Chapter 16: Analytics for Informal Learning in Social Media

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ABSTRACT

Social media reaches billions of people on a daily basis, with many interactions and sites helping individuals learn and participate in learning discussions. Much of the research in learning analytics has focused on understanding practices in formal educational settings, with limited examination of learning in open, online forums. Yet, the prevalence of open, online learning suggests including learning in and through social media is a relevant area of study for learning analytics. This chapter addresses how learning in social media aligns with informal learning as, learner-led and conversation-based; how participation is essential, but also nuanced, including stages of learning how to join the community, and partial participation as each medium complements learning in an overall personal network; and how conversational interaction builds the social learning network. Conversation analysis and social network analysis are highlighted as analytical techniques, as the former defines the ties that build the network, with analysis of social media postings revealing discussion relating to subject matter, persuasion and explanation, career advice, socializing, and reinforcement of in-network rules and norms.

Keywords: Informal learning, social media, social learning, online learning, social networks, learning networks

The reach of social media, online sites, discussion forums, and communities is vast, with recent estimates of monthly active users of 2.4 to 1.1 billion per platform: Facebook, 2.4 billion; WeChat, 1.1 billion; Twitter, 330 million; Reddit, 330 million; and Stack Overflow, 50 million (as of October 2019) [54, 70, 69]. Within these social media platforms, features and subsections are emerging that focus intentionally on learning, setting the expectation of learning about a subject area of interest while also enacting a forum for discussion. How can learning analytics address these sites? What are we learning about these sites that can support design, knowledge sharing, and learning on and through social media?

This chapter addresses analytics for open, online learning environments on social media. Such online sites support a variety of collective approaches to information seeking, learning, discussion, and sharing of knowledge and life experiences. Social media sites are of interest not only for their wide reach, but also for how learning processes are determined by appropriation of technical features and in-group regulation and management, and how this creates and sustains learning communities. Neither formal nor non-formal, social media sites enact a form on informal learning dependent on networked interaction, conversation, and community in support of knowledge exchange and community. Examining how learning happens in these sites opens up exploration of what supports and signifies successful individual and community learning, and knowledge development in open, online initiatives.

This chapter first situates learning in social media within the frame of formal, non-formal and informal learning, arguing that such learning represents a new form of informal learning. Features of this new form include: a self-organizing structure for the discussion of subject matter, norms of interaction, role definition, and expert validation; the necessity of visible participation through conversation; the record of the *persistent conversation* that forms in-network social capital; and the challenges of an open, fluid membership. The chapter then addresses analytics for informal, open, online learning in social media through conversational analysis and social network connectivity.

Informal Learning in Social Media

Informal learning is distinguished from formal and non-formal learning by practice outside institutions. While formal learning is associated with educational institutions, and non-formal learning with institutions such as community and recreation centers, museums, and libraries, informal learning is associated with more ad hoc learning, and includes acquisition of attitudes, values, skills, beliefs, and knowledge from sources such as family, friends, work colleagues, media, etc. In formal and non-formal learning, experts organize and oversee the learning. In informal learning, the expert is seen as an agent who is able to identify and respond to opportunities to engage learners

in any aspect of knowledge [17, 13, 68, 37].

While *informal learning* is sometimes used as a catch-all for learning not classifiable as formal or non-formal, its value is in responsive to learner interests, in spontaneous, unplanned, conversationally-based interaction. "Informal education can be viewed as being driven by conversation and, hence, unpredictable. Informal educators do not know where conversation might lead. They have to catch the moment, to try to say or do something to deepen people's thinking or to put others in touch with their feelings." This kind of informal learning: "Works through, and is driven by, conversation. Involves exploring and enlarging experience. Can take place in any setting" [68].

A view of learning as "driven by conversation" situates informal learning in the tradition of *social learning theory*, with its emphasis on observation of behavior and its imitation (or not) based on the observed reaction to behaviors [2]. Following this tradition, Buckingham Shum and Ferguson [9, p. 5] describe the social, interactive aspect of this kind of learning and engagement online as "either interacting directly with others (for example, messaging, friending or following), or using platforms in which their activity traces will be experienced by others (for example, publishing, searching, tagging or rating)".

