

What Can We Learn from Facebook Activity? Using Social Learning Analytics to Observe New Media Literacy Skills

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ABSTRACT

Social media platforms such as Facebook are now a ubiquitous part of everyday life for many people. New media scholars posit that the participatory culture encouraged by social media gives rise to new forms of literacy skills that are vital to learning. However, there have been few attempts to use analytics to understand the new media literacy skills that may be embedded in an individual's participation in social media. In this paper, I collect raw activity data that was shared by an exploratory sample of Facebook users. I then utilize factor analysis and regression models to show how (a) Facebook members' online activity coalesce into distinct categories of social media behavior and (b) how these participatory behaviors correlate with and predict measures of new media literacy skills. The study demonstrates the use of analytics to understand the literacies embedded in people's social media activity. The implications speak to the potential of social learning analytics to identify and predict new media literacy skills from data streams in social media platforms.

Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]: Literacy

General Terms

Measurement, Human Factors.

Keywords

Learning Analytics, Social Learning Analytics, Social Media, Literacy, New Media Literacy.

1. INTRODUCTION

Some of the most popular websites in the world are social networking applications such as Facebook, video sharing sites such as Youtube, and massive, user-generated resources such as Wikipedia. Online applications are increasingly ubiquitous, social, and participatory [19, 29]. Against this backdrop, educators and policymakers agree that individuals must develop so-called "21st century skills" which include critical thinking, collaboration, communication, and information literacy [13, 26]. The concept of

21st century skills is not new, but the nature of these skills is profoundly different in media-rich environments. For example, collaboration is an enduring human skill, but individuals must now be able to collaborate in environments that are mediated by technology, across distances, with mass numbers of users, and with easy access to information.

Literacy scholars also contribute to this dialogue by elaborating particular skills that are important when individuals interact with new media. For example, Jenkins [19] observes that the rise of online communities such as Facebook facilitates a *participatory culture* where individuals must develop literacies such as networking, information appropriation, remix, judgment, and collective intelligence. As individuals leave traces of their online behavior in platforms such as social network sites, there are ripe opportunities to examine whether these behaviors can be utilized as indicators of such literacies. The emerging field of learning analytics offers strategies to assess and examine the development of new media literacy skills in naturalistic, online environments [12].

Learning analytics describes different ways of collecting and analyzing data about learner interactions within their contexts, with the goal of understanding and optimizing learning environments [5]. One particular opportunity is to leverage the data individuals produce via their participation in social media communities. Buckingham Shum & Ferguson [8] identify this opportunity as social learning analytics, which focuses on combining sociocultural frameworks of learning with analytics to understand people's learning processes and dispositions. This study demonstrates this idea by utilizing traces of participatory behavior that individuals enact in a popular social media platform (Facebook) to directly analyze, measure, and predict new media literacy skills.

In the following paper, I demonstrate the use of social media data, culled from the popular social network site (SNS) Facebook, to observe new media literacy skills. First, the paper integrates ideas about social media, sociocultural learning, and social learning analytics. Second, I argue for the utility of using publicly available social data from popular platforms to assess literacy skills. Third, the paper outlines an approach that utilizes Facebook's application programming interface (API) to collect individuals' activity data. In this study, I consider two exploratory questions:

1. Do Facebook interactions cluster into conceptually distinct behaviors?
2. And do these behaviors correlate with and predict new media literacy skills?

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I report two analyses from this data: (1) an exploratory factor analysis to examine how raw activity data may group into broader categories of behavior, and (2) regression models that explore whether these behaviors predict new media literacy skills. The analyses present exploratory evidence towards the validity of analyzing raw activity data from social media platforms, as indicators of different literacy skills. Such indicators could be used in a variety of ways such as to make learners cognizant of the new media literacy skills they develop through their everyday online activities or validate the presence and importance of 21st century literacies as measurable outcomes for learners. The following study is exploratory in nature, but offers implications for the use of publicly available social data streams to assess and predict literacy skills *in situ*, from an individual's natural participation in online communities.

2. SOCIAL MEDIA, LITERACY SKILLS, AND SOCIAL LEARNING ANALYTICS

Educators are increasingly interested in the use of social media for learning. Scholars argue that platforms such as Facebook or Twitter allow individuals to practice new skills and ways to engage with learning processes [15, 16, 17]. A natural link between social technologies and learning is the development of new media literacy skills. Jenkins [19] observes that individuals now participate in online communities and engage with new technologies that encourage media creation and sharing. Today's learner does not merely read or consume content. They create information in a myriad of media channels and formats, such as status updates on Facebook, tweets on the Twitter platform, videos on Youtube, or personal blog posts. These affordances create a *participatory culture* where creating, sharing, and collaborating in online networks become vital skills for learning. Jenkins suggests that the following literacy skills are vital when working in new media environments:

