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A conceptual model for analysing informal learning in online social networks for health professionals

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Abstract. Online social networking (OSN) provides a new way for health professionals to communicate, collaborate and share ideas with each other for informal learning on a massive scale. It has important implications for ongoing efforts to support Continuing Professional Development (CPD) in the health professions. However, the challenge of analysing the data generated in OSNs makes it difficult to understand whether and how they are useful for CPD. This paper presents a conceptual model for using mixed methods to study data from OSNs to examine the efficacy of OSN in supporting informal learning of health professionals. It is expected that using this model with the dataset generated in OSNs for informal learning will produce new and important insights into how well this innovation in CPD is serving professionals and the healthcare system.

Keywords. Learning analytics, social learning analytics, social network analysis, social learning, networked learning, informal learning, health professional education, data visualisation

Introduction

Staying up-to-date and delivering best evidence-based care is crucial for health professionals. They need to be lifelong learners as medical knowledge expands and changes rapidly. Some evidence suggests that current CPD approaches (e.g., educational courses, lectures) are not efficient or effectively meeting this need and thus are inadequate to improve the safety and quality of patient care [1].

This and wider Internet use factors have led to the emergence of a more informal approach to CPD making use of OSN [2]. OSN plays an important role in supporting the CPD of health professionals as it allows health professionals to stay up-to-date and knowledgeable of the current literature; it has been increasingly used for learning from experts, sharing medical knowledge, discussing practice management challenges and clinical issues [3]. For example, one OSN site in the US, sermo.com has over 200,000 members from nearly 70 medical specialties.

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However few efforts have been made to analyse such OSN data for insights about the CPD they are supporting; the scarce evidence about this phenomenon makes it difficult to identify and understand how to increase CPD efficiency and effectiveness for individual health professionals through OSN, and thereby improve patients' outcomes [1]. One factor impeding such research is the difficulty of making sense of their large and complex datasets. This paper proposes a conceptual model that can be applied to analysing these data, to understand more about the informal learning occurring on OSNs for health professionals.

1. Literature Review

In order to identify papers relating to online informal learning and in particular those for health, we used the search term: ("social learning" OR "informal learning") AND ("health professions" OR "health education") to search across major electronic databases and international conferences, and Google Scholar to complement the search and locate some specific publications.

In this paper, we first discuss the traditional content analysis (CA) approach that is used for studying online informal learning, and then introduce the social network approach that has been developed lately. Finally, we discuss the recent emerging field - social learning analytics (SLA), which tries to bring together the two approaches and other techniques to investigate the underlying patterns of learning interaction and behaviors emerging from social learning environment.

1.1. The Traditional Approach

Earlier work on the analysis of online informal learning was dominated by analysis of asynchronous discussion forums, with a focus on identifying effective learning and knowledge building processes via CA [4, 5]. The social-constructivist view of learning considers the situativity of learning processes [6]. This means that the ideas about situativity learning is viewed as a set of processes by which the learner personalises new ideas by giving meaning to them based upon earlier experiences, learning is therefore understood and viewed as situated by the activity in which it takes place. This suggests that it is possible to search for evidence of the learners' online interactions such as conversations, in order to identify cognitive and social processes in which learners engage to give meaning to their new ideas.

A variety of analytical models have been proposed for analysing the content of conversations. The models of Henri [4], Gunawardena, Lowe [7], and Garrison, Anderson [8] were mostly used. Henri [4] proposed five dimensions to be used for evaluating computer-mediated conferences: participative, social, interactive, cognitive and metacognitive. Gunawardena, Lowe [7], pointed out Henri's model was not specific enough for evaluating the process of knowledge construction, so they presented a coding scheme that consists of five phases of knowledge construction to study the process of social construction of knowledge. Based on the work of Gunawardena, Lowe [7], Garrison, Anderson [8] developed a Community of Inquiry (CoI) model to study the nature and quality of learning occurring in a large group of distance education professionals, which assumes that learning occurs through the interaction of three conceptual elements: social presence, cognitive presence, and teaching presence.

1.2. Social Network Approach

Another major research stream focused on the analysis of online informal learning is based on theories of communities of practice, social constructivism, networked learning and connectivism. The main focus of this approach is on using social network analysis (SNA) to examine patterns of interactions occurring on the network.

A number of research studies have been conducted to investigate learning interactions using SNA in online informal learning environments. Notably, Schreurs and De Laat [9] employed SNA to capture and analyse traces of teachers' informal learning occurring in their social-professional networks. They found centrality measures (one of the SNA techniques) was useful to identify the relationships among participants (i.e. who interacts with whom). Another recent study by Stewart and Abidi [10], who studied the interaction patterns that emerged within a Paediatric Pain Discussion Forum using SNA to understand the flow of experiential knowledge sharing among health professionals. They employed centrality measures to identify the active participants and threads in the network. In addition, block modelling was employed to identify potential subgroups of participants within the network.

1.3. Social Learning Analytics

Social learning analytics (SLA), a recent emerging field, is a subfield of learning analytics (LA) that focuses on the application of LA in social learning setting; it tries to bring together CA, SNA, and other techniques to investigate the underlying patterns of learning interactions and behaviors that signify effective learning processes. As described by Ferguson [11], SLA has five main categories: social network analytics, content analytics, discourse analytics, context analytics, and disposition analytics.

