Evaluation of Attitudes Towards Thinking and Learning

in a CALL Website through CMC Participation

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ABSTRACT

Computer-Mediated-Communication (CMC) is fast becoming a big part of our daily lives. More and more people are increasingly using the computer to communicate and interact with each other. The internet and its advantages of connectivity, enable CMC to be used from a plethora of applications. Most common uses of CMC include email communication, discussion forums as well as real time chat rooms and audio/video conferencing. By communicating through computers and over the internet, online communities emerge. Discussion boards and other CMC applications offer a huge amount of information and the analysis of this data assists in understanding these online communities and the social networks that form around them.

There have been various frameworks by different researchers aimed at analyzing CMC. This chapter's main objective is to provide an overview of the models and frameworks available that are being used for analyzing CMC in e-Learning environments. The significance of the proposed presentation is that it aims to provide the reader with up-to-date information regarding these methods. Advantages and disadvantages of each of the CMC analysis methods are presented and suggestions for future research directions are made. Finally, these suggestions are applied to a characteristic scenario in e-Learning.

INTRODUCTION

The focus of this study is to introduce the reader to the concept of Computer-Mediated Communication (CMC) and Online Communities. Furthermore, we discuss the various types of CMC analysis that can take place. The purpose of each framework is described along with its strengths and weaknesses. The paper begins with a literature review of CMC and Online Communities, and continues with the evaluation of the existing frameworks where we draw conclusions based on the advent of new technologies and platforms that are available, as to whether or not these frameworks are up-to-date in analyzing CMC as it exists today. Furthermore, we used a selection of the methods on a case study. More specifically the Attitudes Towards Thinking and Learning Survey (ATTLS) was used in conjunction with a technique called Social Network Analysis (SNA) to analyze the students' CMC in an e-Learning courses. The paper describes the methodology of the study, the results are presented and the outcomes discussed. The paper ends with recommendations for future research.

COMPUTER-MEDIATED COMMUNICATION

It is by now no secret how vital the Internet was, is, and will continue to be in our lives. One of the most important characteristics of this medium is the opportunities it offers for human-human communication through computers and networks. As Metcalfe (1992) points out, communication is the internet's most important asset and e-mail is the most influential aspect. E-mail is just one of the many modes of communication that can occur through the use of computers. Jones (1995) points out that through communication services like the Internet, Usenet and bulletin board communication has for many people supplanted the postal service,

telephone, even fax machine. All these applications where the computer is used to mediate communication are called Computer-Mediated Communication or CMC.

"Computer-Mediated Communication (CMC) is the process by which people create, exchange, and perceive information using networked telecommunications systems (or non-networked computers) that facilitate encoding, transmitting, and decoding messages. Studies of CMC can view this process from a variety of interdisciplinary theoretical perspectives by focusing on some combination of people, technology, processes, or effects. Some of these perspectives include the social, cognitive/psychological, linguistic, cultural, technical, or political aspects; and/or draw on fields such as human communication, rhetoric and composition, media studies, human-computer interaction, journalism, telecommunications, computer science, technical communication or information studies" (December, 1997, pp.1).

Examples of CMC include asynchronous communication like email and bulletin boards; synchronous communication like chatting; and information manipulation, retrieval and storage through computers and electronic databases (Ferris, 1997). Table 1 shows the main types of CMC, their mode (synchronous or asynchronous) and the type of media they support (text, graphics, audio, video).

CMC has its benefits as well as it limitations. For instance, a benefit of CMC is that the discussions are potentially richer than in face-to-face classrooms, but on the other hand, users with poor writing skills may be at a disadvantage when using text-based CMC (SCOTCIT, 2003).

Table 1: CMC systems, their mode, and they types of media that they support

Type of CMC	Communication Mode	Supports			
		Text	Graphics	Audio	Video
Audio conferencing	Synchronous	Some applications	No	Yes	No
Video conferencing	Synchronous	Yes	Yes	Yes	Yes
IRC	Synchronous	Yes	As attachments	As attachments	As attachments
MUD	Synchronous	Yes	No	No	No
WWW	Sync & Async	Yes	Yes	Yes	Yes
E-mail	Asynchronous	Yes	As attachments	As attachments	As attachments
Newsgroups/BBS	Asynchronous	Yes	No	No	No
Discussion Boards	Asynchronous	Yes	As attachments	As attachments	As attachments
Voice mail	Asynchronous	Some applications	No	Yes	No

Advantages of CMC (Scotcit, 2003):

- Time and place independence

- No need to travel to the place of learning

- Time lapse between messages allows for reflection

- Speakers of other languages have added time to read and compose answers

- Questions can be asked without waiting for a 'turn'

- It allows all students to have a voice without the need to fight for 'airtime', as in a face-to-face situation

- The lack of visual cues provides participants with a more equal footing

- Many to many interaction may enhance peer learning

- Answers to questions can be seen by all - and argued...

