COLLABORATION IN WEB BASED LEARNING: A SOCIAL COMPUTING PERSPECTIVE

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***Abstract*—The rapid advance of Information Communication Technology [ICT] has enabled Higher Education Institutions to reach out and educate students transcending the barriers of time and space. This technology supports structured, web-based learning activities, and provides diverse multilingual and multicultural settings and also facilities for self assessment. Structured collaboration, in the conventional education system, has proven itself a successful and powerful learning method. Online learners do not enjoy the same collaborative benefits as face-to-face learners because the technology provides no guidance or direction during the online discussion sessions. This paper presents a Web Based Learning Environment [WBLE] from the perspective of social computing to bring collaborative learning benefits to online learners. The paper also highlights how the deployment of social computing tools can support the creation of an open and socially shared information space for better collaboration among the learners. With Social Network Analysis [SNA] techniques, collaboration among twenty learners is explored and metrics such as in-degree, out-degree and Betweenness and collaborative network mapping are presented.**

Keywords- Web Based Learning; Social Computing; Social Network Analysis

I. INTRODUCTION

The focus of Higher Education [**HE]** in the present scenario is global based and it has been growing appreciably facing challenges in the process of evolving as a commercial one. This global approach has created awareness amongst HE institutions to revamp their methodologies in teaching and related issues. In the recent days, Information and Communication Technology [**ICT]** education is followed in the HE institutions and the conventional classroom is converted into Web Based Education **[WBE].** This technology supports structured, on-line learning activities, and provides diverse multilingual and multicultural settings and also facilities for self assessment. However, in all technology-enabled learning, there are less social opportunities for students to engage themselves in face-to-face meeting; it may also involve social, cultural and language differences. Due to constraints of time and space, there is a loss of physical interaction and contextual cues between the teacher and the students, and among students themselves. These problems can result in a lack of trust, rendering an unwillingness to collaborate with others in online learning. A popular response to this issue will be the deployment of social computing tools in WBLE. Several researchers have also noted that emergent social computing tools offer effective learning and have the potential to support lifelong learning process [8]. As part of providing rich support for collaboration among learners, the WBLE have social computing tools that enable all the stakeholders of the system to have direct contact with one another. Social computing tools are used with the specific focus not only by creating central knowledge repositories but also by encouraging other knowledge based activities such as knowledge reuse, sharing, and collaboration. With these activities, all the learners of the system can form a social network in a typical bottom-up fashion and establish strong social relation among themselves by way of helping learners to connect, converse, collaborate and manage digital content.

A. The Social Computing Perspective

The Social computing name incorporates the idea of computer-mediated interaction. In addition, the term 'Social', especially in the Web 2.0 context [8], underlines interactions related neither to professional nor to educational activities. In other words, social computing mostly facilitates informal interaction among peers for social networking purposes. The social impact of such interaction within the Internet generation is tremendous, not only for keeping them connected always, but also for developing their knowledge based activities. It is in fact a powerful tool for online learning, and has huge potential to create the skills such as awareness, enrichment of knowledge and behaviour conditioning etc. These skills seem prerequisites for effective learning.

B. Educational Goals of Social Computing

Social computing methodology, tools and applications have been receiving intense and growing interest across all HE institutions [2] [1]. They are seen to hold high potential for addressing the needs of today's diverse learners, enhancing their learning experiences through customisation, personalisation, and rich opportunities for networking and collaboration [3] and also to set and achieve the following online educational goals:

- Initiating new ways of learning
- Learner Centric
- Simulation of learning environment
- Group learning
- Reflective learning
- Collation of educational resources
- Virtual Learning
- Creating digital identity
- Social engagement
- Fostering community building

C. Collaboration : A definition

The term 'Collaboration' can be generally defined in a variety of ways, but perhaps a typical definition is working in a group of two or more to achieve a common goal. This general definition, however, does not tell us about collaborative measurements. To make such measurements, we need an operational definition of collaboration [5] and it may be defined as it consists of at least three ingredients: interdependence [6], a product that is achieved through genuine synthesis of information and contributions from all members [7], and independence from a single leader [9]. In education, this would likely be independence from the class instructor. In other settings, it would mean relative independence from supervisors or others who might otherwise control the process too tightly.

