USING YELLOWDIG IN MARKETING COURSES: AN ANALYSIS OF INDIVIDUAL CONTRIBUTIONS AND SOCIAL INTERACTIONS IN ONLINE CLASSROOM COMMUNITIES AND THEIR IMPACT ON STUDENT LEARNING AND ENGAGEMENT

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ABSTRACT

Students in four marketing classes participated in a pilot program where they used Yellowdig in the classroom. Yellowdig is a private network for collaboration targeted towards educational institutions to increase student engagement. Yellowdig seeks to engage students using a broad array of resources including videos, news articles, blogs and more. It offers a Facebook-like experience (a platform the majority of students are very familiar with) for ease of use.

In the classes, Yellowdig was used for two purposes: as a way to create a community inside and outside of the classroom and as a means by which students create and share course-relevant content throughout the semester. To achieve those goals, students posted items of interest relating to course content to Yellowdig and commented on and up-voted others' posts. Yellowdig data was used to capture insights about students' individual contributions and social interactions.

The manuscript summarizes academic literature on social learning and social media, followed by a description of Yellowdig and how it was used in the marketing classes to benefit student learning and engagement. The results of quantitative analyses, including data visualization and social network analysis, are used to help educators understand both individual contributions to and social interactions in the network. In addition, multiple linear regression results suggest that engagement through Yellowdig activities does benefit student learning. Strategies for instructors to enhance student engagement and learning using these types of analyses are provided.

INTRODUCTION

The topic of *student learning and engagement* is a hot topic today in pedagogical circles at every level of education. But institutions of higher education, in particular, are working to improve student learning and engagement in an age of greater accountability from accrediting bodies, states providing decreased funding, and other constituencies questioning the activities and value of universities and colleges. New pedagogies are being explored, especially ones that utilize new technologies or platforms, such as Web 2.0 and social media platforms like social networking sites (e.g., Facebook), microblogging sites (e.g., Twitter), and blogging. The purpose of this research is to describe the implementation of a new digital learning platform, Yellowdig, in four marketing classes and report the results of data visualization, social network analysis, and multiple linear regression with respect to student learning and engagement. First, literature on social learning and social media as pedagogy is reviewed. Then, the methodology and results are reported. Finally, a

discussion and conclusions, with suggested strategies for enhancing learning and engagement, are presented.

SOCIAL LEARNING

Social learning, with its origins in Bandura (1977), is a paradigm in organizational/ workplace and educational settings that has received much attention lately with the emergence of social media platforms. But *social learning* is not the same as *social media*. Social learning is "learning with and from others by moving within one's culture, workplace, and world," while social media are "the tools that enable social learning to happen on a large scale" (Bozarth, 2012, p. 66).

Bingham and Conner (2015) referred to "the new social learning" to "describe the broader issues and opportunities now available" and stated that social learning is "modeling, observing, sharing, participating, and so much more" (Bingham & Conner, 2015, p. 14). In describing how social learning has impacted the organizational/workplace setting, Bingham and Conner (2015) wrote, "The 20th century was about leading with technology and tools. The 21st century is about leading into a connected world" (Bingham & Conner, 2015, p. 5).

The same is true for an educational context. The social learning model "focuses on developing activities that promote learner-to-learner interactions and the co-construction of knowledge through sharing information and resources" (Feldstein & Gower, 2015, p. 3). "The new social learning is not just the technology of social media, although it makes use of it. It is not merely the ability to express ourselves in a group of opt-in friends. The new social learning combines social media tools with a shift in organizational structure, a shift that encourages ongoing knowledge transfer and connects people in ways that make learning enjoyable" (Bingham & Conner, 2015, p. 8).

SOCIAL MEDIA AS PEDAGOGY

The use of social media in the classroom has increased dramatically in recent years, and researchers have attempted to gauge its impact on student learning and engagement. For example, Chen and Bryer (2012) suggested that using social media as learning tools might connect informal learning to the formal learning environment in the classroom, and wrote, "Social media technologies that allow students to connect to educational contexts in new and meaningful ways beyond the traditional classroom environment have the potential to blur the line between formal and informal learning" (Chen & Bryer, 2012, p. 89). In a qualitative study, Chen and Bryer (2012) found that university instructors believe informal learning using social media can be facilitated by instructors and integrated into formal learning environments, resulting in enriched discussions, increased engagement, and broad connections. Luo and Franklin (2015) found that students in a social media class at an institution of higher education were motivated to use social media in class and employed high degrees of self-discipline and self-exploration in using Twitter and blogs, especially advanced social media users versus novices. In a review of literature related to the use of social media in computing education, Wang and Meiselwitz (2015) found some evidence of improvement in learning and benefits to both students and faculty, such as improved social support and perceived interaction.

The research, however, is mixed when it comes to the impact of social media in education (see Mostafa, 2015; Neier & Zayer, 2015). Some research found negative impacts of using social media in the classroom, such as a negative relationship between social media usage and grade