- Discussion is potentially richer than in a face to face classroom

- Messages are archived centrally providing a database of interactions which can be revisited

- The process of learning becomes more visible to learners and tutors

Disadvantages of CMC (Scotcit, 2003):

- Communication takes place via written messages so learners with poor writing skills may be at a disadvantage

- Paralinguistic cues (facial expression, intonation, gesture, body orientation) as to a speakers' intention are not available, except through combinations of keystrokes (emoticons) or the use of typeface emphasis (italics, bold, capital letters)

- Time gaps within exchanges may affect the pace and rhythm of communications leading to a possible loss in textual coherence

- The medium is socially opaque; participants may not know who or how many people they may be addressing

- The normal repair strategies of face-to-face communication are not available and misunderstandings may be harder to overcome

- Context and reference of messages may be unclear and misunderstandings may occur

ONLINE COMMUNITIES

Through the use of CMC applications, online communities emerge. As Korzeny pointed out even as early as 1978, the new social communities that are built from CMC, are formed around interests and not physical proximity (Korzeny, 1978). Another point to note, is that CMC and the Internet give people around the world the opportunity to communicate with others who share their interests, as unpopular as these interests may be, which does not happen in the 'real' world where the smaller a particular scene is, the less likely it will exist. This is due mainly to the internet's connectivity and plethora of information available and posted by anyone anywhere in the world.

The term online community is multidisciplinary in its nature, means different things to different people, and is slippery to define (Preece, 2000). The relevance of certain attributes in the descriptions of online communities, like the need to respect the feelings and property of others, is debated (Preece, 2000). Online communities are also referred to as cyber societies, cyber communities, web groups, virtual communities, web communities, virtual social networks and e-communities among several others.

For purposes of a general understanding of what virtual communities are, we present Rheingold's definition. "Virtual communities are social aggregations that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace" (Rheingold, 1993, pp.5).

There are many reasons that bring people together in online groups. These include hobbies, ethnicity, education, beliefs and just about any other topic or area of interest. Wallace (1999) points out that meeting in online communities eliminates prejudging based on someone's appearance, and thus people with similar attitudes and ideas are attracted to each other. People are using the internet to make friends, colleagues, lovers, as well as enemies (Suler, 2004).

Preece, Rogers and Sharp (2002) state that an online community consists of people, a shared purpose, policies and computer systems while identifying the following member roles: Moderators and mediators: who guide discussions/serve as arbiters; Professional commentators: who give opinions/guide discussions; Provocateurs: who provoke; General Participants: who contribute to discussions; Lurkers: who silently observe.

CMC ANALYSIS FRAMEWORKS

As mentioned earlier, the Internet plays a vital role in socially connecting people worldwide. The virtual communities that emerge have complex structures, social dynamics and patterns of interaction that must be better understood. Through the use of CMC we are provided with a richness of information and pools of valuable data ready to be analysed.

There are various aspects and attributes of CMC that can be studied. Three important and widely used types of CMC analysis are Content Analysis, Human-Human Interaction Analysis and Human-Computer Interaction Analysis.

CONTENT ANALYSIS

Content analysis is an approach to understanding the processes that participants engage in as they post messages (McLoughlin, 1996). There have been several frameworks created for studying the content of messages exchanged in CMC. Examples include work from Archer, Garrison, Anderson & Rourke (2001) and McCreary's (1990) behavioural model which identifies different roles and uses these roles as the units of analysis. Furthermore, in Gunawardena, Lowe, and Anderson's (1997) model for examining the social construction of knowledge in computer conferencing, five phases of interaction analysis are identified and these are: (I) Sharing/Comparing of Information; (II) The Discovery and Exploration of Dissonance or Inconsistency among Ideas, Concepts or Statements; (III) Negotation of Meaning/Co-Construction of Knowledge; (IV) Testing and Modification of Proposed Synthesis or Co-Construction; (V) Agreement Statement(s)/Applications of Newly Constructed Meaning. Henri (1992) has also developed a content analysis model for cognitive skills and is used to analyze the process of learning within the student's messages. Mason's work (1991) provides descriptive methodologies using both quantitative and qualitative analysis.