- **Play** – capacity to problem solve, tinker, and experiment with one's surroundings
- **Performance** – ability to adopt different identities to explore and learn
- **Simulation** – ability to construct and interpret models to explore real-world phenomena
- **Appropriation** – understanding of how to sample and remix other sources in one's own work
- **Multitasking** – capability to shift attention as needed
- **Distributed Cognition** – skills to effectively use information and tools to expand one's mental capacity
- **Collective Intelligence** – ability to collaborate and pool knowledge effectively
- **Judgment** – skills to evaluate information sources as credible and reliable
- **Transmedia Navigation** – use of multiple means and platforms to follow information streams
- **Networking** – ability to search for, synthesize, and share information through online networks
- **Negotiation** – ability to participate in and adapt to different communities

These examples highlight how literacy skills are uniquely tied to our current environment and technological tools. For example, networking is an enduring skill that exists in a variety of contexts. One can network in a face-to-face setting and one can also network in an SNS such as Facebook. The skills required in either setting differ in many ways. New media literacies, and the related concept of 21st century skills, describe abilities and practices that are intimately tied to the opportunities afforded by new technologies.

Sociocultural theories of learning help to frame how learning is comprised of social interaction that occurs in situated settings. A sociocultural perspective recognizes that learning is defined through interaction with others, with tools available to the learner, and within specific institutional and cultural constraints [20, 22]. To illustrate, one can ask the question, "How do I know if a person has learned or developed expertise in appropriation skills?" The evidence to answer this question is entirely dependent on the situated context one considers. For example, the proper practice of citing prior research in an academic paper consists of particular skills, cultural expectations from different communities of scholars, and institutional norms such as publication venues and a plethora of other drivers. Learning appropriation skills in this context is uniquely tied to these complex social interactions, cultural contexts, and institutions within which academic writers work.

With new media tools, the skill of appropriation takes on entirely new meanings. Memes that emerge and spread via Internet forums are a common example of new definitions of appropriation. Shirky [27] documents one such phenomenon, "lolcats", which feature images of cats with humorous or poignant captions. These images are often shared, voted on and spread, via online social forums. The creators of these images combine, or remix, already existing images and words, to create combinations that exhibit new forms of thought, humor, or social commentary. Learning how to be a good remixer requires different appropriation skills – technical cultural, and institutional – than the appropriation practices seen in formal academic work [3].

Sociocultural theories also recognize that artifacts, technology, and tools mediate learning [20]. The use of language and the tools available in a given environment are examples of how artifacts mediate the way we learn. For example, within primary and secondary science education classrooms, scholars observe that cultural norms of communication styles define whether and how one can observe learning happening [4, 22, 24]. A young person learns science in particular ways in a formal classroom and in other ways via everyday life activities [10, 11].

Similarly, recent studies of youths and social media highlight how the technological language of new media environments also shape learning. For example, Jenkins [19] identifies performance as an important literacy skill. A "good" performance can be defined in various ways depending on a situation such as acting in a stage play, giving a speech, or participating in a classroom discussion. Young people also readily adopt the technological tools available to them, such as social network sites, to develop their everyday performance skills. Researchers have found that adolescents will actively configure their SNS profiles to "perform" their identities – friends, interests, hobbies, and personalities etc. – in these online communities [6, 16].

A sociocultural framework suggests that different environments may afford very distinct behaviors and literacy skills. This understanding leads to natural questions of what specific literacies

might develop from using different social media platforms such as Facebook. Observing and measuring these literacy skills has traditionally been limited to qualitative observation. New media literacy skills are difficult to quantitatively measure, predict, or assess because they are often processes, or interactions that are cumbersome to observe via traditional methods such as surveys [28]. Learning analytics may aid in observing indicators of literacy skills in natural settings.

2.1 A social learning analytics approach to understand new media literacy

In the nascent literature of learning analytics, a few scholars have forwarded the idea of understanding social learning in online communities through analytics. For example, Buckingham Schum & Ferguson [8] define the term social learning analytics to delineate strategies to measure and “render visible, and in some cases potentially actionable, behaviours and patterns in the learning environment that signify effective *process*” [sic]. In addition, Dawson [12] observes that researchers are now able to use big data culled from online communities to measure and track new literacy skills. These ideas arise from the fact that users’ actions are now readily tracked and recorded in online platforms, providing a direct view into some learning behaviors.

These authors highlight how online social platforms allow researchers to utilize different analysis strategies to understand social learning. For example, one could use social network analysis to ascertain an individual’s position in a network of learners or network of interactions [8, 12]. Network position then serves as a measure of influence (e.g. a person is more central in a learning network) or perhaps collaboration (e.g. a person is connected with diverse others). In addition, researchers could utilize strategies such as analyzing discourse patterns in online conversation or content analysis of user-generated media [8].