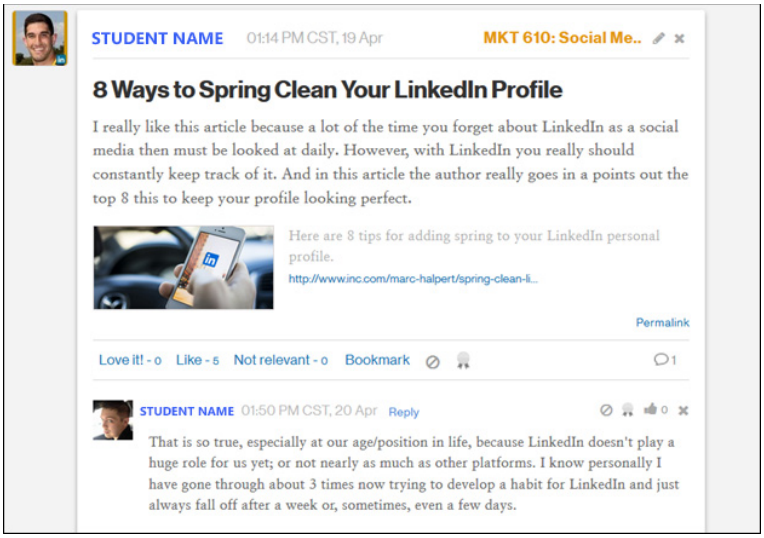
point average (Bijaria, Javadiniab, Erfanianc, Abedinid, & Abassi, 2013; Junco, 2012; Kirschner & Karpinski, 2010). Wang and Meiselwitz (2015) report several concerns of students and faculty when using social media including, for example, security, privacy, and the difficulty of performance evaluation and monitoring. Bennett, Bishop, Dalgarno, Waycott, and Kennedy (2012), in a collective case study of six Web 2.0 implementations in Australian higher education, found that most students had little prior experience with the technologies used (digital photo archives, blogging, and wikis) and many did not see the value of these technologies for learning and teaching.

Despite the mixed findings regarding the impact of social media in education, the marketing discipline is embracing social media for two reasons. First, social media marketing, as a sub-discipline of marketing, is a rapidly emerging field in terms of careers and academic research. Second, marketing educators are increasingly exploring social media as a pedagogical tool and its potential to boost student learning and engagement. For example, the *Journal of Marketing Education* published a special issue focused on student engagement via digital and social media. As Crittenden and Crittenden (2015) wrote, "Student engagement with regard to social media in marketing classrooms is a critical component of learning in today's world of fast-paced, every-changing marketing practices." Authors in this special issue used social media platforms to enhance student engagement, including Facebook (Bal, Grewal, Mills, & Ottley, 2015; Northey, Bucic, Chylinski, & Govind, 2015), Twitter (West, Moore, and Barry, 2015), and blogging (Fowler & Thomas, 2015). Fowler and Thomas (2015) and Bal et al. (2015) implemented marketing projects in classes in which social media tools were the primary teaching tool. Consistent with social learning theory and the movement in marketing to embrace social media as a pedagogical tool, we piloted the use of Yellowdig in two marketing classes.

YELLOWDIG

Founded in 2014, Yellowdig is a collaborative, immersive digital learning platform that complements the traditional educational experience. The platform is a mix between a university social network and a course management tool, helping to establish knowledge communities, increasing students' knowledge of current affairs related to coursework, and encouraging course participation. Yellowdig feels like Facebook, so most students do not find it challenging; rather, the platform feels instantly familiar and natural to most students. Yellowdig allows students to share original or curated content, relevant links, photos or notes with their classmates on a feed, and classmates can up-vote ("like" or "love") and discuss ("comment" on) posts. Students can build their "influence" score by getting up-votes, posting on the platform, and gaining followers and instructor badges. A Leaderboard is displayed on the right side of a Yellowdig feed, and features the top seven contributors on a board at any given time (based on the point system enabled for the particular board). The Leaderboard provides an incentive for students to become a top contributor on a board by posting relevant content and participating through up-votes and comments. To help organize the content, students can assign a "topic(s)" (hashtag) to each pin. An example of a Yellowdig post ("pin") is found in Figure 1.

Figure 1
An Example of a Yellowdig Pin (Post)



Instructors can monitor student progress throughout the semester. Students accumulate points (as determined by the instructor) and the points are automatically transferred into a learning management system such as Blackboard. Yellowdig provides a dashboard that summarizes Yellowdig board activity for a specific time period and individual student activity reports (see Figures 2 and 3). In addition, summary, detailed, and weekly points reports can be downloaded by the instructor.

Figure 2
An Example of a Yellowdig Dashboard

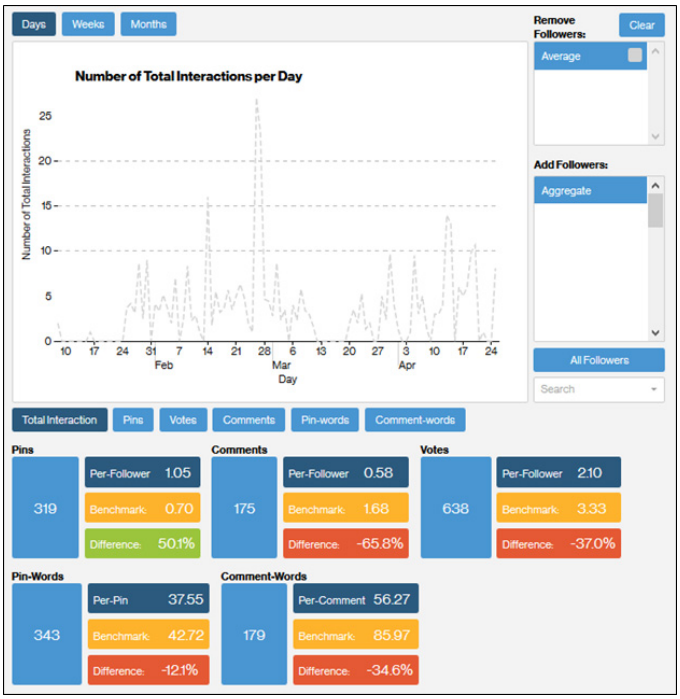
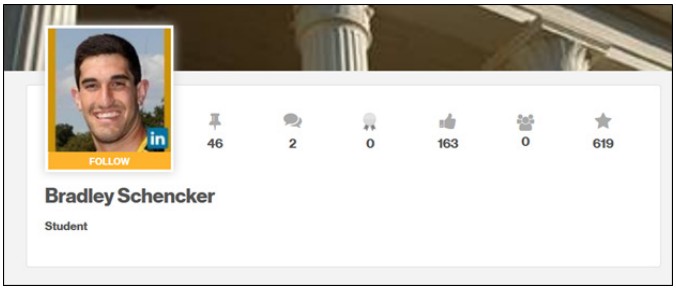