In the case of e-learning for example, a useful framework is the Transcript Analysis Tool (TAT) (Fahy, 2003) as it offers:

- A student-centred approach
- It works with Gunawardena's model
- It was built on weaknesses of other models
- It uses the sentence as the unit of analysis

The TAT focuses on the content and interaction patterns at the component level of the transcript (Fahy et al., 2001). Based on Fahy et al's experience with other transcript tools and reviews of previous studies, they chose to adapt Zhu's (1996) analytical model for the TAT. Zhu's (1996) assumption that electronic conferencing promoted student-centered learning led her to examine the forms of electronic interaction and discourse, the forms of student participation and the direction of participant interaction in computer conferences. The TAT also contains echoes of Vygotskian theory (Vygotsky, 1978), primarily those dealing with collaborative sense making, social negotiation and proximal development (Cook & Ralston, 2003). The TAT developers have come up with the following strategic decisions (Fahy 2001): The sentense is the unit of analysis; The TAT is the method of analysis; Interaction is the criterion for judging conference success; Topical progression (types and patterns) is the focus of analysis.

PURPOSE AND ADVANTAGES OF THE TAT

The TAT was designed to permit transcript content to be coded reliably and efficiently. (Fahy, Crawford, Ally, 2001), while the advantages of TAT are (Fahy, 2003; Cook & Ralston, 2003; Fahy et al, 2001; Fahy, 2002): It reveals interaction patterns useful in assessing different communication styles and online behavioral preferences among participants; It regonizes the complexity of e-conferences and measures the intensity of interaction; It enables the processes occurring within the conferences to be noted and recorded; It probes beyond superficial systems data, which mask the actual patterns of discussion; It relates usefully to other work in the area; It discriminates among the types of sentences within the transcript; It reflects the importance of both social and task-related content and outcomes in transcript analysis research

LIMITATIONS OF TAT

After applying the TAT on several case studies, Fahy et al. (2001), found that a weakness of the TAT is the level of inter-rater agreement demonstrated to date. They conclude that further trials need to be conducted to determine how reliable the TAT is under conditions of greater practice (Fahy et al., 2001).

UNITS OF ANALYSIS

The unit of analysis of the TAT is the sentence. In the case of highly elaborated sentences, the units of analysis can be independent clauses which, punctuated differently, could be sentences (Fahy 2001). Fahy et al (2002), have concluded that the selection of message-level units of analysis might partially explain problematic results that numerous researchers have had with previous transcript analysis work. They also believe that the finer granularity of sentence-level analysis results in several advantages (Fahy, 2001; Ridley & Avery, 1979): Reliability; Ability to detect and describe the nature of the widely varying social interaction, and differences in networking pattern, in the interactive behavior of an online community, including measures of social network density and intensity; Confirmation of gender associations in epistolary/expository interaction patterns, and in the use of linguistic qualifiers and intensifiers.

TAT CATEGORIES

The TAT consists of the following categories (Fahy et al., 2001; Fahy, 2002; Fahy, 2003):

Category 1: Questioning

The questioning category is further broken down into two types of questions:

　　　1A Vertical Questions

These are questions which assume a "correct" answer exists, and that they can be answered if the right authority to supply it can be found. An example of such a question is: "Does anybody know what time the library opens on Saturdays?"

1B Horizontal Questions

For these questions, there may not be only one right answer. They are questions that invite help and the provision of plausible or alternate answers, or information that would help shed light on the question. These questions invite negotiation and an example is: "Do you really think mp3 files should become illegal, or you don't see any harm by them?"

Category 2: Statements

This category consists of two sub-categories:

2A Non-referential Statements

These statements contain little self-revelation and usually do not invite response or dialogue and their main intent is to impart facts or information. The speaker may take a didactic or pedantic stance, providing information or correction to an audience which he/ she appears to assume is uninformed or in error, but curious and interested, or otherwise open to information or correction. Such statements may contain implicit values or beliefs, but usually these are inferred, and are not as explicit as they are in reflections. For example: "We found that keeping content up-to-date, distribution and PC compatibility issues were causing a huge draw on Ed. Centre time."

2B Referential Statements

Referential statements are direct answers to questions. They can include comments referring to specific preceding statements. An example of a referential statement is: "That's right, it's the 1997 issue that you want."

Category 3: Reflections

Reflections are significant personal revelations, where the speaker expresses personal or private thoughts, judgments, opinions or information. He/she could also reveal personal values, beliefs, doubts, convictions, and ideas acknowledged. The reader is assumed to be interested and empathetic and is expected to respond with acceptance and understanding. He/she receives both opinions as well as insights into the speaker and may reply with questions, support and self-revelations in turn. An example of a reflection is: "My personal opinion is that it shouldn't have been a penalty kick."