Social media sites, such as Facebook, collect detailed interaction data. These platforms might collect user activity such as how many messages are posted, updates shared, photos uploaded and other user behaviors. If one takes a sociocultural learning perspective, that these actions themselves define potential literacy behaviors, then there is opportunity to better understand whether social media activities could serve as general indicators of underlying new media literacies. Traditional measurement tools, such as surveys, might instead give way to natural observation from digital traces left by individuals in their everyday online activity. In this study, I consider this opportunity by exploring whether publicly shared Facebook activity data can be used to measure and predict new media literacy skills.

2.2 Research questions

Individuals participate in a variety of activities within social network sites such as Facebook. Members of these communities can create their own profiles, add and delete friends to their networks, and browse the profiles of friends in their network [7]. In addition, users can write email messages, leave short wall posts on friends’ pages, broadcast status updates, create groups, share links, upload media such as photos and videos, and spread information by sharing posts from one’s friends. A growing literature has documented how these affordances are used to create diverse examples of participatory culture such as college students using the platform to create campus groups, teenagers learning media skills, or individuals developing social capital [1, 2, 9, 14, 16, 21].

However, it is unclear whether raw Facebook activity might reflect specific behaviors that can be linked to new media literacies. Thus, the first research question in this study explores whether Facebook activity (e.g. messages sent, status updates, photos shared etc.) coalesce in ways that suggest broader categories of behavior:

R1: Do Facebook interactions cluster into conceptually distinct behaviors?

The first research question is exploratory and asks whether Facebook activity can be categorized into higher-order categories of behavior. The second research question then examines whether Facebook activity is significantly correlated to measures of new media literacy.

R2: Do these behaviors (in Facebook) correlate with and predict new media literacy skills?

In this analysis, I apply Jenkins’ [19] framework of new media literacy skills: Play, Performance, Simulation, Appropriation, Multitasking, Distributed Cognition, Collective Intelligence, Judgment, Transmedia Navigation, Networking, and Negotiation.

3. METHODOLOGY

Data for this analysis was collected via a custom Facebook application that was developed for this project. A website was developed that presented participants with a clear consent form detailing all research activities. Once participants gave consent they were presented with an online survey. The survey collected basic demographic data in addition to measures of new media literacies and general technology literacy (described below). Once participants completed the survey they were invited to login to their Facebook accounts and share their public social network data for this study. I utilized the publicly available Facebook API to connect the research website, online survey, and participants’ Facebook accounts. The API allows developers to access particular data fields that represent the users’ interactions on the Facebook platform.

Facebook policies for data use require that any application that utilizes user data must request *clear and explicit permissions*. When a participant connected their Facebook account, they were presented with a standard Facebook screen that listed all potential permissions for data sharing. The participant was able to decline or opt out at any time in this process. Thus, all participants in this study went through two explicit phases of consent. They were given all research information at the outset and gave their consent to take the online survey. They then went through a second opportunity for consent when sharing their Facebook data for the research project. There were 189 participants who took the online survey, and 99 then connected their Facebook data in the second phase.

The participants in this study clearly took part in both consent phases and took full advantage of opportunities to opt out at any moment, as nearly 50% of participants opted out of Facebook sharing. I employed this strategy of multiple consent processes because the ethics of data in social media platforms is a vital consideration that remains an unexplored issue in current research. The data collection experience reported here provides a demonstration for researchers who might leverage social media data in future studies. This type of data collection should require explicit consent at every phase and researchers can expect substantial opt-out rates. Finally, researchers could also plan to develop web applications that benefit the user in addition to serving as a data collection mechanism, as a way to improve both

the participant experience and participation rate. These are among the best practices recommended by Facebook for application developers, and are highly salient for researchers as well.

Participants were recruited through email, announcements via the author’s Twitter and Facebook network, personal contacts and flyers distributed on a college campus in the eastern United States. As noted earlier, 189 participants completed the online survey with 99 who also provided additional consent and shared their Facebook data for the study. I note from the outset that this is a convenience sample and the design of the present study is exploratory in nature. However, this exploratory study is the first from the author’s knowledge, to quantitatively examine new media literacy skills using a novel approach of data collection from participants’ Facebook activity.

3.1 Measures and variables

I employed another safeguard for participants in the data collection by only collecting aggregate measures of Facebook activity, and not gathering any personally identifiable information. For example, the data used in this analysis considered aggregate measures such as the total number of friends a user had in their network, but I did not collect the actual usernames or IDs of these friends. This detail is important because it shapes analytic strategies. User privacy remains generally intact in this data collection, but methods such as social network analysis are not possible since exact ties to particular friends are not collected.

These ethical decisions also require researchers and analysts to be critical about what insight is gained or lost from a particular data collection strategy. In this study, I explore whether different Facebook activities group together into broader categories of behavior (see findings below). This analytic strategy of discerning fewer, broader variables can be potentially useful for data streams culled from popular social media platforms where the number of variables can be large. However, this decision necessarily abstracts behavior at a higher-level and blurs our understanding of more detailed cultural practices. For example, the variable – Links (see below) – can serve as a relatively clear proxy for members sharing information through hyperlinks. However, without direct observation of what the hyperlinks refer to, one cannot analyze the diverse cultural practices that might emerge from the same function of sharing links. I note these tensions at the outset.

