiment, students would also be learning how to use Twitter for their own use after the course is over. To evaluate the success (or failure) of this experiment, students would take a survey before and after the course to see how much the exposure to analytics influenced their learning.

### **Facebook**

- **Students and faculty working together on Facebook.** Since the iCollege resident courses are only one week in duration, the authors believe the Distributed Learning (DL) format would work best for this experiment. Students would create accounts in Facebook and learn how to use it for collaboration. In doing this, they would also be posting material for class, turning in assignments, and asking questions. Facebook can be used as a blog so that stu-

dents can comment on each other's postings and it can be used to "chat" in real time. It also has a lot of flexibility when it comes to privacy settings so students should feel safe to interact and work together without interruption. The idea of this experiment is to test using Facebook as a collaboration tool for learning. Faculty and students would receive training on how to use the tool and students would be instructed on privacy settings and ways to conduct themselves while in the public space. Facebook also has a direct email aspect which is more private so faculty and students may conference individually as required. The experiment would be evaluated by using a periodic review of the process throughout the 12-week period and course corrections made along the way. At the end of the course, faculty would "unfriend" their students but students could continue relationships if they chose to do so.

- **Creating lessons on social media:** In this case, a lesson on social media could be developed. The lesson would cover the applied learning aspect of how to use both Facebook and Twitter but would also be asked to analyze the value of social media in today's society and to develop a policy document for their own agencies. In this lesson students would be exposed to existing federal policies on social media and would explore several social media tools such as Facebook and Twitter. Students will be asked to evaluate and reflect on the use of social media tools and to evaluate several social media sites.

## Findings and Conclusions

Web 2.0 technology and social media are moving forward quickly and creating opportunities for people to connect in unprecedented ways. Web 3.0 technologies are in the making and educators and IT innovators need to be ready to embrace what lies ahead. Although there are many challenges to using social media within the government, faculty want to move forward. The technology and tools are in place at the iCollege and Senior Leadership has made a commitment to create a collaborative, experiential environment for students. This is vital because government leaders and managers need to embrace tools for better decision making, faster communication, and more effective collaboration between Federal agencies. The initial discussions and experiments at the iCollege revealed that faculty and students both need to be educated on the use of social media tools. In fact, a great many of the mid- to senior-level students have not even heard of these tools much less thought about how they could use them. Perhaps just getting students to play with the tools and becoming familiar with their functionality is a good learning outcome. Faculty that have tried to use Facebook and/or Twitter in their classes found that, almost across the board, government students are blocked from using social media tools on their government computers. By blocking sites such as Facebook and YouTube, the government is sending the message that it is not committed to the use of social media in the workplace. On the other hand, efforts are underway by the Chief Information Officer's Council and the DOD to develop policies to guide the use of social media. Students reported that they learned a lot about working with social media tools but they did not see its application for their workplaces. This paper outlined some ways in which the NDU iCollege could create opportunities for faculty and students to experiment with social media tools, specifically Facebook and Twitter. There is a need to develop a social media implementation plan with clear and specific goals. What faculty and students need most is guidance on what the iCollege wants to achieve. Follow-on research needs to be done and fundamental questions about social media and learning outcomes need to be asked. The authors solicit feedback and discussion on the ideas presented in this paper. In the true spirit of collaboration and openness, the authors also hope that others will find the information of value and will share their own classroom experiences.