Category 4: Scaffolding and Engaging

Scaffolding and engaging initiate, continue or acknowledge interpersonal interaction. They personalize the discussion and can agree with, thank or otherwise recognize someone for their helpfulness and comments. They also include comments without real substantive meaning, rhetorical questions, and emoticons. For example, "Thanks Dave, I've been trying to figure that out for ages ☺"

Category 5: References/Authorities

Category 5 is compromised of two types:

     5A: Quotations, references to, paraphrases of other sources.

     For example, "You said, 'I'll be out of the city that day'."

     5B: Citations, attributions of quotations and paraphrases.

     For instance, "Mathew, P. (2001). A beginners guide to mountain climbing."

HUMAN-HUMAN INTERACTION ANALYSIS

Over the years there have been several models by different researchers for analyzing interaction. It is important to note that the type of interaction studied in this case is interpersonal interaction, more specifically the human-human interaction that takes place through the use of CMC. Examples of Interaction Analysis models include but are not limited to Bale's Interaction Process analysis (Bales, 1950; Bales & Strodbeck, 1951), the SIDE model (Spears & Lea, 1992), a four-part model of cyber-interactivity (McMillan, 2002), Vrasidas's (2001) framework for studying human-human interaction in Computer-Mediate Online Environments and Social Network Analysis (SNA) (Krebs, 2004). We have found the technique called SNA to be more suitable for analyzing CMC in e-Learning and explain it in more detail here.

Social Network Analysis (SNA)

"Social Network Analysis (SNA) is the mapping and measuring of relationships and flows between people, groups, organizations, computers or other information/knowledge processing entities. Network analysis is concerned about dyadic attributes between pairs of actors (like kinship, roles, and actions), while social science is concerned with monadic attributes of the actor (like age, sex, and income). The nodes in the network are the people and groups while the links show relationships or flows between the nodes. SNA provides both a visual and a mathematical analysis of human relationships" (Krebs, 2004, pp.1). Preece (2000) adds that it provides a philosophy and set of techniques for understanding how people and groups relate to each other, and has been used extensively by sociologists (Wellman, 1982; Wellman 1992), communication researchers (Rice, 1994; Rice et al., 1990) and others. Analysts use SNA to determine if a network is tightly bounded diversified or constricted, to find its density

and clustering, and to study how the behaviour of netwok members is affected by their positions and connections (Garton, Haythornhwaite & Wellman, 1997; Wellman, 1997; Hanneman, 2001; Scott, 2000; Knoke & Kuklinski, 1982). Network researchers have developed a set of theoretical perspectives of network analysis. Some of these are (Bargotti, 2002):

- Focus on relationships between actors than the attributes of actors
- Sense of interdependence: a molecular rather atomistic view
- Structure affects substantive outcomes
- Emergent effects

Goals of SNA

The goals of SNA are (Dekker, 2002):

- to visualize relationships/communication between people and/or groups using diagrams
- to study the factors which influence relationships and the correlations between them.
- to draw out implications of the relational data, including bottlenecks
- to make recommendations to improve communication and workflow in an organisation

SNA approaches

Ego-centered analysis – Focuses on the individual as opposed to the whole network, and only a random sample of network population is normally involved (Zaphiris, Zacharia, & Rajasekaran, 2003). The data collected can be analyzed using standard computer packages for statistical analysis like SAS and SPSS (Garton, Haythornthwaite, & Wellman, 1997).

Whole network analysis – The whole population of the network is surveyed and this facilitates conceptualization of the complete network (Zaphiris et al., 2003). The data collected can be analyzed using microcomputer programs like UCINET and Krackplot (Garton et al., 1997). SNA data is represented using matrices, graphs and sociograms.

Units of Analysis and network characteristics

The following are important units of analysis and concepts (Garton et al., 1997; Wellman, 1982; Hanneman, 2001; Zaphiris et al, 2003; Wellman, 1992):

Nodes –   The actors or subjects of study.

Relations –   The strands between actors. They are characterized by content, direction and strength.

Ties –   Connect a pair of actors by one or more relations.

Multiplexity – The more relations in a tie, the more multiplex the tie is.

Composition – This is derived from the social attributes of both participants.

Range -   The size and heterogeneity of the social networks.

Centrality -   Measures who is central (powerful) or isolated in networks.

Roles -   Network roles are suggested by similarities in network members'behavior.

Density -   The number of actual ties in a network compare to the total amount of ties that the network can theoretically support.

Reachability - In order to be reachable, connections that can be traced from the source to the required actor must exit.

Distance -   The number of actors that information has to pass through to connect the one actor with another in the network.

Cliques -   Sub-sets of actors in a network, who are more closely tied to each other than to the other actor who are not part of the subset.