Figure 3
An Example of a Yellowdig Student Summary



METHODOLOGY

The research question driving this study was, "To what extent will Yellowdig enhance and improve student engagement and their learning experiences?" In this study, two marketing courses – Social Media Marketing, Customer Service and Relationship Management – used Yellowdig throughout a semester. Each course is taught by a different instructor and each instructor has one face-to-face section and one online section. In the classes, Yellowdig was used for two purposes: as a way to create a community inside and outside of the classroom and as a means by which students create and share course-relevant content throughout the semester. Students were instructed to share course-relevant content by posting ("pinning") items of interest relating to the content being covered, as well as articles, videos, and other webpages related to their personal interests or experiences preparing activities and assignments in the class. Students accessed Yellowdig through Blackboard, the university's learning management system, or through the Yellowdig mobile app.

Students' Yellowdig activities were counted as part of their course grades. To earn full credit for the Yellowdig portion, students needed to earn at least 300 points over the course of the semester by adding pins and by commenting on and earning loves or likes from their peers. Specifically, grading was explained as follows:

> *Each pin of 40 words or more earns 10 points, each comment of 40 words or more earns 5 points, and earning a like or love earns 1 point, so to earn 300 these points you will need to earn, on average, 25 points on Yellowdig per week. For example, you could add a pin (10 points), make 2 comments (10 points), and earn 5 likes or loves (5 points) for a total of 25 points. Or you could comment on 4 pins (20 points) and earn 5 likes or loves (5 points). You can earn up to a maximum of 50 points a week, so please do not wait until the end of the semester to earn your points. Each week starts at 12:01 am CST Monday and ends at 11:55 pm CST Sunday.*

Students were also asked to assign a "topic(s)" to each pin. Topics are like hashtags and are used to designate discussion of a pertinent topic. For example, some of the topics used in the Social Media Marketing course included #SocialMediaStats, #SMMCareers, #SMMResources, and #PersonalBranding.

Throughout the semester, the instructors minimized their digital footprints in the courses, purposely not up-voting or commenting on students' posts. We decided that we should let the students influence and determine the nature and direction of the conversations taking place on Yellowdig without instructor interference.

In both the face-to-face and online classes, Yellowdig allowed students to curate new, recently published content relevant to the course material. In a field like marketing, keeping up to date is extremely critical and much content in typical textbooks is already outdated. In the face-to-face (on-campus) classroom, we used Yellowdig to structure or supplement class discussions. Prior to meeting, the instructors would select one or more articles posted on Yellowdig. Then, in class, the instructors would ask a particular student who posted a particular article to summarize the article. Since other students had up-voted or commented on the article, the instructor would also ask for their opinion of the article. The incorporation of the Yellowdig content into class discussions held the students accountable for their individual-level and social activities, and allowed discussions to focus on interesting content relevant to the course.

In the online courses, Yellowdig allowed students to connect and engage in ways not possible with discussion boards through a typical learning management system. While students can comment on others' posts in a discussion board, the ability for students to up-vote and comment in Yellowdig and to gain a level of influence in the community (through up-votes and gaining followers), along with content being organized through topics (hashtags), brings individual-level contributions and social interactions to a higher level of engagement and social learning.

Data Analysis

Summary reports for the semester were generated and downloaded from Yellowdig, along with students' course grades, and used for quantitative data analysis. The data was imported into Tableau, a data visualization software (www.tableau.com), and Gephi, a social network analysis software (https://gephi.org/). The field of learning analytics guided the quantitative data analysis. Learning analytics, as defined by the Society for Learning Analytics Research, is "the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (Siemens & Gasevic, 2012, p. 1). Learning analytics as a field of study is in its infancy but, fueled by the availability of large amounts of data that can be gathered from learning management systems and Web 2.0 platforms, it is attracting the attention of educators and administrators alike. The *NMC Horizon Report: 2016 Higher Education Edition* currently projects the adoption timeline for learning analytics at one year or less, stating, "The goal is to build better pedagogies, empower active learning, target at-risk student populations, and assess factors affecting completion and student success" (Johnson, Adams Becker, Cummins, Estrada, Freeman, & Hall, 2016, p. 38).

To better understand this data, we need to make a distinction between various types of learner information that is available. A recent report by the Educause Learning Initiative (ELI) suggests three categories of learner information: "dispositional (e.g., incoming GPA, biographic and demographic data), course activity and engagement, (e.g., keystrokes, selections, time on task), and learner artifacts (e.g., essays, blog posts, media products)" (Brown, Dehoney, & Millichap, 2015, p. 6). Although useful, these categories place the focus on individual characteristics, actions, and outcomes.