## References

- 13 enlightening case studies of social media in the classroom* (August 11, 2009). Retrieved November 22, 2009, from <http://bestonlineuniversities.com/2009/13-enlightening-case-studies-of-social-media-in-the-classroom/>
- Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, 13(1) article 11. Retrieved November 22, 2009, from [http://jcmc.indiana.edu/vol13/issue1/boyd\\_ellison.html](http://jcmc.indiana.edu/vol13/issue1/boyd_ellison.html)
- Cassidy J. (2006). *Professors use social media in the classroom*. Retrieved November 22, 2009, from <http://insideoregon.uoregon.edu/professors-use-social-media-in-the-classroom/>
- CIO Council, (2009) *Guidelines for secure use of social media by federal departments and agencies*. Washington D.C.
- Facebook website: [www.facebook.com](http://www.facebook.com)
- Mediabadger, (2009, 26 October), *Age groups and social media usage patterns: October 2009*. Retrieved November 22, 2009, from <http://www.mediabadger.com/>
- Morozov, E. (2009), *Iran elections: A twitter revolution?* The Washington Post. Retrieved December 5, 2009, from <http://www.washingtonpost.com/wp-dyn/content/discussion/2009/06/17/DI2009061702232.html>
- Nielsen, J. (2009). *Nielsen's social media quicktake: May 2009*. Retrieved November 13, 2009, from [http://blog.nielsen.com/nielsenwire/wp-content/uploads/2009/06/nielsen\\_pr\\_090619.pdf](http://blog.nielsen.com/nielsenwire/wp-content/uploads/2009/06/nielsen_pr_090619.pdf)
- Open Government Initiative (2009). <http://www.whitehouse.gov/Open>
- Parry, M. (November 12, 2009). *Course requirement: Friend your professor on Facebook*. Retrieved November 13, 2009, from <http://chronicle.com/blogPost/Course-Requirement-Friend/8827/>
- Thibodeau, P. (2009, March 5,). *New federal CIO Vivek Kundra wants a Web 2.0 government*. Retrieved December 15, 2009, from [http://www.computerworld.com/s/article/9129043/New\\_federal\\_CIO\\_Vivek\\_Kundra\\_wants\\_a\\_Web\\_2\\_0\\_government](http://www.computerworld.com/s/article/9129043/New_federal_CIO_Vivek_Kundra_wants_a_Web_2_0_government)
- Twitter website: [www.twitter.com](http://www.twitter.com)
- White House Facebook page: <http://www.facebook.com/WhiteHouse>
- Young, J. R. (November 12, 2009). Professor encourages students to pass notes during class—via twitter. Retrieved November 13, 2009, from <http://chronicle.com/blogPost/Professor-Encourages-Students/4619/>
- YouTube (2009) at <http://www.youtube.com/watch?v=6WPVWDkF7U8>



## Biographies



**Dr. Brenda F. Roth, Ph.D.** is currently the Assistant Dean for Curriculum at the Information Resources Management College (iCollege), National Defense University. She began her academic career while serving in the Air Force. She taught history at the United States Air Force Academy as an Assistant Professor between 1990 and 1993, was the Chief of Curriculum Development and Integration at the Air Command and Staff College, Air University, Maxwell Air Force Base, Alabama from 1996 to 1998, and served as an Operations Officer (1998-2000) where she led a multi-service division of over 150 select field grade officers, civilian students, and international officers. Between 2000 and 2002, she was the Chief of the Professional

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Dr. Roth earned her Ph.D. from the University of Virginia, her master's degree from the University of Colorado at Boulder, and her bachelor's degree from the University of Arizona. As an Air Force officer, educator, and leader, her interests center on non-traditional methods of education including distributed learning, blended learning, and mastery learning. She is particularly knowledgeable about professional military education programs and policy, curriculum design and evaluation, strategic planning, and faculty development. Her current research focuses on curriculum development and innovative technology methods for improving teaching and learning.



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Colonel McCully served 28 years in the US Air Force as a Long Range Strategy and Security Assistance Planner, Joint Staff; Pentagon; Deputy Chief, Command, Control and Reconnaissance Division, AF Center for Studies and Analyses, Pentagon; Threat Assessment and Evaluation Analyst, North American Air Defense Command, Colorado and Thailand; Professor and Associate Dean, Industrial College of the Armed Forces; and Assistant Professor of Mathematics, US Air Force Academy. She earned her Ph.D. in engineering from Arizona State University, and was a Harvard Senior Executive Fellow.

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