When a participant connected their Facebook account, the application collected an aggregate record of the user’s activity over the previous 30 days. The variables collected for each participant included:

- **Emails received** – number of emails received on Facebook
- **Emails sent** – number of emails sent by the user on Facebook
- **Friends** - number of friends in the user’s network
- **Friend Lists** – Facebook users can organize their friends into lists (close friends, coworkers etc.). This variable is the number of lists created.
- **Links** – number of hyperlinks shared by the user with his or her network
- **Member Pages** – number of Facebook pages a user had joined
- **Networks** – number of networks a user joined (e.g. geographic network, a college network etc.)
- **Notes** – number of blog posts a user wrote

Table 1: Descriptive Statistics

Variable	Mean (St. Dev.) or Percentage
Gender (Female)	68.69%
Age	26.42 (7.99)
New Media Literacy Scales	
Negotiation	10.65 (3.03)
Networking	14.61 (3.27)
Judgment	15.67 (2.58)
Play	11.58 (2.52)
Multitasking	9.85 (3.21)
Remixing	8.71 (2.76)
Transmedia Navigation	4.67 (1.85)
Technology Literacy Scale	58.65 (14.25)
Facebook Data	
Emails Received	60.36 (90.74)
Emails Written	64.31 (134.02)
Friends	444.64 (381.62)
Friend Lists	3.35 (4.41)
Links	5.04 (8.35)
Member Pages	169.24 (501.37)
Networks	0.87 (0.93)
Notes	0.21 (0.95)
Photos	17.98 (42.84)
Status Messages	13.69 (20.73)
Videos	0.19 (0.77)
Wall Posts	22.53 (12.38)
N = 99	

- **Photos** – number of photos posted
- **Status Messages** – number of status messages posted by the user
- **Videos** – number of videos posted by the user
- **Wallposts** – number of wall posts received by the user from their network

The Facebook application for this study only collected this data at a single time point (Spring 2011) and ceased any data collection after a participant completed the study. The variables were chosen based on a combination of decision points: whether the specific data was directly available via the Facebook API at the time of development (with no need to parse user’s news feeds) and indicators that might signify active behaviors such as sending messages or joining groups (versus news items that appear on a member’s news feed, but would be unclear whether the member actually read the item or not).

The participants completed a survey that sought to measure the new media literacy skills outlined by Jenkins [19] using 5-point likert scale question (see [23] for more details of the new media literacy scales). To illustrate a typical scale, the networking scale

Table 2: Factor Loadings of Facebook Activity

	Factor 1: Messaging	Factor 2: Info. Sharing	Factor 3: Friending	Factor 4: Affiliating
Emails Received	0.91			
Emails Written	0.91			
Wall Posts	0.55			
Status Messages	0.63	0.53		
Friend Lists		0.63		
Links		0.65		
Member Pages		0.55		
Photos		0.71		
Friends			0.83	
Notes			-0.83	
Videos			-0.52	
Networks				0.92
Factor loadings < 0.50 suppressed, N = 99				

consisted of 5 statements where participants answered with their agreement level:

- I like to share my favorite links or creative work on social media sites like Facebook or YouTube or Twitter.
- I often share links on Facebook, Twitter, my blog, etc.
- I am happy that I can interact online or on Facebook with people from all over the world.
- I like the fact that I can see all my friends on my Facebook profile.
- When I go online, I like to feel like I am part of a community.

Similar scales asked participants about their propensity to engage with the other literacy behaviors. In this study, I collected survey scales for 7 new media literacies that had well-developed question items (see [23]): negotiation, networking, judgment, play, multitasking, remixing, and transmedia navigation.

In addition to the literacy scales, I collected several control variables for the analysis. For demographic variables, participants reported their gender and age. In addition, I collected a general scale of technology literacy developed by Hargittai & Hsieh [18] that asks participants about their general level of comfort with common technology terms such as weblog, pdf, spyware, wiki and other items. Descriptive statistics are provided in Table 1.

4. ANALYSIS AND RESULTS

In the following, I present two related analyses to address the research questions posed in this study. First, an exploratory factor analysis was used to explore whether Facebook activity data grouped into distinct participatory behaviors. Second, I used the factors that arose from this analysis in regression models to examine whether behaviors found in the Facebook environment correlated with survey measures of new media literacies.

4.1 Exploratory factor analysis

Before factor analysis, I conducted descriptive exploration of the Facebook variables. As is often the case with data culled from online communities, almost all of the variables followed a power

law distribution except the variable, networks. For example, the majority of members in this sample sent and received a few emails with others in the Facebook platform. However, there were a few individual users who exchanged increasing amounts of emails, creating a long tail distribution. Due to these non-normal distributions, I transformed the variables using the natural log.