Working with these definitions, the structure of learning in social media aligns well with informal learning, particularly in terms of the focus on learner-directed question and answer effected through conversation. Yet, the open context and peer learning associated with social media sites differentiates it from non-school, informal learning associated with family or workplace settings. In particular, the *self-organizing structures* that emerge in open, online communities are different from the acquired structures of family and workplace. In creating these structures, participants collaborate to define and reinforce practices that support their collective learning goals [63]. Conversation, of various types and forms, provides the connective structures for the learning network. Examining conversational interaction thus provides a window into normative and emergent practices that support learning.

Within the wide range of attributes that could be analyzed for informal learning in social media, this chapter concentrates on the conversational aspects and how this supports a learning network. Discussion begins with the crucial element of participation, as it is only through some critical mass of participation that learning via social media can happen.

PARTICIPATION IN SUPPORT OF SELF-ORGANIZING PRACTICES

Self-organizing structures define and maintain the subject matter of interest, norms of interaction, membership practices, role definition, and expert validation. Yet, they depend on participation. As such, how individuals participate, and what motivates, maintains and drives participation, are key factors in assessing informal learning in social media. Such participation must be visible. Through social media and other forms of computer-mediated communication, where there is no face-to-face or institutional co-location, social presence is only measurable through visible contributions. While communications may include many modes of text, image, photo, video, audio, etc., these all must be accessible through the social medium, and contribute to an ongoing conversation.

Early research on computer-mediated communication and virtual communities wrestled with the need to build *critical mass* to start and maintain functional conversations via interactive media, and thereby build and sustain online community (e.g. [49, 12, 56]). Encouraging participation has been a major area of concern for online classes, communities, peer productions, citizen science, and knowledge sharing environments (e.g., [3, 38, 14, 62]). From an analytics perspective, participation can be assessed in a multiple ways: raw counts of activity, number of participants contributing at all or above a particular threshold, reciprocity in discussion, centrality in the network of contributions, churn in membership, longevity of the forum, affect demonstrated in posts, topics discussed, sanctions applied, and more. To determine appropriate measures, it helps to explore what is known about why people do or do not contribute, how they learn to contribute, and what is needed to sustain a viable learning community.

From Lurking to Posting

Conversation is seen as a major contributor to learning, whether informal or formal [43]. Thus, it is not surprising to find that lurking, i.e., reading and not posting, has been seen as a liability for online learning communities. On Stack Overflow, a site for learning and sharing knowledge about computer programmers, non-participants cited a number of reasons for their behavior, including doubts about personal reputation and a lack of a safe environment:

> "Over 20% of respondents said they have never participated on Stack Overflow, and we asked them why in a free text question. Many respondents said their questions already had answers, so they felt no need. Others shared different factors, though, including lack of English proficiency, the time commitment involved, and not having enough reputation to contribute the way they want. A few participants perceive the community or site mechanics as too strict or toxic for them to feel safe interacting here." [54]

Creating the *safe space*/ for contribution has been a focus of collaborative learning, another area of learning that requires contribution [7]. The safeness of a space depends on conversational style, discourse, and norms accepted and practiced in the learning environment, and how this motivates (or not) potential contributors. Safe spaces encourage expression of opinion, asking questions and potentially revealing a lack of knowledge. FAQs repositories can provide initial help on norms, but it is the actual live practice, and others' response to that practice, that matters most.

In online spaces, part of what makes a space safe is knowing how to engage in the conversation; this requires learning how to contribute in open forums [33]. Recognition of this learning has given new emphasis to lurking as *legitimate peripheral participation*, allowing newcomers the time and space to observe and learn how to participate [44, 57]. At the same time, this space to learn must eventually turn to participation or critical mass will not be maintained and the community will dissipate. An equal concern about online communication has been that the dominance of a small set of voices can mitigate against wide-spread contribution, and thus fail when central individuals leave the forum [6, 24].

Participation also requires knowing how to engage with others, i.e., how to be a member of the community. This is well-taught and well-learned for the traditional classroom, but a barrier when engagement in online environments is new. Engagement is a collective effort; how others respond to posts greatly affects whether participation continues. A post with no answer can be discouraging. For example, Bornfeld and Rafaeli [5] found about 50 percent of contributors to Stack Exchange Q&A sites dropped out after posting a single answer, but positive feedback, in up-votes and comments, was correlated with further contribution.

