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# INVESTIGATING THE IMPACT OF COMPUTER CONFERENCING: CONTENT ANALYSIS AS A MANAGEABLE RESEARCH TOOL

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## **Abstract**

*Content analysis of computer conferences provides a rich source of data for researching and understanding online learning. However the complexities of using content analysis in a relatively new research field have resulted in researchers avoiding its use as a qualitative or quantitative method and using more familiar methods such as survey and interview instead. Ethical issues are also raised that, though ensuring students' rights, particularly to privacy and with no fear of coercion, are making it difficult for researchers to access and analyse archives of conference data as a research source. This paper suggests a pragmatic but systematic approach to solving these research issues by using several research strategies that are described in the context of the authors' research and practice.*

## **Keywords**

*Content analysis, computer conferencing, online learning, research ethics.*

## **Introduction**

*"The asynchronous conference on the other hand, I am unsure of. ... I have to acknowledge that the requirement to log on, even the desire to log on out of sheer curiosity, has seen me read the messages and then go off and think about various issues and how they apply to my own work. So on the one hand I think 'I don't like this' but then have to realise that it has probably got me working sooner than I might otherwise have done, and thinking about the issues, and even posting the occasional response (such as this one)." (Mature-age, male, distance, postgraduate student)*

When teaching and researching in the online environment, reflective comments such as this are often shared with us by students as they negotiate the new process of learning online. In order to capture and analyse such comments, whether about the process of students' learning or about their commentary on the cognitive content of the unit, we enthusiastically negotiate the ethical minefield of using such text and begin to analyse the huge volume of 'written speech' that a computer conference can become. Analysing 1281 messages generated by 20 students (Stacey, 2002) can become an onerous and ethically complex task when messages can be long and entwined with responses to other students' messages. How can we analyse the conference content reliably and how can we use this data as a valid but manageable source for our research?

Since the earliest computer conferencing systems, researchers have attempted to analyse communication, learning strategies and patterns of interaction through content analysis and categorising of the text

generated when messages are sent to computer conferences. Analysis categories and methods are generated in many different ways depending on the focus of the research and have been both quantitative and qualitative. Quantitative approaches to content analysis are now well established and have recently been reviewed as a methodology by Rourke et al ( 2003), with a sample of 19 different content analysis studies. In an influential study early in the use of computer conferencing, Henri (1993) developed a qualitative approach which analysed messages into units of meaning and attempted to measure social dimensions, interactivity, cognitive skills, levels of processing and metacognitive knowledge and skills. Her approach was critiqued and further developed by Gundawardena, Lowe and Anderson (1997) into a five phase constructivist interaction analysis model. Kanuka and Anderson (1998) applied this preliminary model successfully, suggesting modifications, and McLoughlin and Luca (1999) also adapted this model of analysis for a learner-centred use of computer conferencing. Mellar and Howell-Richardson (1996) have approached content analysis based in the philosophy of language, particularly Speech Act theory and Cecez-Kecmanovic and Webb (2000) also used a linguistic basis for developing a communicative model for collaborative learning online. Garrison, Anderson and Archer (2000) have focused on conferencing as a medium for critical thinking and have developed detailed coding methods to analyse conference data through indicators of cognitive presence, social presence and teacher presence.

As researchers in this field, we have been dealing with such bodies of text for the last decade and have been faced with the difficulty of systematically and reliably analysing these ‘written conversations’ in a way that will represent the interaction and construction of ideas that occur in the online environment. Practical and methodological difficulties of content analysis that a number of researchers have noted (for example, Howell-Richardson and Medlar, 1996) include the often enormous amount of data available and the significant amount of time involved with the analysis. Studies into early use of computer conferences often yielded manageable numbers of messages for analysis as students and teachers experimented with the medium. Levin (1999) reported a web based conference among a cohort of preservice elementary student teachers who discussed 12 topics with about 20 messages per topic. Analysis of purpose of 240 messages into 11 categories was a manageable task resulting in reflection as the primary purpose of the conferences. Studies of on campus student use of conferencing as an additional communication tool (Gerbic, 2003) , or controlled studies of interaction through web based learning ( Oliver, Omari & Herrington, 1998) are also ways that can yield more manageable quantities of messages for analysis. Yet as students and teachers become more capable and confident of entering an online classroom, as the technology becomes easier to use and the infrastructure supporting it becomes more reliable, the possibility of more learners coming online also increases the potential amount of text they will generate and researchers face the possibility of analysing overwhelming quantities of data.