I utilized the data shared by Facebook participants in a principal components analysis to explore whether these online activities coalesced into distinct factors. Varimax rotation was applied to identify distinct, independent factors that were orthogonal to one another. Four factors were identified that had eigenvalues above 1.0. These four factors explained approximately 71% of the variance among variables. The first factor accounted for 34% of the variance, the second factor accounted for 17%, the third factor for 12%, and the fourth factor accounted for 8%.

Table 2 reports the factor loadings of the variables. The first factor included Facebook activity such as emailing, writing status messages, and receiving wall posts on one's profile page. These variables represent different *messaging* behaviors in the Facebook platform. The second factor included Facebook activity such as writing status messages, sharing links, sharing photos, managing networks by creating friend lists, and joining member pages. The interactions suggest different ways that Facebook members manage their *information sharing* behaviors. The online community is a place for individuals to share personal information, links to other sources, and media such as photos. In addition, individuals are increasingly using features such as friend lists to manage what they share and with whom. For example, creating a friend list of coworkers and another list of personal friends requires an explicit thought process that one will share particular information with one group and not the other.

One interesting result was the overlap of status messages with both messaging and information sharing. This finding lends face validity to the analysis, as status messages are often used in diverse ways. Most of the variables in the messaging factor refer to direct communication where an individual directly writes to another via a Facebook email or on their wall. Most of the variables in the information sharing factor refer to updates or

media that Facebook members share broadly. Status messages appear to be a part of both distinct behaviors.

The third factor identified in this analysis was *friending* behavior. The main variable in this factor was the size of one’s friend network. Having more friends on Facebook means an explicit practice of accepting friend requests and seeking out more connections. Interestingly, this factor had some substantial negative loadings for writing notes (e.g. Facebook’s version of blog posts) and sharing videos. Writing notes and creating videos might be examples of inward, individual-focused behaviors, which is different than outward, networking-focused behavior such as accumulating larger networks. The fourth factor was largely made up of one major variable, networks, which denote how many groups with which a person affiliated. In Facebook one can join networks such as an alumni group, a regional group (e.g. I am a part of the New York City network), and other group identifications. This feature may represent *affiliating* or group identity behaviors in the Facebook platform.

The exploratory factor analysis suggests that Facebook data from this sample of participants can form higher-order categories of participatory behavior. In this sample, the behaviors that appear to be represented also align with the major features and activities one would undertake in a social networking platform: messaging others, sharing media and information, linking with friends, and affiliating with networks. Using the results of this factor analysis, I then created four composite variables that represent these behaviors, to use in the subsequent analysis.

4.2 Regression analysis

The second research question asks whether the participatory behaviors observed in the Facebook platform might also reflect or correlate with measures of new media literacy skills. To examine this question, I conducted an ordinary least squares (OLS) regression analysis. The regression model examined the survey measures of new media literacy skills as the dependent variable. I examine seven literacy skills: negotiation, networking, judgment, play, multitasking, appropriation, and transmedia navigation [19]. The independent variables in the regression model included the four factor variables – messaging, information sharing, friending, and affiliating – in addition to three control variables (technology

literacy, gender, and age). The resulting linear model is:

$$y = \beta_1 \text{messaging} + \beta_2 \text{information sharing} + \beta_3 \text{friending} + \beta_4 \text{affiliating} + \beta_5 \text{tech-literacy} + \beta_6 \text{gender} + \beta_7 \text{age} + \epsilon$$

The results of the regression analyses are presented in Table 3. I do not display the demographic variables in the table, but report the instances where these variables were statistically significant predictors of particular new media literacies to aid in the interpretation.

An overarching finding from this analysis is that particular Facebook behaviors uncannily relate to new media literacy skills in ways that are ecologically valid. Popular discussions of the impact of social media for learning generally suggest that these online communities help develop literacy skills. The results presented in Table 3 contribute empirical evidence of these claims and also illuminate with more specificity, what types of activities in the platform relate to what particular media literacy skills. The results suggest that Facebook activity is particularly salient for the literacy skills of negotiation, networking, appropriation, and transmedia navigation.

Negotiation. As noted earlier, the literacy of negotiation describes the ability for individuals to participate in and adapt to diverse communities of others. The results of this study suggest that messaging behaviors in Facebook are highly related to an individual’s negotiation literacy (Table 3). A standard deviation increase in Facebook messaging behaviors was related to a 0.67 standard deviation increase in the negotiation scale. Interestingly, the other Facebook behaviors (information sharing, friending, and affiliating) were not statistically significant. These results begin to make sense however, when considering what these behaviors actually mean in the situated context of Facebook. Sharing media is largely about information dissemination, not about negotiating different community norms. Friending others in Facebook is about growing the size of one’s network, but does not necessarily mean active interaction. Affiliating with networks in Facebook is a largely passive activity; the user does this affiliation once and rarely engages with this affiliation explicitly in their daily Facebook use. It seems that active communication behaviors are related to an individual’s opportunity to negotiate diverse relationships with others.