Not all participation is, or needs to be equal. Participation can change over time, as newcomers join the community, and others move on to other interests or forums [39, 36]. With more participation, and more commitment to the site, many individuals choose to take on more prominent roles in the community [8], e.g., as moderators, specialists, or experts; as gatekeepers bridging between multiple similar communities; and in-network *librarians* who bring attention to frequently asked or answered questions. Collectively, these commitments define the roles that support membership across the whole community. From the not-quite-ready to post lurker, to the tentative novice poster, to the fully engaged advanced participant who are likely to contribute more than they receive for their effort.

Commitment to the site may also be only partial. Participation in sites is no longer all-or-none. and learners may engage in *legitimate partial participation*. Multiple sites can provide resources. The networked individual and connectivist learner pick and choose across various sites and sources to find their ideal knowledge set [59, 67]. Participation in one site may be single threaded, e.g., seeking just the answer to a question, but multi-threaded in another, e.g., seeking and providing information on the topic, career advice, social and learning support. This shows two aspects of connectivity. First, that the combined set of threads – single for some actors, multiple for other – reveals the full nature of the social network connections that define each community (with caveats against selecting just a few members as exemplary of the site). Second, that sites with adequate participation can sustain individuals in partial participation modes, e.g., as lurker, newcomer, novice; a critical mass of participation can sustain a wider range of onlookers.

Individual motivations greatly affect participation, but, there are motivations also beyond the personal. The networked individual is often motivated by personal as well as community wide goals. Raymond [60] first noted the 'personal but shared need' associated with contribution to open source projects, which highlights dual motivations relating to personal knowledge, and contribution to a wider community. Following this idea, Budhathoki and Haythornthwaite [10] found contributors to the open source, crowdsourcing project OpenStreetMap were motivated both by personal interest associated with career or individual learning, and a wider orientation to making mapping information free to all via an open source platform. Participation may thus depend on what the site is supporting, as much as for individual learning objectives.

An In-House Library of Informal Resources

While learning engagement happens through conversation, one of the features of open, online discussion is the record of interaction that remains. Although this is not true of all social media, on platforms were online conversation is recorded and retrievable, it becomes *persistent conversation*. As defined by Tom Erickson and Susan Herring (e.g., [19]), the "transposition of ordinarily ephemeral conversation into the potentially persistent digital medium. ... Such communication is persistent in that it leaves a digital trace, and the trace in turn affords new uses. It permits conversations to be saved, visualized, browsed, searched, replayed, and restructured." (`http://www.tomeri.org/HICSS_PC.html`).

In social media, the resulting library of opinion pieces, speculations, questions and answers, becomes a resource for new learners entering the domain (supporting learning both content and conduct). The use of this library of resources has given rise to a newly identified role of the *FAQ Finder* (Frequently Asked Questions finder). These *site librarians* research and pull together resources from within the site to streamline community knowledge exchange. The resources themselves challenge traditional information gatekeeping mechanisms, e.g., of approved texts and authorities. They provide a new kind of resource that is a history of informal inquiry, argumentation, and answer construction.

While Reddit has formally identified the site librarian role with an FAQ Finder *flair*, other communities similarly build and recognize in-site knowledge. For example, Preston [58] found participants in an online professional development community for teachers created new artifacts by braiding together texts from across the community and outside. These texts were further validated by community interaction and comment and remained a resource for use inside and outside the community. In this way, stored online discussion becomes a tangible asset of the community – its *social capital* – embodied in the questions, answers, comments, arguments, dialogue, interaction patterns, actors and roles that constitute the collective resource. While these features are familiar to epistemic communities, e.g., in academic domains comprised of publications, scholarly meetings, and a range of scholarly actors, they are not features that are normally associated with ephemeral social

media, nor with analytics of the learning community.

ANALYTICS OF LEARNING IN SOCIAL MEDIA

Social structures, participation, and persistent conversations, together build the social capital of these networks. These in-network structures hold both accessible and mobile social capital, through network actors and accumulated resources [47]: accessible through conversational Q&A with peers and in-network experts, and through records of conversation; mobile through communal response to questions, and searchable conversational records. While analytics might focus on one aspect of structures, participation, capital, etc., the learning community is a net result of their multiple interactions, and as such may best be examined as a collective set of elements leading to a particular learning community outcome. This places examination of social media learning in the traditions of ecological analyses (e.g., [53]), activity theory [18], and multi-dimensional statistical analyses.