II. THEORETICAL FRAMEWORK

The major components of our framework are social computing tools, computer supported collaborative learning, social network and social network analysis. The functional aspects of each component are described below:

A. Social Computing Tools

Social computing is the collaborative and interactive aspect of online user and it is closely related to the concept of Web 2.0, which can be thought of as the framework of applications supporting the processes of social interaction. Social computing tools include such as wikis, blogs, instant messaging, forum etc.

B. Computer Supported Collaborative Learning [CSCL]

Computer Supported Collaborative Learning or CSCL is a computer-based learning environment. It refers to computer-enabled learning done in groups [11] and supports the development of meta cognitive skills of students [10]. These environments can facilitate not only individual learning but also the developments of social systems.

C. Social Network

Social computing tools are applied in the web based learning environment enabling all the learners of Web Based Learning to cooperate and collaborate during the learning process. It generally inspires all learners to involve in knowledge based activities such as reuse of knowledge, sharing and collaboration of knowledge. With these activities, a social network can be built among all the learners of the system. In such a network learners are connected through common association either directly or indirectly.

D. Social Network Analysis

Social network analysis (SNA) is a methodology with its own version of data collection, statistical analysis, and presentation of the results. It enables researchers, practitioners, and educators to see how "actors are located or 'embedded' in the overall network" [4]. This way of thinking creates an advantage of multilevel analysis. Its methodology enables the analysis of relationships at individual and group level. With the proposed framework, SNA was set to analyse the collaborative pattern of learning and to identify powerful and important actors of the network. It can also help to interpret deficiencies and structural holes in the network.

As Social network-related research and its applications are increasingly used in various disciplines, a wide range of software are available to examine social network dynamics and UCINET is one such software that can be applied to analyse common network routines such as centrality measures, clique analysis, and network visualisation.

III. METHODOLOGY

The study consists of two phases: i) Development of Web Based Learning environment and ii) An analysis of collaborative learning through SNA.

Phase 1

WBLE for the course 'Programming in Java' was developed to provide students with specific knowledge of the typical features that characterize program development in Java. The platform offers the following web-based learning resources. In the WBLE learners could share, collaborate and help one another through discussion forums deployed. It is considered to be one of popular social computing tools increasingly used for peer-to-peer collaboration. Learners are encouraged to use this resource not only to solve technical problems but also to exchange suggestions and information or help each other while completing the didactic activities assigned.

Phase 2

To analyse and measure collaborative learning, data can be collected through different sources. We have used Log file data, which can be automatically generated and stored by the learning environment and it can serve as an easily accessible data base for analyzing collaborative process. These log file data can be used to identify activity patterns and participation structures in networked learning groups, it can also be graphically displayed. [10] Data were transferred and cleaned in Excel. The Excel data were then transformed in to UCINET.

IV. RESULT AND DISCUSSION

A. Network Visualization

The major step in social network analysis is to provide visual mappings of the social networks. The following are the social network mapping showing inter-collaboration as group level and select learners as individual level. The squares represent learners and the lines between them indicate the relationship. The width of the line indicates frequency, or strength of tie.

B. *Inter-Collaboration*

In the WBLE, there are 20 learners. Figure 1 is the Network mapping that shows what happens during collaborative learning process. The network mapping is highly useful to assess the collaborative learning from multi dimension and analyse groups and individual contribution in collaborative learning. The nodes represent the learner (the names of learners have been renamed L1 – L20 for reasons of privacy and anonymity). When there is a line directly connecting two nodes then these nodes are adjacent. When a node is one of a pair of nodes defining the line then the node is incident to the line. The number of lines that are incident with it is called nodal degree [12]. In-degree is the number of lines that are incident to a node while out-degree is the number of lines that are incident from it. Nodes whose degree equals 0 are called isolates. Figure 1 shows four sub-groups, which are coloured to identify the members of the nodes to their related group. It also shows that colour and shape of nodes to represent qualitative differences among actors based on their classification according to their position in the graph regarding the way they are embedded.