Table 3: Regression Analysis Predicting New Media Literacies

	Negotiation	Networking	Judgment	Play	Multitasking	Appropriation	Transmedia Navigation
Messaging	0.67 **	0.60 *	0.31	0.19	-0.01	0.48	0.30
Information Sharing	0.20	1.39 **	-0.002	-0.10	0.36	0.55 *	0.32 *
Friending	-0.34	0.48	-0.32	-0.18	-0.52	0.21	0.32
Affiliating	0.33	0.77 **	-0.09	0.14	0.34	-0.06	-0.01
Control Variables ¹							
Technology Literacy	0.06 **	0.01	0.09 **	0.08 **	0.04	0.01	0.02
Adjusted R ²	0.09	0.23	0.17	0.31	0.01	0.04	0.08
N	94	95	94	93	95	93	95

Standardized coefficients

⁽¹⁾ Control variables gender and age not displayed in the table, but included in the model.

** p < 0.05, * p < 0.10

Networking. Not surprisingly, the participatory behaviors seen in Facebook are most predictive of networking literacy (Table 3). These results confirm intuitive notions of social networking sites, that they are designed for networking, and also confirm the conceptual model proposed in this study. The findings offer indicators of validity that the exploratory factor analysis identified participatory behaviors that are highly salient and related to a survey measure of networking literacy. The results in Table 3 show that messaging, information sharing, and affiliating behaviors were all highly related to networking literacy. Also interesting to note, was that information sharing behaviors had an extremely large relationship to a person's networking score. In the context of Facebook, this finding again makes perfect sense. Individuals who share more information in the platform, create more opportunities to actively interact and glean the benefits of networking behavior. Conversely, merely adding friends to one's network (and not necessarily sharing with them) was not significantly related to networking literacy.

Appropriation. The skill of appropriation describes the ability to take previous ideas and artifacts, to create one's own work. In the context of new media, practices of remix (e.g. appropriating digital media to create new projects) are an example of appropriation skills. The results in Table 3 show that information sharing behaviors in Facebook are highly correlated to appropriation literacy. Facebook members who share more media and information in their Facebook activity are likely to have more opportunities to practice appropriation skills. In fact, the very act of sharing itself could be interpreted as an act of appropriation, since one is actively using other information sources to present to others. An example of appropriation situated in Facebook is sharing of links to other media sources or creating and sharing one's own photos with the network.

Transmedia Navigation. Transmedia navigation is the ability to follow information across multiple platforms and pathways. For example, fans of the popular television series *LOST* also often participated in online forums, played reality-based games connected to the plot of the show, and discussed actual scientific knowledge to explain elements of the series. In current media environments, individuals can follow ideas through multiple platforms such as television, online communities, books, magazines, mobile applications and other means. The results in Table 3 show that information sharing behaviors in Facebook were highly correlated with transmedia navigation. The social network site itself is designed for individuals to share media, and thus could act as a connector for transmedia behaviors. Facebook members who share more information are also more likely to navigate this information by following links, or bringing other media sources into the online community.

What Didn't Facebook Activity Predict? The Facebook behaviors identified here were not significant predictors of three new media skills: judgment, play, and multitasking. A deeper interpretation of these findings also lends face validity to these results. Judgment is the ability to evaluate information sources as credible and reliable. There is nothing inherent about sending messages to others, sharing media, adding friends, or affiliating with networks that might lead a person to feel more capable to effectively evaluate credibility of information sources. The only statistically significant predictor of judgment in this model was a general measure of technology literacy. This result suggests that perhaps a broader experience with diverse media types is more likely to help one be a better evaluator of credibility, than only interacting in Facebook.

Play is the ability to problem-solve, tinker, and experiment with artifacts and objects. None of the social interactions in Facebook were significantly correlated with play literacy, and this finding makes intuitive sense as well. There is little designed into Facebook that require individuals to tinker or experiment in ways that other activities might allow (e.g. programming a computer or building a model). General technology literacy was correlated with a person's propensity to play. Interestingly, gender was highly correlated with the play scale. Males in this sample were substantially more likely to report tinkering, problem solving, and experimenting with objects than the female participants.

Finally, the ability to multitask was not significantly predicted by Facebook activity or general technology literacy. The only main predictor of multitasking literacy was age, with older individuals scoring lower on the multitasking scale compared to younger individuals. This finding mirrors popular thought, which suggests that younger generations are more comfortable with multitasking in new media environments [25].

5. DISCUSSION

This study makes several contributions to learning analytics, social media and learning research. First, the study demonstrates ways to utilize social data from the popular social media platform Facebook, to explore the new media literacy skills embedded in people's everyday online networking behaviors. Applying analytics to this social interaction data, I show how Facebook behaviors group into distinct participatory behaviors: messaging, information sharing, friending, and affiliating. In addition, this study illuminates how Facebook activity correlates and predicts particular new media literacy skills. Social media platforms represent a ripe arena to examine the social learning behaviors and sociocultural learning processes embedded in people's everyday activities. Social learning analytics provide a methodological lens to make meaning from these massive data streams.