Limitations of SNA

Preece et al (2002) and Beidernikl & Paier (2003) list the following as the limitations of SNA:

- More theory that speaks directly to developers of online communities is needed
- The data collected may be personal or private

As SNA is useful in collecting important actor relationship data, HCI techniques can be used to supplement some of its limitations.

HUMAN-COMPUTER INTERACTION ANALYSIS

"Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them" (ACM SIGCHI, 2002). The focus is on the interaction between one or more humans and one or more computational machines. HCI is a multidisciplinary subject which draws on areas such as computer science, sociology, cognitive psychology and others (Schneiderman, 1998). The concept of HCI consists of many tools and techniques that are used for information gathering and evaluation. The data collected in conjunction with data collected from other frameworks assists in assessing the online communities of courses and learning more about the users while collecting their feedback. Methods for CMC data analysis include: Questionnaires, Interviews, Personas and Log Analysis.

INTERVIEWS

An interview can be defined as a type of conversation that is initiated by the interviewer in order to obtain research relevant information (Preece et al., 2002). The interview reports have to be carefully targeted and analyzed to make their impact. Interviews are usually done on a one-to-one basis where the interviewer collects information from the interviewee. Interviews can take place by telephone and face to face (Burge & Roberts, 1993). They can also take place via non-real time methods like fax and e-mail, although in these cases they function like questionnaires. Interviews are useful for obtaining information that is difficult to elicited through approaches such as background knowledge and general principles. There are three types of interviews (Preece et al., 1994):

- *Structured:* Consist of pre-determined questions; Asked in fixed order; Like a questionnaire

- *Semi-structured:* Questions determined in advance; Questions may be reordered, reworded, omitted, and elaborated

- *Unstructured:* No pre-determined questions; Interview has a general area of interest; Conversation may develop freely

Advantages of Interviews: What is talked about can address directly the informant's individual concerns; Mistakes and misunderstandings can be quickly identified and cleared up; More flexible than a questionnaire; Can cover low probability events. Disadvantages of Interviews: Danger of analyst bias towards own knowledge and beliefs; Accuracy and honesty of responses; For validity must be used with other data collection techniques.

PERSONAS

A persona is a precise description of the user of a system, and of what he/she wishes to accomplish. (Cooper, 1999). The specific purpose of a persona is to serve as a tool for software and product design and although personas are not real people, they represent them throughout the design stage (Blomkvist, 2002). Personas are rich in details, include name, social history and goals, and are synthesized from interviews with real people (Cooper, 1999). The technique takes user characteristics into account and creates a concrete profile of the typical user (Cooper, 1999).

Advantages of personas: Can be used to create user scenarios; Can be anonymous protecting user privacy; Represent the user stereotypes and characteristics. Disadvantages of personas: If not enough personas are used, users are forced to fall into a certain persona type which might now accurately represent them; Time-consuming

LOG ANALYSIS

A log, also referred to as web-log, server log or log-file is usually in the form of a text file and is used to track the users' interactions with the computer system they are using. The types of interaction recorded include key presses, device movements and other information about the users activities. The data is collected and analysed using specialist software tools and the range of data collected depends on the log settings. Logs are also time stamped and can be used to calculate how long a user spends on a particular task or how long a user is lingered in a certain part of the website (Preece, Rogers & Sharp, 2002). Examples of what information can be collected include: When people visited a site; the areas they navigated; the length of

the visit; frequency of visits; patterns of navigation; where they are connected from; details of the computer they are using.

By carrying out log analysis, questions like student attendance can be answered more accurately. For instance, the log files will show which students were active in the CMC postings even if they were not active participants (few postings themselves), but just observing the conversations.

Advantages of Logs (Preece et al., 2002): Helps evaluators analyse users behaviour; helps evaluators understand how users worked on specific tasks; it is unobtrusive; large volumes of data can be logged automatically. Disadvantages of Logs (Preece et al., 2002): Powerful tools are needed to explore and analyse the data quantitatively and qualitatively; user privacy issues;

QUESTIONNAIRES

A questionnaire is a self-reporting technique whereby subjects fill in the answers to questions themselves (Nielsen, 1993). Questionnaires were typically produced on printed paper, but due to recent technology and in particular the internet, many researchers engage in the use of online questionnaires thus saving time, money and eliminating the problem of a subjects distance. There are three of questions that can be used with questionnaires. Open questions, where the participants are free to respond however they like, closed questions, which provide the participants with several choices for the answer, and scales where the respondents must answer on a pre determined scale. The purpose of a questionnaire is to elicit facts about the

respondents, their behavior and their beliefs/attitudes (Nielsen, 1993). The data is first recorded and then analyzed.