Another method is social network analysis, taking the network configuration as the outcome, as built through conversation. This method combines examination of actors, conversation, and community, with communications between actors as the relations and ties that form the social network [71, 72, 51, 34]. The following sections discuss two complementary approaches to learning analytics for social media based on a social network perspective: *conversation analysis* and textitnetworked connectivity. These approaches provide a beginning to exploring the vastness of open, online learning, and suggest some starting points for analysis and further study.

CONVERSATION ANALYSIS

What people talk about creates the ties that support the learning community and the emergent network; thus analysis of online conversations is a key part of analyzing open, online learning networks and communities [74, 55]. Analyses have explored how arguments are formed [73, 15], how people are persuaded to adopt a different perspective [41], and what constitutes community communication online [34].

A number of efforts have used content analysis and automated coding to identify the underlying relations that create the learning communities. Gruzd, Haythornthwaite and colleagues studied postings in Reddit using content analysis to explore conversational patterns in four "Ask" subreddits (AskScience, Ask_Politics, AskAcademia, and AskHistorians; [42, 34]), and later to evaluate the application of the coding to Twitter and test an automated coding process [26]. The coding process built on earlier studies of interaction analysis [28] and exploratory dialogue [50], and was framed by the community of inquiry framework [20, 21] and analytics approaches to social learning, social networks, and online community [9, 30, 56, 25, 27].

Three rounds of coding resulted in a set of eight major types of conversation in these subreddits that are the basis of the learning network: explanation, with (1) disagreement, (2) agreement or (3) neutral presentations; socialization, with (4) negative or (5) positive intent; (6) information seeking; (7) providing resources; and (8) rules and norms. These codes show not just argumentation, but also the practices of a self-organizing community, e.g., managing in-network norms, and the non-topic based socializing that form the safe (or not safe) space for learning. Moreover, this analysis was able to show differences across subreddits, e.g., that Ask_Politics has more explanation with disagreement (18% in the study sample) than the other forums (6-9%).

Similar studies have examined other platforms. Comparing history learning communities on Twitter and Reddit, Gruzd et al. [26] found the eight codes held, but more posts with the #Twitterstorians tag fit with the code of "providing resources" than did posts in #AskHistorians. This suggests differences in conversation in response to the affordance of the two platforms – short vs longer text. Looking at postings about computer programming on Stack Overflow revealed a similar array of conversational exchange [65]: postings about computer programming that offer (1) code only (2) explanation only (3) code and explanation (4) improvements of posted code or explanation (5) alternative solutions (6) limitations to offered solutions; postings that include (7) affect, from frustration at a problem to thanks for suggestions; (8) references and/or in-network links; and (8) moderator comments relating to site norms.

Coding in this way shows how conversation effects informational exchanges and learning in open, online forums. The coded texts represent that connections – social network relations and ties – that form the community and its norms, and build the sustaining basis for each social network. In these media, the *learning conversation* first enacts a space for learning through the practice of seeking information by asking questions and responding with answers; knowledge is then refined through dialogue, explanation, and disagreement; verification is provided through use of references to outside resources or to previously posted answers.

These are just a few studies of learning in social media, but similar conversational coding efforts can show how an open learning site comes to be define by the participation of its members, enacting *community* through the conversational types, tone and responsiveness, and the management of norms. As an open site, community practice can be observed by newcomers, allowing time to act as legitimate peripheral participants before joining the conversation. In Reddit, as in other online learning spaces, questions and answers can be voted up or down according to approval or interest, providing an observer with evidence of what is a good (or appropriate) post versus a poor (inappropriate, non-relevant, etc.) post. Norms within the community are maintained by other participants in ways that conform to site use, e.g., by asking for references to support an explanation (#AskHistorians), or by moderators keeping conversation on topic and with

appropriate tone [23].

NETWORKED CONNECTIVITY

Where conversation can show the ties among actors, the next step is to see how the many different relations support the overall networks. Two complementary perspectives stand out for approaching analysis of learning networks: an *egocentric* approach examining *personal learning environments* and a *whole network* approach examining *learning networks*.

In a connectivist manner [67], analytics may address the way self-directed individuals create their own *personal learning network*, pulling learning together across multiple platforms, drawing on multiple sources, in real or asynchronous time, conversing online with a variety of others, and creating their own space for learning [61, 16, 48, 67, 35, 45, 53, 64]. This highly individualist, *egocentric* network approach allows aggregation in a way that provides a picture of typical multi-site media use for learning, reaching both multiple resources and multiple actors. It allows insight into the *media multiplexity* [29, 31, 46] associated with networked individualism [59], and how multiple media (including face-to-face communication) are used to build a personal learning space, in what combination, and to what effect.