Recent studies on SLA have been focused on the discovery of relevant network structures and visualisation of students' interactions in LMS discussion forums, in order to provide teachers with better means to assess students' online participation [12-14]. These studies focus on identifying interactions and understanding interpersonal relationships, as well as the ways an individual links to contacts, resources and ideas. However, so far, little effort has been put to considering the contents of the interactions, i.e. what individuals are talking about and why they are talking in the observed way, also, the elements affecting those interactions; these and similar challenges are planned to be addressed in the authors' future work.

2. Conceptual Model

The review of the literature reveals that online informal learning can be investigated through the analysis of learning contents using CA to possibly observe the effective learning process [8], and learners' interactions using SNA to discover relevant network structures and patterns of interactions occurring in networks [9]. This research adopts these approaches for analysing the informal learning of health professionals but proposes considering learning outcome as another key element.

Learning outcome is considered essential, since CPD of health professionals is concerned not only with an individual health professional's self-improvement but with what may be life and death outcomes for patients. In the absence of data on patients' outcomes, health professionals' self-reported learning outcomes from their

participation in online learning activities (such as a knowledge gain or a behavior change), can be collected using survey method, to provide insight into their learning [1]. Although such self-reported outcomes may not always be accurate and valid, at least, they can help identify motivation and gaps in knowledge, and provide information for the validation of the learning interactions, behavioral patterns and the effectiveness of learning processes.

Therefore, as shown in Figure 1, we propose that the data about informal learning of health professionals on OSNs can be analysed using SNA, CA and survey method, along three dimensions: learning interaction, learning process and learning outcome.

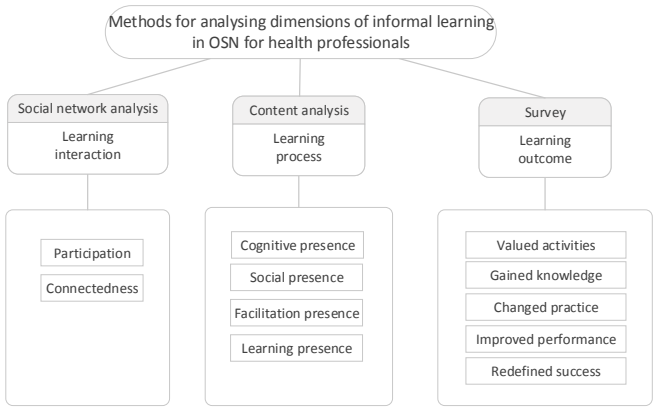

Figure 1. Conceptual model for analysing informal learning in OSN for health professionals.

1. Learning interaction is focused on studying the structure of interactions (i.e. Connectedness), the level of and influential factors associated with engagement (i.e. Participation) [15]. While Connectedness is focused on understanding how and why people come together and interact by identifying the structure of the network, regular equivalence block modelling could be used for positional analysis to identify potential subgroups in the network which may share similar learning attitudes and behaviors. Then, stochastic actor-oriented models for longitudinal analysis [16] could be used to observe how actor attributes and other influential factors may contribute the evolution of these subgroups.

   Participation can be measured via centrality analysis which is mostly used in SNA research. The centrality measures include: degree centrality, eigenvector centrality, betweenness centrality, and closeness centrality.
2. Learning process involves the examination of cognitive presence, social presence, and facilitation presence by following Garrison, Anderson [8]'s Community of Inquiry model, as well as learning presence as suggested by Shea and Bidjerano [17]. Cognitive presence refers to "the extent to which the participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication" [8]. Social presence is defined as "the ability of participants to project their personal characteristics into the community, thereby presenting themselves to the other participants as

'real people'" [8]. Facilitation presence is viewed as "a means to an end to support and enhance social and cognitive presence for the purpose of realising educational outcomes" [8]. Learning presence is viewed it as an indicator of online self-regulated learning, which includes elements such as self-efficacy and other cognitive, behavioural, and motivational constructs supportive of online learner self-regulation.

CA can be applied to code and explore patterns of cognitive presence, social presence, facilitation presence, and learning presence based on the indicators defined in the CoI framework.

3. Learning outcome can be analysed using Wenger, Trayner [18] model for measuring the five types of social value for online community members: valued activities (i.e. activities that produced value in and of themselves), gained knowledge, changed practice, improved performance and redefined success (i.e. learning goals or values are redefined as a result from participation). These values have been found consistent with the learning outcome levels for evaluating physicians' CPD activities [19].

3. Conclusion

A conceptual model for analysing informal learning occurring in OSN for health professionals can enable learners, and those who design and manage learning, to make better use of the data they generate. Our model describes the essential components of learning interaction, process and outcome based on relevant health literature and theories. For future studies, we will evaluate this model by applying it to the analysis of a large online medical community used by more than 10000 health professionals during the period 2007-2012. Ongoing research, using our model with the dataset from any active OSN for health professionals' informal learning, is expected to refine the model and to produce new and important insights into how well this innovation in CPD is serving professionals and the healthcare system.

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