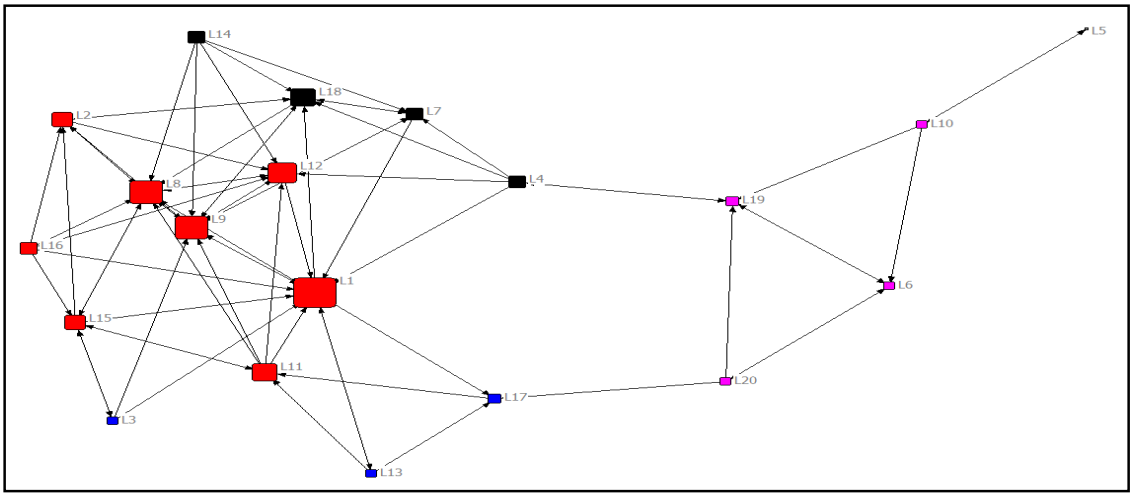


Figure 1

The figure 2(a) and 2(b) show collaboration among L1,L2,L3,L4,L7,L8,L9,L11,L12,L13,L15,L16, L18 and L1,L2,L3,L7,L8,L9,L11,L12,L14, L18 respectively

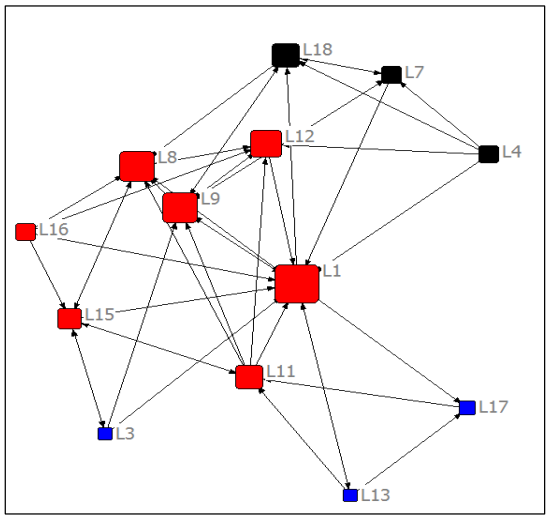


Figure 2(a)

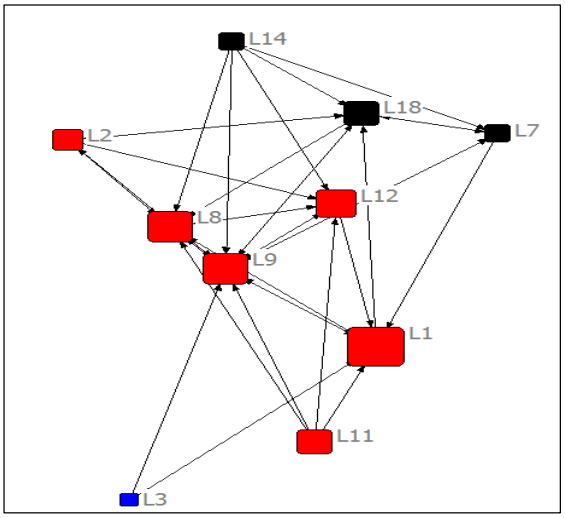


Figure 2(b)

C. *Quantitative Analysis*

Although network visualisations do provide a visual representation, the quantitative part of SNA may also appeal to researchers. UCINET has a wide variety of tools to identify key players, isolated learners and key ties