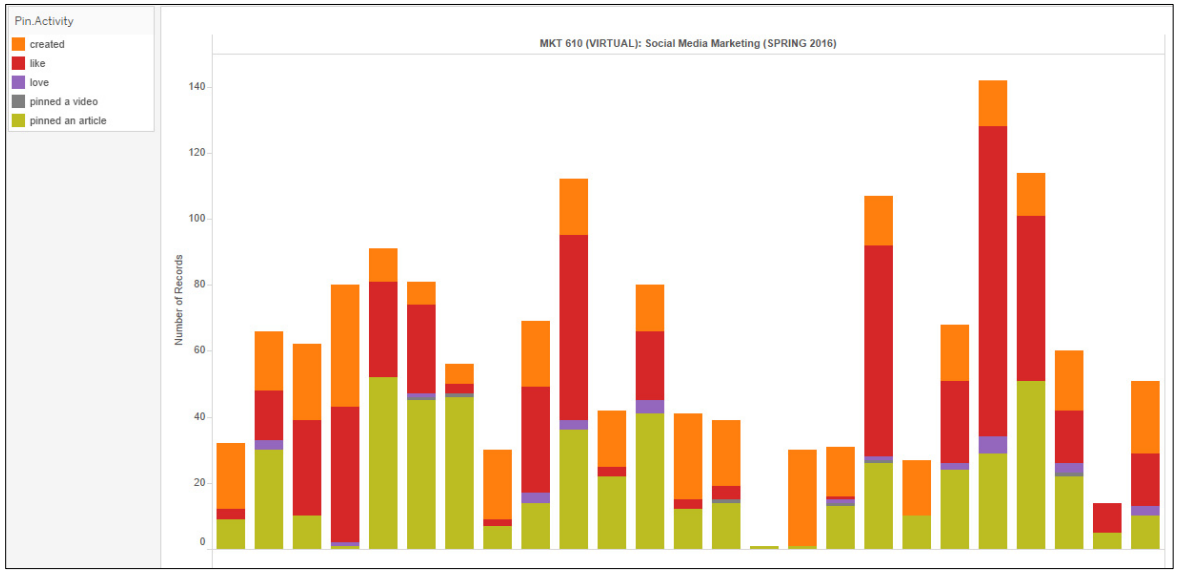
This focus on individual characteristics, actions, and outcomes is not surprising. In educational settings, outcomes and summative assessment are often analyzed to determine a student's competence in a specific content area. One of the reasons we rely so heavily on summative assessment is the ease with which it can be accomplished. Exams, quizzes, and papers are, for the most part, discrete events that take a snapshot of what someone has learned. They can

be administered at a specifically scheduled time and the scope of the assessment is totally in the control of the instructor. Measuring outcomes, in this context, is a straightforward process.

Web 2.0 tools and platforms that allow for robust social interactions among students are relatively new and cannot necessarily be assessed in the same way we have learned to assess individual contributions. Shum and Ferguson (2012) define Social Learning Analytics as "a distinctive subset of learning analytics that draws on the substantial body of work demonstrating that new skills and ideas are not solely individual achievements, but are developed, carried forward, and passed on through interaction and collaboration" (Shum & Ferguson, 2012, p. 5).

The Yellowdig platform allowed assessment of *individual contributions* and *social interactions*, and both types are presented here. The Tableau data focuses on individual contributions and behaviors. We see how many pins, comments, or likes an individual has contributed to the learning community, and an example for one of the courses (Social Media Marketing online) is shown in Figure 4. While this is valuable, it does not tell the whole story. We may know how many times a student has up-voted someone else's contributions but it does not tell us who they up-voted, who up-voted their contributions, or what that particular behavior can tell us about the dynamics of the course. As we look to create more collaborative learning environments, these dynamics can help us identify a student's position in the learning community and give us an indication of the effectiveness of the community as a whole.

Figure 4
Tableau Course Analysis: Number of Pins Created, Likes, and Loves and Number of Videos and Articles Posted by Each Student in the Social Media Marketing Online (MKTG 610V) Course



In this study, data was also analyzed with Social Network Analysis (SNA) in Gephi. Examples of SNA in education research include Feldstein and Gower (2015) who analyzed the network of comments exchanged by students in the knowledge-building blog deployed in an undergraduate brand management course. The authors found SNA provided an opportunity to gauge the communicative interactions that take place and to assess the relationship between the students' positions within the network, their communication and collaborative feedback skills, and course outcomes (Feldstein & Gower, 2015). In addition to data visualization and SNA, multiple

linear regression was used in this study to determine whether students' course grades could be predicted by their engagement using Yellowdig in the classes.

RESULTS

For the quantitative analysis, student course grades and data for all activities taking place on the Yellowdig platform were captured. Yellowdig identifies various activity categories. For instance, if a student creates a "pin," usually a content specific contribution designed for the entire class to see, a statement that "Student A 'created a pin' owned by Student A" is generated. This represents the type of information that is typically collected as individual student contributions to a course.

With Yellowdig, data on activity that is more social was also captured. The statement "Student A 'liked' a pin owned by Student B" indicates that Student A's action was directed specifically toward a contribution made by Student B. This type of activity serves as feedback for Student A and it also signals to the rest of the class that there is some interest in Student B's pin. For the purpose of this study, we looked specifically at the more "social" activity as a way to describe the social characteristics of the community of students enrolled in each of the courses examined.

The structure of each of the four course communities – Social Media Marketing face-to-face and online (MKTG 610 and MKTG 610V) and Customer Service and Relationship Management face-to-face and online (MKTG 603 and MKTG 603V) – was examined, and then the contributions of individuals within each community were assessed. Since all courses were offered in the same semester, some overlap of students was present. The face-to-face courses had four students in common. The online courses had five students in common. We compared and contrasted these student's activities in the two courses in which they participated. We also examined their place in the network community built around student interactions with one another. We also examined the role of the instructor in each community and benchmarked the activity of the overlapping students against the "most active" student in each course. Finally, we examined the students' grades in the courses and whether their class performance was related to their engagement in Yellowdig.

Community Structure

Table 1 examines community structure. The first column, *TTL Actions*, represents the total number of activities, including pins, comments, likes, follows, etc., that took place in each community. The online sections of each course had more activity than the corresponding face-to-face courses. By the same token, the number of *Social Actions* (comments and up-votes) and *% Social* (the number of social actions relative to total actions) is also much greater in the online courses than the face-to-face courses.

TABLE 1
Community Structure

Course	TTL Actions	Social Actions	% Social	Graph Density	Nodes	Edges	Average Degree	Modularity Class
MKTG603f2f	2031	288	14.18%	0.686	21	288	27.4	3
MKTG603V	2131	519	24.35%	0.558	31	519	33.4	3
MKTG610f2f	1308	177	13.53%	0.657	17	177	20.8	3
MKTG610V	1670	337	20.18%	0.611	24	337	28.0	2

Another network measure is *Graph Density*. Graph density measures how close the network is to being complete. A complete graph, one in which all students have connected with each other (i.e., all students in the network directed a comment to every other student in a class), has a density equal to 1. Although there does not seem to be a dramatic difference across communities, it is interesting that the face-to face sections of each course are denser than the online sections.