Many studies mention computer conferences amongst a range of data gathering methods (Carr-Chellman, Dyer & Breman, 2000) or ignore them as a source of data altogether and rely on survey and/or interview (Conrad, 2002, Howland & Moore, 2002) as the means of answering questions that could also be answered through the rich sources of data that conferences constitute. Conferencing data also provide an observational perspective which, when combined with other data like interviews or surveys, increases the validity of findings. Rourke et al (2003) admit that researchers find content analysis “difficult, frustrating and time-consuming” (p 132) and that few who have published a thorough content analysis study have repeated the process. Is content analysis going to be a tool we can use for measuring the impact of interaction online or are we going to avoid it because of its complexity?

Ethical dilemmas are also arising in the field of content analysis and researchers are finding the use of such data difficult to access unless they anticipate its use well in advance and can convince institutional ethics committees, who have often had little experience with computer conferences, that they are not infringing on the rights of the participants of the conference. So, if a comment like that quoted at the beginning of this paper, were to inspire a teacher to research an archive of learning dialogue saved at the end of a semester’s course, it may already be too late to tap into this rich data source.

This paper suggests a pragmatic but systematic approach to these research issues by using several research strategies :

- 1) Instead of analysing all messages in a computer conference, a sequence of analysis points are selected within the period of the conference being researched eg three week-long periods within a semester,

which are representational points in the development of the online interaction. These analysis points may be weeks selected at key stages of progress which relate to the focus of the research question.

This helps the situation of analysing intensely interactive conferences and, if the opposite situation exists with a less interactive conference, these points can be staged across more than one semester.

- 2) The analytical framework chosen or developed for the content analysis should be developed for the focus of the purpose of the research but this process can be simplified by beginning with a basis of a simple or established framework of analysis. Drawing from existing frameworks or modifying these can facilitate content analysis especially as recent studies have provided reliable frameworks that can be successfully replicated.
- 3) Analysis data are coded through qualitative software tools such as NUDIST and NVivo. If these tools are used to manage content analysis as well as other data, they facilitate triangulation of data when all forms of data (eg data from interview, or focus groups) are added to the categorised database and categories are extended to enable emergent theorising.
- 4) Conference data can be used as a source for stimulated recall. Research participants can reflect on their own online contributions and draw from their own previously articulated thoughts and conceptual development through revisiting representative messages or interactions. The researcher or the participant can select these messages to stimulate remembrance of earlier interactions.

The paper will also discuss the ethical issues that are specific to researching computer conferences which, because of the newness of the field of research, are creating dilemmas for researchers.

### **1) Sequence of representational points for analysis and staging the analysis**

The density of messaging in a completely online course results in many studies analysing selected weeks at progressive points in the semester. Most researchers select points in the semester when their theoretical framework enables them to hypothesise that particular activity from participants will be found online. McDonald and Gibson (1998), studying interpersonal interaction in small groups from the perspective of Schutz' model of small group development, selected three weeks (weeks 3, 8 and 13) that anticipated Schutz' described group development phases, rather than analyse all 2 200 messages online. Stacey (2002), with 1 281 messages generated in one semester, and with content analysis of messages only one research method, decided analysis of the entire conference was a major task which was unnecessary for the purpose of defining social presence. Careful selection of time periods and of conference spaces, when differences of communication were anticipated, enabled a more purposeful content analysis to determine online behaviour.

The introductory period when students were asked to introduce themselves to the group and where the whole group established their online relationships before breaking into small groups, was analysed because the study was focussing on the development of social presence as a modelled and learned process and at that time the teacher facilitated and moderated a whole group space, modelling welcoming dialogue and other social presence factors such as using message reply and interacting with the text of students' messages. Two later periods (weeks 7 & 12) when conference discussions in small group spaces had begun were also analysed. Research into groups (Tuckman & Jensen, 1977) suggested that the formation of small groups usually required members re-establishing social presence so to investigate this, the message content of a representative group conference was analysed during week 7 of the semester when the small collaborative group conferences were established. The small groups' first week of interaction was analysed to consider social presence factors and whether there were differences in the style of communication in the large and small group conference spaces. Conference data were compared with data in a later week of semester when the closed group space was used for assignment discussion.