An alternative, but complementary view, is to put the focus on the collective with a *whole network* approach, considering how a particular learning site is structured, how members interact with each other, and how the open, online forums support knowledge exchange and co-construction. Looking at the network reveals patterns of conversational interaction – who talks to whom about what – that sustains the ties and roles that support learning. For example, in a study of a Twitter group dedicated to learning about social media use in healthcare (#hcsmca), a network analysis showed how site members communicate as a whole, rather than in separate cliques, and how communication crossed work roles (nurse, health communication specialists, doctors, other health professionals; [24]; see also [22]).

Keeping the egocentric and whole network approaches in mind, there are further opportunities for understanding open learning that could be explored, e.g., understanding a *collective learning space* and the set of media and resources that collectively support their goals; or looking at how multiple collectives build a knowledge infrastructure supporting a particular area of inquiry – what one might call *disciplinary learning environments*. Taking a sociocultural and sociotechnical perspective, mappings of online ecologies can show how knowledge is distributed across online spaces, and how the different participants and technologies support knowledge construction (e.g., [4, 66, 1]).

One more aspect of ecologies can be found with a network perspective – the roles and positions that support the network structure. Roles emerge as actors take on specific patterns of topic, social, and/or conversational interaction (e.g., the questioner, answerer, joker, social support provider, norms manager, administrator), and/or occupy certain important positions in the network (e.g., central actors who receive a lot of questions or provide a lot of answers; [11]). Somewhat different in open, online environments is the way roles can swap regularly – each new question defines a learner, whether this is their first question or their 100th. Similarly, each answer defines a teacher, particularly as they adjust explanation to craft the appropriate response for the question.

How and what *roles* emerge in open, online learning has not yet received a systematic analysis in the context of open learning environments. Yet, many different kinds of roles are emerging and identifiable in online learning environments. In a formal online learning setting, Montague [52] identified *learner-leaders* who take information, experiences, and opinions from inside and outside the learning context in an iterative process of learning and leading; in a community of practice for teachers, Preston [58] identified *braiders* who weave together others' posts to create a synthesis. *Moderators* are identified and invited based on in-network participation and given technical privileges to manage adherence to norms and site content [23]. In some sites, *experts* are identified based on their contributions, including those who provide good answers to questions (e.g., earning points in Stack Overflow, karma in Reddit), and researching in-group conversations to find previous answers (e.g., the FAQ finder in Reddit). In social networks, roles appear as patterns of common relations, and network analysis may identify roles before they are formally recognized. Further study can examine what roles are emerging and how these specifically support learning goals.

The two network perspectives discussed above are synergistic, each addressing different aspects of open, online learning: the egocentric view of personal learning and knowledge networks, the whole network view of group interaction and community practice, and the networked view of the collective or disciplinary space. The emphasis of a social network approach is to examine what patterns and roles are present, rather than those designated on an organization chart. Thus, this method responds well to finding the 'unpredictable' in informal learning. It is well suited to observing what kinds of relations and ties build network structures, where roles emerge, and where established roles no longer follow or need to follow traditional practice. (For more on applying a social network perspective to online learning and learning analytics, see [32, 40]).

SUMMARY

The increasing reach of social media, and its support of sites for learning opens up questions of how learning happens in these open, online spaces. Approaching open, online learning as a form of informal learning highlights the role of conversation in creating and maintaining the self-organizing structure of learning sites. This paper addressed the importance of participation through conver-

sation as an essential element of online learning spaces, and how participation has different stages and extent depending on individual status in the site, and the relevance of the site to individual's personal learning networks. Attention to conversation leads to applying techniques such as content analysis and automated coding as means of identifying and evaluating the range of interactions that sustain learning in different communities. Conversational topics represent the network relations and ties that support a network of users, and build structures and roles that support persistent communities. While many social media provide ephemeral, just-in-time answers to questions, recorded interaction permits searching within site history to support the process of knowledge exchange and authentication. There is much yet to understand in how and why individuals choose to participate and collectively address knowledge spaces, and this chapter has introduced just a few ideas on how to begin addressing informal learning in social media.

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