Average Degree, which is the average number of directed social actions (i.e., comments and up-votes) by members of each community, is higher in the online sections than in the face-to-face sections. In the face-to-face Customer Service and Relationship Management (MKTG 603) course, online interactions are 18 percent higher and in Social Media Marketing online (MKTG 610V), interactions are approximately 25 percent higher. *Nodes* represents the number of members in the community – students and an instructor in this particular study – that are connected by *Edges*, connections formed when a comment made by one student is directed to another.

Finally, we have calculated *Modularity Class*. The Modularity algorithm implemented in Gephi looks for nodes (students) that are more densely connected together than to the rest of the network **(**Blondel, Guillaume, & Lefebvre, 2008). A high modularity number indicates the presence of a number of sub-communities in a network. Members of a specific sub-community will typically interact with one another more than they will interact with members of the community at large. The algorithm has identified three sub-communities in three courses and two in the remaining course. Network Graphs for each course are presented in Figures 5-8. In all four network graphs, each modularity class is identified by the color of the corresponding nodes. Modularity class was examined more closely by looking at the students who were members of both courses (Social Media Marketing and Customer Service and Relationship Management).

Figure 5
Network Graph – Face-to-Face Customer Service and Relationship Management Class

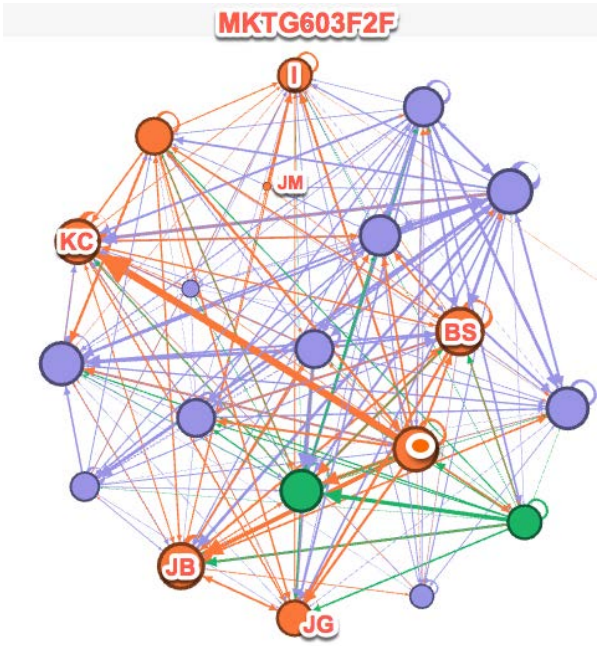


Figure 6
Network Graph – Face-to-Face Social Media Marketing Class

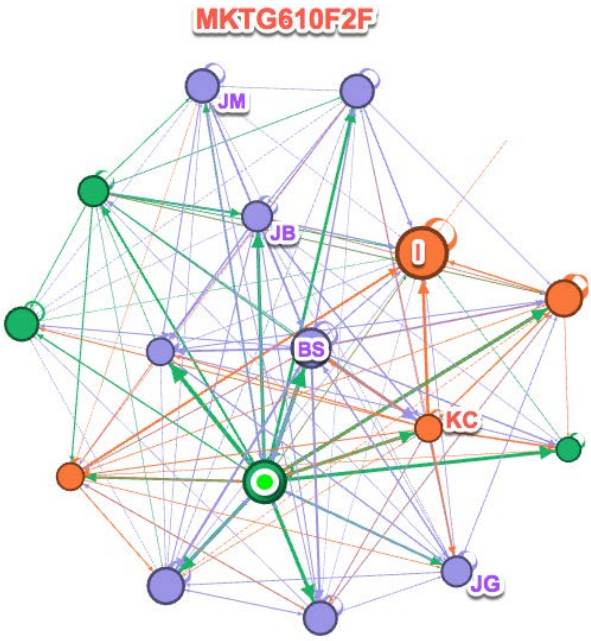


Figure 7
Network Graph – Virtual/Online Customer Service and Relationship Management Class

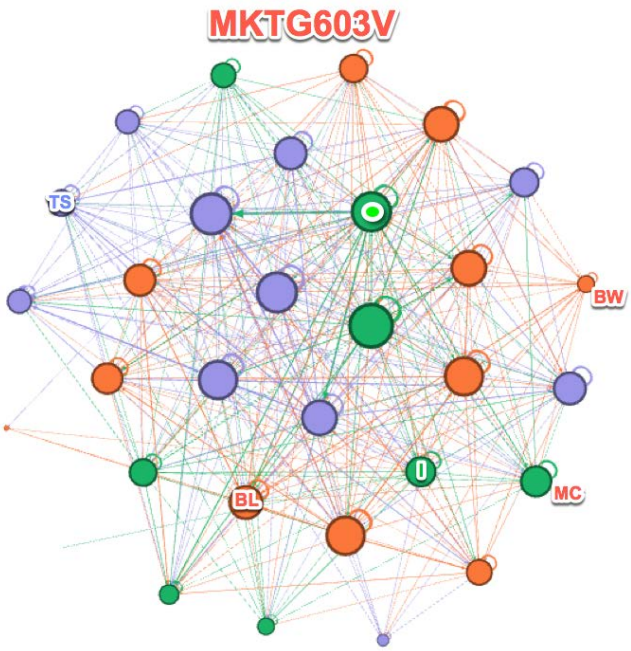
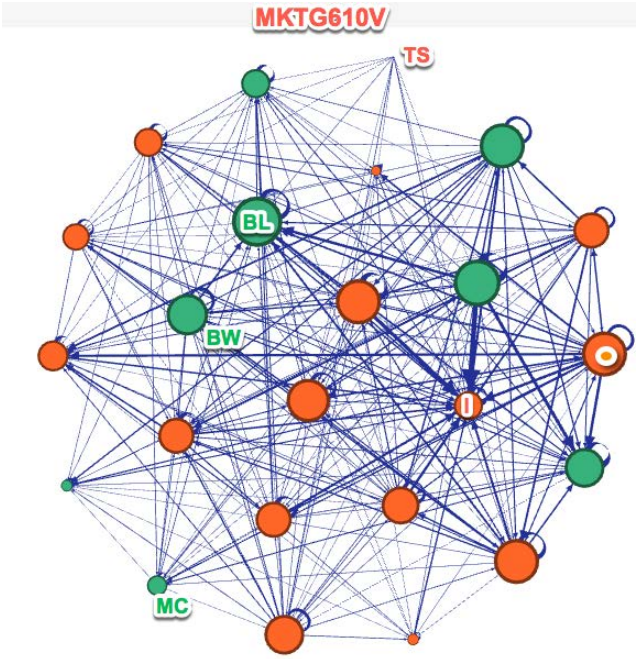