Second, this study contributes empirical evidence of the literacy skills that are involved in one's Facebook participation. The results introduce additional clarity to the broader discussions about social media and learning. Moving beyond general claims that people's participation in social media are related to new media literacies, the use of analytics on this Facebook data begins to clarify what particular activities in these online communities relate to which specific literacy skills. Facebook behaviors appear to be most related to networking, negotiation, appropriation, and transmedia navigation. However, literacies such as play, judgement, and multitasking where not related to Facebook behavior. Such findings lend more detail to scholarly discussions about which media tools may promote which specific literacy skills.

Furthermore, the findings illuminate new questions such as what other types of media-based activities might lend themselves to the literacies not represented in Facebook behavior? For example, Facebook's design enables certain types of participatory behavior: messaging, information sharing, friending, and affiliation. Future work might consider whether other major social media platforms such as Twitter, Tumblr, Pinterest, Instagram, and others, enable diverse modes of behavior. Future work might also consider whether particular tools used to access these platforms also engender diverse practices and literacies. For example, one can interact with Twitter via the web-browser interface, Twitter clients on the iPhone and Android devices, or desktop clients such as Tweetdeck. Behaviors may differ with various tools, even within the same social media community. Social media platforms

tap into different human needs to connect and share with one another, and future work might consider whether different platforms are related to particular literacy skills.

Third, this study contributes to the emerging vision for social learning analytics. Researchers can now collect large streams of social interaction data, which directly reflect on learning dispositions that are difficult to assess via traditional instruments such as surveys. The implication of this technological capability is that researchers who utilize a sociocultural perspective on learning can actively observe, quantify, and test hypotheses about social learning processes and soft-skills in ways not possible before. For example, the exploratory study presented here begins to show how common, everyday platforms such as Facebook can show the emerging literacy skills that people develop in new media environments. Learning analytics of social data add to the repertoire of research strategies to understand learning in online platforms.

Finally, the results of this study offer potential design implications from social learning analytics. If researchers identify measures of literacy skills that are directly reflected in people's everyday social media participation, there is great potential to design dashboards and visualizations that can help individuals understand the learning benefits they accrue from this online activity. Already, for-profit services such as Klout are creating dashboards that attempt to calculate one's level of "influence" in their online social networks. A similar potential exists for educators to value, and make visible to learners, the literacy behaviors that are being developed in popular social media platforms. The idea to leverage popular platforms such as Facebook to help learners understand their own literacy development is potentially a powerful and exciting idea where learning analytics plays a central role.

5.1 Limitations

There are several limitations to note when interpreting the present study. First, the analyses presented here are clearly exploratory in nature. I utilized a convenience sample and the participant pool was relatively small, as 99 participants opted to share their Facebook data. Any interpretations are bounded by this sample only and not generalizable to the broader Facebook population. Despite these boundaries, the present study is among the first to utilize analytics on data collected directly from the Facebook platform, to assess new media literacy skills. Future work that might gain broader access to members of the platform will be helpful to validate and refine the analyses performed here.

Second, as noted in the methodology section, I made explicit data collection choices to protect the privacy of participants. Only aggregate numbers of user activity were collected in this study. While this strategy values the privacy of Facebook members by not collecting personally identifying information, it precludes certain analytic strategies such as social network analysis. However, this study demonstrates how analytic strategies that are accessible to social scientists in general, such as factor analysis and regression models can be applied to social media data in productive ways. Future studies that examine different social learning processes via network analysis, different clustering algorithms, and other modeling techniques will also make a needed contribution to the literature.

6. CONCLUSIONS

Learning analytics is a multidisciplinary field that combines the technical opportunities of data with social theories drawn from learning research. This study demonstrates how these multiple

perspectives may combine to derive deeper insight into literacy development with social media. The meeting of data, theory, and methodology in a learning analytics framework also illuminates some fundamental implications and tensions.

Opportunities to Integrate Sociocultural Learning Frameworks with new Data Streams. In traditional social science and education research traditions, it has often been difficult to directly and quantitatively observe sociocultural learning concepts and dispositions in a natural way. I argue that new media literacies are an example of learning dispositions or skills that could be readily observed and measured from social media data streams. However, to recognize such opportunities, requires researchers to integrate ideas from multiple fields. In this study, I was inspired by a theoretical framework of literacy forwarded by humanists and media literacy scholars such as Jenkins [19]. I was then able to link these concepts of literacy to behavioral data culled from a popular, global social network site, Facebook. As new media tools become increasingly *social* in focus, researchers may be able to link data streams from these platforms to traditionally difficult-to-measure facets of literacy.