Anticipating a large body of data, Gerbic (2003) planned to analyse discussions from selected weeks, for example, those relating to a case study, a particular discussion topic or an assessment. However, the quantum of data was not overly demanding due to the level of participation and contribution. To date, much of the research reported in the literature has been carried out in the distance education context and often in the USA. The online discussion is one of the main communication avenues in distance learning and in universities in the USA, different value systems may be operating which encourage student participation in research. Gerbic's research project was sited in an on campus context in New

Zealand. Here, students meet regularly in face-to-face classes and online discussions are only part of the interaction. These discussions are generally voluntary and not assessed. The discussions may not run for the entire semester and contributions may reduce when there are other demands on students like exams. Other issues affected student participation in the research project itself. The diverse nature of the undergraduate student population meant that many students were unfamiliar with research activity and its role in creating knowledge. There is also a 'user pays/what's in it for me' view expressed by students, where the benefits of research into student learning do not compare favourably with a commercial world which offers discounts, loyalty points and extra product for participation.

In the study, students were also very concerned about the time commitment of participation, which is understandable given the high number of working hours that many students sustain while they study. In one of Gerbic's studies, in the course of a 13 week semester, 602 messages were posted by the whole class with an average word count of 200 words. Ten students from the class of 35 agreed to participate in the research project. The participants contributed 4 - 14 messages which ranged from 1113 - 3181 words each during the semester. While the participation level may raise issues of limitations of the content analysis, it does result in a manageable corpus of data. However, it does not entirely reduce the workload, because it is still necessary to read all the contributions to accurately analyse the postings of consenting students. Low levels of participation could compromise some kinds of research objectives, if for example, interaction was investigated. However, in this study, where the research was examining deep and surface approaches to learning, participation produced sufficient data for adequate analysis.

Where studies produce smaller amounts of data, for whatever reason, then a staged approach may add extra value to the research. Here, content analysis can be carried out sequentially over several semesters, either within the same course or across several courses. The advantages of doing this include the ability to reflect, evaluate and review the content analysis process, to refine the framework, and to develop data driven ideas and concepts which can then be tested in the next round of analysis. With a staged approach in the same course, the validity of the analysis is increased and data can also be used to support program review and development.

## **2) Simplicity of analysis frameworks**

A major issue which impacts on the complexity of the use of content analysis will obviously be the choice of analytical framework. As online learning has become more frequently used, a range of frameworks have been devised which have provided a framework of analysis of both student learning (Hara, et al, 2000) ) and teacher presence (Tagg and Dickenson 1995), undergraduate (Bullen 1998), postgraduate (Zhu 1996) or professional development (Gunawardena, Lowe et al. 1997), and distance education (McDonald and Gibson 1998) and mixed mode (McKenzie and Murphy 2000) programs. Most of these frameworks have not been replicated, perhaps due to the short history of online learning as a research area, but Rourke et al (2000) have viewed this as a serious methodological problem and have devised a lengthy study that has developed a three-fold framework for identifying the manifest variables that indicate cognitive presence, teacher presence and social presence as part of their community of inquiry model (Garrison & Anderson, 2003).

To simplify the process of analysis many researchers use existing frameworks. These are no doubt attractive to researchers because they provide a framework that has been tested, evaluated and reported in the literature. The use of existing frameworks is also efficient in that it saves time which would otherwise be devoted to the development and piloting of the framework. In an exploratory study of a listserve discussion, Weiss and Morisson (1998) successfully used Mason's (1991) simple question framework to evaluate critical thinking. McLoughlin and Luca (1999) used Gunawardena's (1997) knowledge construction framework to investigate the value of text based interactions in an online discussion. This particular framework was chosen because it matched the course design, and was constructivist based, with an emphasis on collaborative learning. McKenzie and Murphy (2000) chose to apply Henri's (1991) framework to an evaluation of a postgraduate online discussion because of the range of analysis that is offered through its five dimensions.