The main advantages of questionnaires are: Faster to carry out than observational techniques; can cover low probability events. Disadvantages: Information is idealized version of what should rather than what does happen; responses may lack accuracy or honesty; danger of researcher bias towards subset of knowledge he/she possesses; must be used in conjunction with other techniques for validity.

ATTLS

The Attitudes towards Thinking and Learning survey (ATTLS) is used to measure the quality of discourse within the course. It measures the extent to which a person is a 'connected knower' (CK) or a 'separate knower' (SK). People with higher CK scores tend to find learning more enjoyable, and are often more cooperative, congenial and more willing to build on the ideas of others, while those with higher SK scores tend to take a more critical and argumentative stance to learning (Galotti, Clinchy, Ainsworth, Lavin, & Mansfield, 1999).

The two different types of procedural knowledge (separate and connected knowing) were identified by Belenky, Clinchy, Goldberger & Tarule (1986). Separate knowing involves objective, analytical, detached evaluation of an argument or piece of work and takes on an adversarial tone which involves argument, debate or critical thinking (Galotti et al, 1999). "Separate knowers attempt to 'rigorously exclude' their own feelings and beliefs when evaluating a proposal or idea" (Belenky et al., 1986, p.111; Galotti et al, 1999). Separate knowers look for what is wrong with other people's ideas, whereas connected knowers look for why other people's ideas make sense or how they might be right, since they try to look at things from the other person's point of view and try to understand it rather than evaluate it

(Clinchy 1989, Galotti et al, 1999). These two learning modes are not mutually exclusive, and may 'coexist within the same individual' (Clinchy, 1996, p. 207).

Initially the ATTLS consisted of 25 questions each for separate and connected knowing and contained quotations from original papers on the 'Ways of Knowing' framework (Belenky et al, 1986; Clinchy 1990; Galotti et al, 1999). However it took a long time to administer and thus a shorter version consisting of 20 self-report Likert-scaled items was developed. This shortened version is highly correlated with the longer version, nearly as reliable, and the authors propose that this shorter version be used in future research (Galotti et al, 1999). Based on their findings, the authors argue that difference in SK and CK scores 'produce different behaviors during an actual episode of learning, and do result in different descriptions of, and reactions to, that session' (Galotti et al, 2001, p. 435).

In the sections that follow we describe a case study where different techniques are applied to the analysis of an e-Learning course.

METHODOLOGY

For our case study we used a synthesis of quantitative (SNA) and qualitative (ATTLS questionnaires) methods and applied them to a Computer Aided Language Learning (CALL) course. Data was collected directly from the discussion board of a student centered e-Learning course for learning Modern Greek called "Learn Greek Online" (LGO).

LGO was built through participatory design and distributed constructionism (Zaphiris & Zacharia, 2001). The course is hosted on Kypros-Net Inc. (Kypros-Net Inc, 2005), a non-profit organization for the promotion of the culture and language of Cyprus. It uses the Moodle (Dougiamas, 2001) open source course management system. LGO is not a required course. The students enroll on their own will and their CMC participation is completely voluntary. Unlike other courses where the students are required to participate in the discussions allowing for experimental bias, LGO students contribute to the discussions because they want to and not because they have to. The students of the course include people with no knowledge of Greek language, bilingual members of the Greek Diaspora, as well as high-school teachers and higher education professors of non-Greek language teaching.

These students created an open online community whose collaboration has boosted the learning experience of the whole community. The web-based discussion board has proven to be the most constructive tool for the students learning experience and the main source of feedback for the maintainers of the project. The experiences shared on the discussion board included tricks and tips on how to record the audio files, installation of Greek fonts, learning methodologies and questions about the Greek language itself that arise from the lessons. The experienced users had taken a lead role in the vast majority of the threads on the discussion board, answering most of the questions and encouraging the beginners to study the lessons further (Zaphiris & Zacharia, 2001). They have also become the communication interface between the maintainers of the project and the community's needs and requests.

In an ego-centered approach to SNA, we have carried out analysis on the first 50 actors (in this case the students of the course) of the discussion forum for Lesson 1 in the Greek 101 (Elementary) course of LGO and tabulated these interactions in the form of a network matrix.

To carry out the social network analysis we used an SNA tool called "NetMiner for Windows" (Cyram, 2004) which enabled us to obtain centrality measures for our actors. The "in and out degree centrality" was measured by counting the number of interaction partners per each individual in the form of discussion threads (for example if an individual posts a message to 3 other actors then his/her out-degree centrality is 3, whereas if an individual receives posts from 5 other actors then his/her in-degree is 5).