Figure 8
Network Graph – Virtual/Online Social Media Marketing Class



Individual Contributions

Table 2 reports specific variables in the network analysis for students who overlapped in the courses (i.e., were members of both the Social Media Marketing course and the Customer

Service and Relationship Management course, either face-to-face or online) and who were most active in each network. First, the table reports *Total Actions* for each student (TTL Actions) which includes social actions (comments and up-votes) and more traditional contributions (posts). Next, we measured *Out-Degree* which, in our course communities, is the number of times a community member has sent feedback directly to another student through comments and up-votes. Conversely, *In-Degree* is the number of times a community member has received direct feedback from another member of the course community through comments and up-votes.

Eigenvector Centrality is a measure of power and/or influence in a community. It represents not only the number of times a community member has received feedback, but also whether that feedback was or was not given by someone else who is receiving a large amount of in-degree connections. The closer a community member's score is to one, the more influence they have. *Modularity Class* in Table 2 identifies the sub-community to which each of our identified community members belongs.

TABLE 2
Individual Contributions:
Instructors, Most Active Students, and Students Who Overlapped Communities

Course	Id	TTL Actions	Out Degree	In Degree	Eigenvector Centrality	Modularity Class
MKTG610V	INST_mcm	32	2	24	1	0
Most Active	STUD_smc	144	23	12	0.519792487	0
	STUD_bal	66	18	20	0.837423055	1
	STUD_bnw	82	18	15	0.675437269	1
	STUD_mlc	32	12	9	0.383701963	1
	STUD_tls*	14	10	0	0	0
MKTG603V	INST_mjm	10	4	31	1	0
Most Active	STUD_mae	226	27	19	0.684100378	0
	STUD_bal	57	18	21	0.759609405	2
	STUD_mlc	41	15	21	0.723494971	0
	STUD_tls	36	16	15	0.489480856	1
	STUD_bnw	47	16	4	0.134130635	2
MKTG610f2f	INST_mcm	43	3	17	1	0
Most Active	STUD_ble	274	16	14	0.892515535	1
	STUD_bds	160	16	13	0.80155206	2
	STUD_jjm	49	7	11	0.679659799	2
	STUD_jeb	83	16	10	0.638985831	2
	STUD_jmg	66	12	10	0.608110951	2
	STUD_kac	106	15	9	0.576811134	0
MKTG603f2f	INST_mjm	15	6	21	1	2
Most Active	STUD_cms	210	18	17	0.896044002	2
	STUD_jeb	131	18	18	0.952437494	2
	STUD_bds	137	18	19	0.932695322	2
	STUD_kac	103	18	17	0.91444533	2
	STUD_jmg	68	12	16	0.85017816	2
	STUD_jjm	18	3	4	0.172768964	2

*This student (STUD_tls) dropped the course during the semester.

Instructors

In each course community, the instructors tried to create as small a footprint as possible. In all four communities, the instructors performed fewer total actions than anyone else in our sample group and directed less feedback to members of the class communities. However, this did

not deter students from directing feedback (comments and up-votes) to the instructors. In all four communities, the instructors received more in-degree actions than any other member of our community sample. The instructor eigenvector centrality score of one indicates that, despite efforts to maintain a low profile, instructors maintained their power and influence in course interactions.

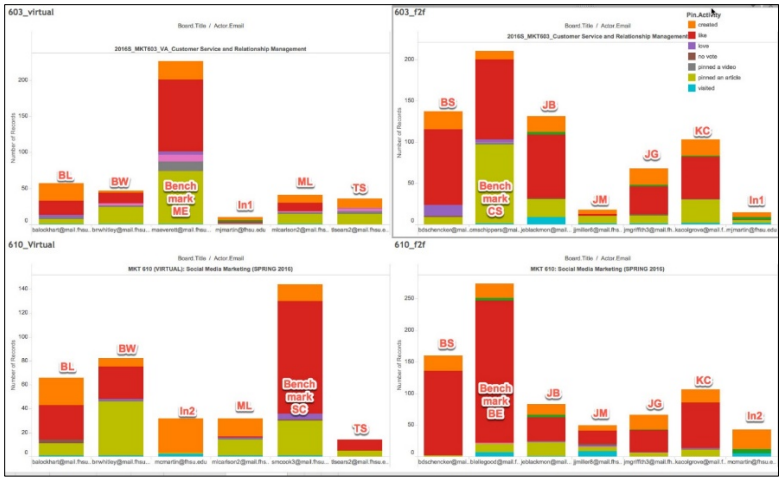
Most Active Student

In each community, we identified the one student who was most active (i.e., had the most total actions). We used this student's activity as a way to benchmark the activities of the other members of our sample communities. It is interesting to see that total actions does not automatically confer power and influence. All of our most active students had out-degree actions greater than or equal to the highest numbers in our sample. However, in three of our four course communities, the social actions of these high-activity students were reciprocated at a lower rate than the other students in the sample. If we compare eigenvector centrality scores, only one of these high-activity students had the highest score in their respective community. Finally, in three of our four communities, the student with the highest level of activity was in a different sub-community from most of our sample members.