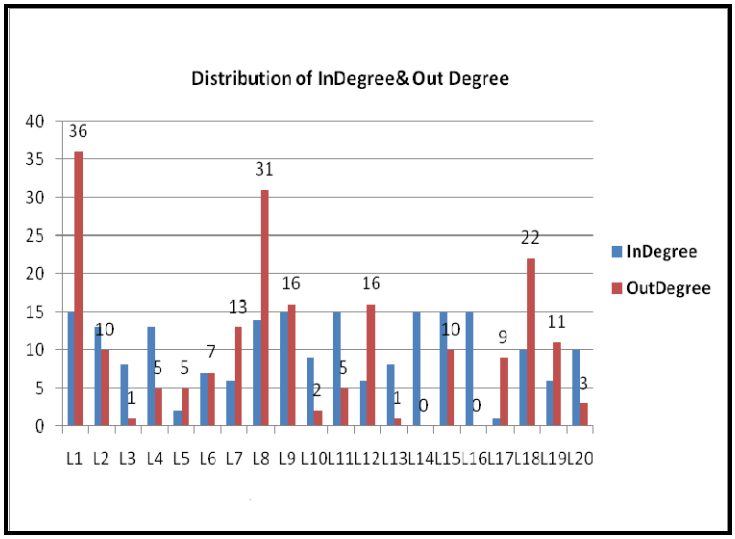
within a network. It is very common to measure network activity for a node by using the concept of degrees—the number of direct connections a node has. In SNA the notion of degree suggests the number of connections an individual has in the network. Freemen outdegree and indegree measures are some of the most commonly used degree of centrality used for various reasons. In this paper we have applied Freemen's in-degree and out-degree measures to determine the number of connections among individuals in the community.

D. Distribution of In-Degree and Out-Degree

In table 1, Learner's In-degree and Out-degree are shown. Learner's out-degree varies between 9 and 36 (M= 47.2, SD = 26.16) and In-degree between 1 and 15 (M=, 47.2 SD = 23.59). The most active learners in the space are L1, L8, L9 and L2. There are few learners (L14, L16) who have a very low out degree, meaning that their contribution in the process of collaboration is abysmal.

Table 1

Learner	InDegree	OutDegree
L1	15	36
L2	13	10
L3	8	1
L4	13	5
L5	2	5
L6	7	7
L7	6	13
L8	14	31
L9	15	16
L10	9	2
L11	15	5
L12	6	16
L13	8	1
L14	15	0
L15	15	10
L16	15	0
L17	1	9
L18	10	22
L19	6	11
L20	10	3



E. Betweenness Centrality

Betweenness centrality is used to identify prominent learners and gatekeepers within a network. It is a measure of the extent that a network learner's position falls on the geodesic paths among other learners of a network. Thus, it determines whether a learner plays a (relatively) important role as a broker or gatekeeper of collaborative process with a high potential for control on the indirect relations of the other learners

Table 2 shows that the Betweenness values vary from 0 to 14.52 (M=15.8, SD=14.7). The calculation has been made after symmetrising the adjacency matrix, through the minimum of the values (in this way, strong ties are kept). The highest value is of L1 and it is the gatekeeper and can regulate the process of collaboration in the network. The lowest Betweenness values are for L16, L14, and L5. They can be considered outsiders in the process of collaboration

Table: 2

Learners	Betweeness Value
L1	14.52
L2	1.23
L3	0.12
L4	12.14
L5	0
L6	2.87
L7	0.86
L8	9.62
L9	4.81
L10	4.67
L11	7.36
L12	2.32
L13	0.73
L14	0
L15	8.06
L16	0
L17	4.81
L18	4.87
L19	10.63
L20	3

V. CONCLUSION

In this paper we have combined the approaches of WBLE and social computing in HE setting paying particular attention to the facilities that provide encouragement, cooperation and collaboration among learners. It considers the value of such social computing methodology, tools and applications in terms of educational pedagogy and the advantages that such activities offer. Visual representations were made for better understanding the dynamics of collaborative learning. With help of SNA, several common social network analysis metrics, such as in-degree, out-degree, and Betweenness are presented. Each metric serves a different purpose. For example, in-degree and out-degree are used to measure one's connection with others; Betweenness is used to measure a user's importance in terms of bridging users together; In future, the present study can be extended to examine the dynamics of intra-collaboration in WBLE. Applying social computing methodology in web based educational systems is an ongoing research area, and it is assumed that this study contributes to its continued growth.

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