Due to the complexity of the interactions in the LGO discussion we had to make several assumptions in our analysis:

- Posts that received 0 replies were excluded from the analysis. This was necessary in order to obtain meaningful visualizations of interaction.
- Open posts were assumed to be directed to everyone who replied.
- Replies were directed to all the existing actors of the specific discussion thread unless the reply or post was specifically directed to a particular actor.

In addition to the analysis of the discussion board interactions we also collected subjective data through the form of a survey. More specifically, the students were asked to complete an Attitudes Towards Thinking and Learning Survey (ATTLS) which measures the extent to which a person is a 'connected knower' (CK) or a 'separate knower' (SK).

RESULTS

The out-degree results of the social network analysis are depicted in figure 2 in the form of a sociogram. Each node represents one student (to protect the privacy and anonymity of our students their names have been replaced by a student number). The position of a node in the sociogram is representative of the centrality of that actor (the more central the actor the more active). As can be seen from figure 1, students S12, S7, S4, S30 (with out-degree scores ranging from 0.571 to 0.265) are at the centre of the sociogram and possess the highest outdegree and in-degree scores. This is an indication that these students are also the most active members of this discussion board posting and receiving the largest number of postings. In contrast participants in the outer circle (e.g. S8, S9, S14 etc.) are the least active with the smallest out-degree and indegree scores (all with 0.02 out-degree scores).
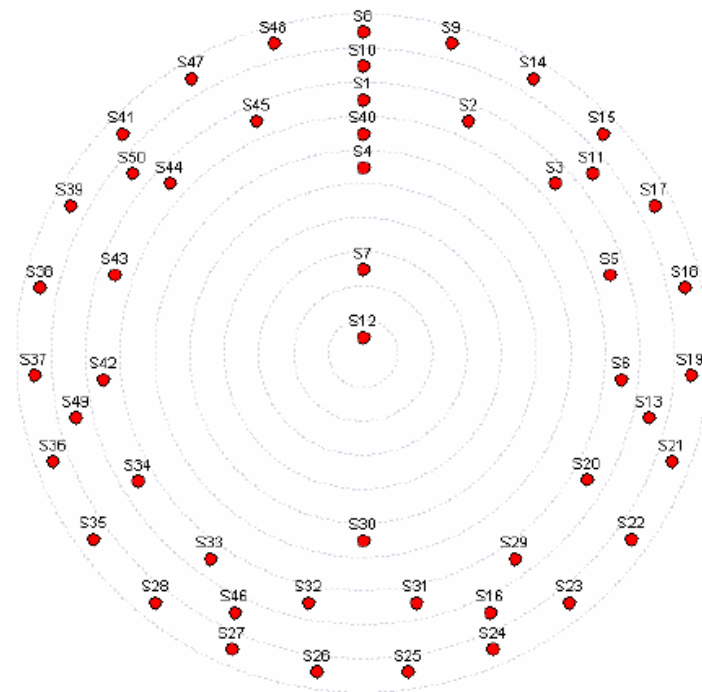

Figure 1: Out-Degree Analysis Sociogram

In addition, a clique analysis was done (Figure 2) and it shows that 15 different cliques (the majority of which are overlapping) composed of at least 3 actors each have emerged in this discussion board. As part of this study we look in more detail at the results from two of our actors. S12, who is the most central actor in our SNA analysis i.e. with the highest our-degree score, and S9, an actor with the smallest out-degree score. It is worth noting that both members joined the discussion board at around the same time. First, through a close look at the clique data (Table 2) we can see that S12 is a member of 10 out of the 15 cliques wherease S9 is not a member of any. An indication of the high interactivity of S12 versus the low interactivity of S9.

In an attempt to correlate the actors' position in the SNA sociogram with their stated attitudes towards teaching and learning we looked more closely at the answers these two actors (S12, S9) provided to the ATTLS. Actor S12, answered all 20 questions of the ATTLS with a score of at least 3 (on a 1-5 likert scale) whereas S9 had answers ranging from 1 to 5. The overall score of S12 is 86 whereas that of S9 is 60. A clear dichotomy of opinions occurred on 5 of the 20 questions of the ATTLS. S12 answered all 5 with a score of 5 (strongly agree) whereas S9 answered them with a score of 1 (strongly disagree). i.e. S12 strongly agrees that

1. S/He is more likely to try to understand someone else's opinion than to try to evaluate it.
2. S/He often find herself/himself arguing with the authors of books read, trying to logically figure out why they're wrong.
3. S/He finds that he/she can strengthen his/her own position through arguing with someone who disagrees with them.