Students Who Overlapped Courses

The four network graphs shown in Figures 5-8 provide visual representations of each course, allowing us to see where overlapping students are positioned in the networks. Each node represents a member of the community (student). The *color* of the node indicates the modularity class of that member. The *size* of the node indicates the relative number of comments made by a student; the larger the node, the greater the total in-degree and out-degree scores for that member. The directional lines linking each member represent connections between community members. The thicker links (edges) indicate that multiple connections have been made. Overlapping students have been annotated with two initials. The most active student in each network has a highlighted dot in the center of his/her node and the instructor is indicated with an "I." The Tableau graph shown in Figure 9 provides a visual representations of the overlapping students' Yellowdig activities in each course. While we represent only the *overlapping* students in Figures 5-9, all students in a course may be represented visually to identify easily their positions in the course, number of comments (both in-degree and out-degree), sub-communities, and links to other students.

Figure 9
Tableau Dashboard: Comparison of Overlapping Students in Each Course



Note: The "Benchmark" student in each graph is the most active student on Yellowdig.

Relationship between Engagement and Learning

For all students in the four courses (n=88), we conducted multiple linear regression to explain the relationship between course grades (the dependent variable serving as a proxy for learning in this study) and the individual network measures of in-degree, out-degree, and eigenvector centrality (independent variables serving as proxies for engagement).

Before running the multiple linear regression, an analysis of standard residuals was carried out on the data to identify any outliers, which indicated that five students needed to be removed from the analysis. Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (Eigenvector Centrality, Tolerance = .431, VIF = 2.318; In-Degree, Tolerance = .356, VIF = 2.811; Out-Degree, Tolerance = .730, VIF = 1.370). The data met the assumption of independent errors (Durbin-Watson value = 2.005). The histogram of standardized residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals, which showed points that were not completely on the line, but close. The scatterplot of standardized residuals showed that the data met the assumptions of homogeneity of variance and linearity. The data also met the assumption of non-zero variances (Course Grade, Variance = 60.965; Eigenvector Centrality, Variance = 0.036; In-Degree, Variance = 23.416; Out-Degree, Variance = 33.523).

A significant regression equation was found ($F(3,79) = 18.845$, $p<.01$), with an R^2 of .417. Students' predicted grade (in percentage) is equal to 69.777 + .646(Out-Degree). Out-Degree was a significant predictor; Eigenvector Centrality and In-Degree were not. Students' grades in the courses were predicted by their out-degree score, which is the number of times a student has sent feedback directly to another student (i.e., commented on or up-voted another student's post), indicating that engagement (out-degree) is a predictor of learning (course grade).

DISCUSSION

Consistent with the paradigm of social learning, a new social media platform designed for use in higher education, Yellowdig, was piloted in four marketing classes (two face-to-face and

two online). Data visualization and social network analyses were conducted to better understand social interactions taking place within a course, as well as individual student contributions to the classroom community. Multiple linear regression was used to determine whether students' course grades (learning) can be predicted by their engagement in a course. We believe that analyses at both levels – social interactions and individual student contributions – are important to understanding and making social learning more effective.

Rather than traditional *summative* assessment, whereby student learning is evaluated at the end of an instructional unit by comparing it against some standard or benchmark (e.g., a final paper or project), Yellowdig allows instructors to conduct *formative* assessment. As Feldstein and Gower (2015) wrote, "Using learning analytics to assess digital social learning platforms allow us to shift our focus from summative assessments of individual performance to visible, and in some cases actionable, behaviors and patterns at the individual and collaborative levels in the learning environment" (Feldstein & Gower, 2015, p. 6). With formative assessment, student learning and engagement are monitored to provide ongoing feedback to students. Visualization and social network analysis of Yellowdig data can help instructors identify students who need to improve their Yellowdig engagement (with pins and comments) and performance (by earning up-votes, instructor badges, and a place on the leaderboard) and then provide explicit coaching of students and/or implicit feedback through class discussions (e.g., recognition of students on the leaderboard or who have received instructor badges).

Social Interactions

Social interactions in the courses were assessed by calculating, for each class community, total actions, social actions, % social, graph density, average degree, and modularity class. We observed more *total actions* in the MKTG 603 Customer Service and Relationship Management classes, perhaps partly due to a greater number of nodes (students and an instructor) in the courses (21 and 31 versus 17 and 24 in the MKTG 610 classes). We also observed the number of *social actions* (comments and up-votes) and percent of total actions for all classes; *% social* ranged from 13.53% to 20.18%, meaning that the majority of actions by students was posting. This is not surprising given that a larger number of points may be earned by posting (versus commenting or up-voting).

We observed a *graph density* less than one for all four courses, which is not surprising as we would not expect all students to have directed a comment to every other student in a class, and that the face-to-face sections of each course are denser than the online sections. Perhaps the fact that the students actually meet physically in the face-to-face classroom encourages graph density.

We observed an *average degree* (the average number of directed social actions, including comments and up-votes) ranging from 20.8 to 33.4 across the four courses, with a higher average degree in the online classes (33.4 and 28 versus 20.8 and 27.4). Interestingly, students in the online classes comment and up-vote more, but do not connect to as many students within a class (graph density). Finally, by calculating *modularity class* for all four classes, we identified three sub-communities in three courses (MKTG 603 face-to-face and online; MKTG 610 face-to-face) and two in the remaining course (MKTG 610 online).