Social media platforms represent a ubiquitous part of individuals' everyday lives. Not only are platforms such as Facebook, spaces for networking, but they also represent a place where tremendous levels of social learning can occur. Many of these platforms share user data through their API's that offer researchers new opportunities to directly examine social learning processes using analytics. However, the availability of large amounts of social data in popular platforms introduces considerations of privacy and ethics in collecting this data. Many companies (such as Facebook) have explicit requirements for using participant data and researchers would do well to follow these best practices.

Beyond these regulations there are critical issues related to research design that this study demonstrates for future scholars. For example, recruitment remains a salient issue for this type of research. Despite the potential availability of massive amounts of big data, access to this data for social scientists is still bounded by actively recruiting participants, unless one is a part of the company's data team itself and can access all the raw data. In this study, participants were given two explicit consent opportunities (one for the study, and another to share their Facebook data). This helps to protect participant privacy, but also demonstrates issues such as substantial opt-out rates. Future researchers in this area will have to plan for these considerations.

In addition, I chose to value participant privacy by only collecting aggregate numbers of activity. I did not collect identifying information such as a Facebook member's direct ties to others. Thus, certain analytic strategies are possible such as factor analysis and regression models, while other potentially helpful metrics are not available (e.g. social network analysis). These data collection choices reflect a tension between research needs and privacy of participants. These dilemmas are likely to be worked out in each respective study, but future work that can demonstrate ethical modes of data collection, while maintaining opportunities for diverse analytic strategies, will make a contribution to the literature.

What is Gained and Lost in Analytics? Related to issues of theory, data collection and methodology, is a critical discussion of what insights are gained and lost with analytics. This study demonstrates the tension between abstraction and depth that is inherent in learning analytics. On the one hand, the present analysis distills the diverse behaviors one can enact in Facebook into clear, broader categories of general behavior: messaging,

information sharing, friending, affiliating. Such abstraction helps in our conceptual thinking, aiding us in being honest about what learning interactions and literacies Facebook activities may engender; and equally important, does not afford. Understanding that Facebook affords particular behaviors, but not others, helps scholars develop finer-grained understanding of how different social media platforms might influence learning. Future work in social learning analytics is needed to explore whether the behaviors observed here also apply to different platforms, and have similar or different implications for learning. In addition, research that can clearly describe new forms of behavior that occur in other platforms will help build deeper understanding of how and when social media might be employed to improve learning experiences.

With learning analytics, this abstraction and analysis can occur at large scale, and data can be collected unobtrusively in naturally occurring online environments. However, a clear consequence of abstraction is lack of rich description and detail. An equally important discussion with analytics is what insight is lost when making specific methodological decisions. For example, in this study behaviors such as sharing links and creating friend lists were highly related in a factor that I generally organized as information sharing. However, individuals always appropriate technical features, such as the ability to share links or organize one's Facebook friends into groups, to create diverse and surprising cultural practices. The analytic strategy used here necessarily abstracts these details out, and other methodologies including ethnography of online communities and discourse-focused methods, are vital to inform learning analytics.

Implications for learning. One major goal of learning analytics is to measure, render visible, and make actionable, individual's learning behaviors [8]. The implications of pursuing these goals in the area of new media literacy are numerous. For education policymakers and evaluators, having indicators of literacy skills may help develop a deeper understanding of learners beyond common measures such as standardized tests of content knowledge. This study contributes to the growing understanding that we may be able to measure such literacies in popular and everyday activities such as Facebook participation. Increasingly, education stakeholders will be able to observe and value soft-skills, such as different forms of literacy, in conjunction with traditional measures of content knowledge.

For educators, recognizing the skills that are embedded in everyday activity such as Facebook also informs popular debate about the role of social media in education. Perhaps the major narrative of social media and education should not be about whether new social tools can aid in learning traditional content, but instead recognize and value literacy skills as a worthy outcome in itself. By making literacy skills visible and measurable through indicators and metrics, such debates might be more grounded in artifacts of shared data. Broad statements such as "Using Facebook helps develop new literacy skills" may instead evolve into more useful and testable claims such as "Facebook activities of messaging and information sharing help young people develop critical networking skills" or "Particular activities such as more frequent direct communication with others online, may influence positive negotiation skills among learners". The findings presented here begin to add more clarity and detail to such popular discussions.

This study only considered the Facebook platform, but nearly 1 billion individuals participate in this social network, and thus it represents a significant context to understand human behavior and

learning. However, there are a plethora of social media platforms that now boast robust membership such as Twitter, Pinterest, Instagram and others. These sites cater to very different types of participatory behavior and also represent potential opportunities to understand learning in social media environments. Future research is needed that can examine multiple social media platforms, gain access to a larger population of users, and employ diverse analytics methods while understanding the constraints of collecting data from popular platforms. Continued work that explores literacy through learning analytics on popular platforms, will make a substantial contribution to education research.

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