4. S/He feels that the best way achieve his/her own identity is to interact with a variety of other people.

5. S/He likes playing devil's advocate - arguing the opposite of what someone is saying.

These are all indications that s/he is a 'connected knower' (CK) whereas S9 is a 'separate knower' (SK).
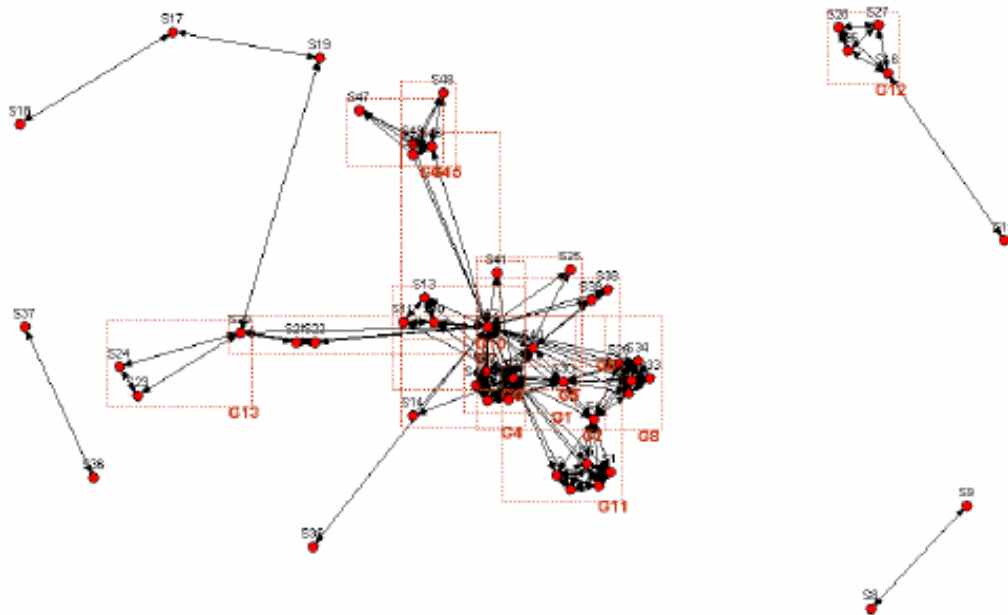

Figure 2: Clique Analysis Sociogram

Table 3: Clique analysis of the LGO discussions

Cliques	Actors
K1	S12,S7,S30,S40,S42,S43,S44,S45
K2	S12,S7,S30,S4
K3	S12,S7,S10,S11,S13
K4	S12,S7,S14
K5	S12,S7,S25
K6	S12,S7,S41
K7	S12,S20,S21,S22
K8	S12,S29,S4,S30,S31,S32,S33,S34
K9	S12,S38,S39,S40
K10	S12,S46,S49,S50
K11	S2,S3,S4,S5,S6,S7,S1
K12	S16,S26,S27,S28
K13	S23,S20,S24
K14	S47,S46,S49,S50
K15	S48,S46,S49,S50

DISCUSSION/CONCLUSION

It is apparent from our research that most existing frameworks make either a qualitative or quantitative analysis of CMC, but rarely do we see a mixture of these techniques or a comparison/correlation of their results. Also, some models can only be used on only synchronous or asynchronous communication, but not both. Our opinion is that it is important that a unified framework is developed, for the complete evaluation of all aspects of online communication. As new teaching methods and different learning activities emerge, new types of interaction and evaluation are necessary. The analysis of CMC should take all these updates into consideration, and incorporate them into future CMC analysis models.

This paper has demonstrated the application of Social Network Analysis (SNA) in a computer aided language learning course of Modern Greek. Furthermore, an Attitudes

Towards Thinking and Learning Survey (ATTLS) was carried out. Both of the methods used had the same results. More specifically, the results of the SNA showed certain students to be more central in the discussions and these findings were matched by the results of the ATTLS which identified the same individuals as the 'connected knowers'. There are large amounts of data online, and it is becoming harder to monitor interaction. SNA was helpful in visualizing the network and in providing a mathematical analysis. It would be interesting to compare the SNA results with the ATTLS replies of more students, however at the time this wasn't possible since not everyone had answered the questionnaire. In the future we plan to extend this study with incorporations of more methods towards a unified framework.

Suggestions to Researchers

This study showed the use of SNA as a mechanism for better exploring the dynamics of online learning communities. Future research directions could include a more detailed comparison of the ATTLS questionnaire with SNA results plus the comparison of the SNA results with other forms of standardized questionnaires (e.g. the Constructivist Online Learning Environment Survey - COLLES).

Suggestions to Practitioners

The approach provided in this paper can be a useful methodology for developers and maintainers of online communities as it can provide insights about the dynamics of their community and will enable them to develop strategies for strengthening the centrality of students with low ATTLS scores, especially since ATTLS surveys could be administered prior to any online interaction of the actors.

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