As instructors, a high level of graph density (closer to one) is desirable (more students directing more comments to every other student in the network) as this indicates an overall higher level of engagement in a class, with individual students who are highly engaged and connected to each other. Posting, a form of co-creation of content, is important as students experience the benefits of social learning. Encouraging all students, not just a few, to post content will result in

higher total actions. The number of social actions relative to total actions and average degree are also important. Instructors should encourage students to comment on and up-vote other students' posts. Comments require effort on the part of a student. They must read the article and then compose a meaningful comment in their own words, and a good comment may attract comments from other students. The Yellowdig point system encourages high quality comments as instructors can revoke a student's points if he/she believes a comment is not relevant, well thought-out, or does not contribute meaningfully to the Yellowdig board. Further, by assessing modularity class, instructors can identify sub-communities within a particular class and encourage, either explicitly or implicitly, for students to interact with all other students in the class, rather than with just those in a sub-community.

Individual Contributions to the Classroom Communities and Impact on Learning

In this study, the instructors purposely minimized their footprints in the courses (i.e., did not up-vote or comment on students' posts or award Instructor Badges which would have awarded points to students), but they were still influential. We observed that the instructors performed fewer total actions than students and directed less feedback (comments and up-votes) to members of the class communities. However, this did not deter students from directing feedback (comments and up-votes) to the instructors; instructors' eigenvector centrality scores were one, indicating that, despite efforts to maintain a low profile, instructors maintained their power and influence in the class communities. Instructors should strive to be influential in the class communities, but monitor their footprints to determine the extent of (through eigenvector centrality scores) and sources of influence (through number of posts, comments, up-votes, etc. reflected in total actions, out-degree, and in-degree).

Instructors should also monitor individual student contributions to the class communities. In this study, individual contributions were assessed by calculating students' total actions, out-degree, in-degree, eigenvector centrality, and modularity class in each class community. Using students who overlapped courses, we demonstrated visual representations of each course to see where overlapping students are positioned in the networks. By studying a network graph, we can identify nodes (students), their memberships in sub-communities (by node color), their number of comments (by node size), and connections to other students (edges).

In this study, we identified high-activity students and powerful, influential students, though these are not necessarily the same students. We benchmarked students' activities against the most active student in each class and found that the most active student had out-degree actions greater than or equal to others in the classroom community. However, in three of our four class communities, the social actions of these high-activity students were reciprocated at a lower rate than the other students in the sample. Further, only one of these high-activity students had the highest influence score in their respective classroom community (as indicated by eigenvector centrality scores).

We conducted multiple linear regression to determine whether student learning can be predicted by their engagement in the class communities. The results of the analysis indicated that out-degree (the number of times a community member has sent feedback directly to another student through comments and up-votes) is a significant predictor of course grades. We believe that a student's course grade was impacted because commenting on other students' posts requires thought and effort into articles being posted on Yellowdig. Students with higher grades read and commented on more articles throughout the semester which complimented the content they were learning in other aspects of the course.

Based on an analysis of their own footprint and individual student contributions to a class community, instructors can work to strategically manipulate a social network to enhance students' engagement and social learning. High-activity and influential students should be recognized by the instructor, and the instructor should encourage others to emulate their behaviors in Yellowdig. Instructors can reward students for meaningful, relevant contributions and good social behavior through comments, up-voting, and instructor badges, and recognize high performers by monitoring and commenting on the leaderboard. In turn, students' confidence and the social learning occurring in the class community will likely be boosted as the health of the network increases.

Conclusions

Social learning is important in today's world and an essential part of our students' lives, both inside and outside the traditional face-to-face and online classrooms. Through social learning, students can develop critical thinking, oral and written communication skills, and collaboration skills such as giving and receiving feedback (Feldstein & Gower, 2015). In the marketing classroom, in particular, social learning and the use of social media platforms like Yellowdig can be powerful. Yellowdig can engage students in course content and help marketing majors become more adept at using social media, a skill many will need as the market for graduates with social media marketing experience continues to grow. It also offers a way for students to integrate theory and practice as they participate in more traditional classroom activities (textbook reading, tests, projects) and, at the same time, compliment that effort with social learning in the form of co-creation and sharing of content on Yellowdig. Researchers found measurable increases in student engagement and learning outcomes when faculty and students co-created content on a social platform (Mandviwalla, Schuff, Chacko, & Miller, 2013). When students are seeking new and interesting content on a daily basis and bringing it to the classroom with their own take on it, that integration between theory and practice comes alive and students become more active learners by taking more responsibility for their learning.

Dabbagh and Kitsantas (2012) discuss social media in higher education in the context of Personal Learning Environments (PLEs). PLEs are "the tools, communities, and services that constitute the individual educational platforms learners use to direct their own learning and pursue educational goals (EDUCAUSE Learning Initiative, 2009, p. 1). Dabbagh and Kitsantas (2012) developed a pedagogical framework for social media use and present ways in which specific social media platforms can be used across three levels of interactivity (personal information management, social interaction and collaboration, and information aggregation and management). Consistent with this pedagogical framework, Yellowdig allows student interaction at all three levels of personal information management, social interaction and collaboration, and information aggregation and management (Dabbagh & Kitsantas, 2012) and can bridge the gap and integrate formal and informal learning (Chen and Bryer, 2012; Dabbagh & Kitsantas, 2012).

This research provides several contributions to the marketing pedagogy literature. First, we describe the implementation of Yellowdig, a new social media platform designed for use in higher education with the goal of enhancing student engagement and learning. Second, we demonstrate how Yellowdig data can be analyzed visually and with social network analysis to understand social interactions and individual student contributions to a classroom community. Third, we provide evidence using multiple linear regression that student learning is predicted by engagement in a course through Yellowdig activities. Finally, we offer educators strategies and suggestions for analyzing and manipulating strategically a classroom community to enhance the health of the overall social network and to increase and improve individual students' social behaviors and

contributions. In the end, we believe social learning through social media platforms like Yellowdig will enhance instructor and student experiences and, ultimately, student engagement and learning.

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