Another approach to facilitate research use of computer conferences is through modification of an existing framework. This has most notably occurred with Henri's framework which has been modified by many researchers who have worked to refine it to fit the purpose of their research. Henri's framework has been highly influential, possibly because it is so comprehensive, and covers many of the basic facets of CMC. It has been used in its entirety, adapted and through its critique, has provided a springboard for new kinds of content analysis approaches. McDonald and Gibson (1998), in an investigation of group interaction, modified the Henri framework and added an interpersonal dimension. Newman et al (1995) provide a detailed description of their adaptation of Henri's paired indicators of cognitive processes in their development of indicators for Garrison's model of critical thinking. In their study, Hara, Bonk and Angeli (2000) acknowledged Howell-Richardson's and Mellar's (1996) critique of Henri's framework, which was that it lacked sufficient specificity. Rourke et al (2000) commented on the paradox of such critiques being positive in that this is one of the few frameworks to be replicated. Now the Community of Inquiry frameworks of the Canadian team (Garrison et al, 2000) are beginning to be replicated in research and attract their own modifications (Swan, 2003).

Stacey (1999), in researching the process of small group collaboration, categorised and calculated the online messages in her study into three types: course content, process of learning the technology and group learning and support, before analysing the online discourse and other data into a model of attributes of online collaborative group learning. These attributes included:

- clarification of ideas,
- feedback to ideas,
- diverse perspectives,
- group solutions and
- group resource sharing

as well as factors of socio-affective collaborative support.

To further study these last socio-affective factors (Stacey, 2002) this simple three-way framework was modified by adding the social presence framework of Rourke et al (1999) to provide an appropriate and reliable content analysis framework. The integration of the two frameworks categorised thematic units of meaning in message content into:

- Cognitive/content, detailed discussion and commentary on the course content
- System messages (relating to learning the online system software, or access issues) and administrative messages.
- Social content analysed further into social presence factors of:
  - o interactive responses, threaded responses with messages of socially appreciative nature,
  - o affective responses expressing emotion, feeling and mood which are expressed by emoticons, humour and self disclosure and
  - o cohesive responses which are group responses which build a cohesive group environment. These are measured by factors such as salutations, addressing participants by name and addressing the group as 'we,' 'our' or 'us.'

### **3) Analysis tools**

To make content analysis manageable and ordered, qualitative analysis software programs such as NUDIST and NVivo can be used. If these are used to analyse both the conference content and other data sources (eg interviews, qualitative survey data), this process can also facilitate triangulation of data within the study.

NUDIST (Non numerical Unstructured Data Indexing, Searching and Theorising) is structured by category headings called nodes which are established under a branching structure, devised by the researcher, that parallel the main concepts being researched and found in the data (Richards & Richards, 1994). As concepts and issues arise out of the data being gathered and organised, these nodes can be added and sub categorised, and a structured, ordered map of the data emerges as it is entered and analysed into the software. Questions can be asked of the database through combinations of the node categories being devised to answer queries.



NVivo (NUD\* IST Vivo) has been developed from NUDIST and therefore shares many of its characteristics. It does have some significant differences. Gibbs (2002) notes that NVivo is much better at “fine grained analysis” (p xxiii). In content analysis of messages, this means that parts of a message, rather than the whole message can be coded (compared with NUDIST is coded to paragraphs or text delineated by hard returns). The availability of coding stripes at the side of the text mean that the posting and its coding can be viewed in its entirety. A speed coding facility enables text to be rapidly coded as it is read on the screen. This enables new concepts of themes to be rapidly captured and coded and stored as free nodes for later consideration. Gibbs (2002) comments that these NVivo nodes are also useful because they enable creation of nodes whose title and description are derived directly from the text in the data, thus creating vivid and colourful images to assist the researcher and the reader.

NVivo also introduces some newer features like attributes, sets and cases, which assist with data management. Also useful is a modelling tool that allows a researcher to develop their conceptual thinking about the project in graphic form, incorporating all the different forms of data within the project, such as nodes, memos, attributes, and sets. The memorandum facility allows the researcher to record various notes in the process which might be about coding decisions or queries or emerging ideas about the transcript analysis. A project journal facilitates the same kind of reflection and recording at the project level rather than at the document or node level. This enables persistent observation of emergent issues and an adequate audit trail, both elements of Lincoln and Guba's (1985, discussed in Bassey, 1999) suggestions for ensuring internal and external validity.

Node descriptions can reflect the variables, both manifest and latent, that are under analysis. The nodes can follow the themes of the latent variables being researched, with sub categories reflecting the manifest variables used as indicators eg social presence -interactive. The data to be analysed from the computer conference is entered into NUDIST or NVivo before analysis begins and as data is identified at the nodes, they structure the content of the data collected and organise the information gathered. The nodes can be added or changed to suit the structure of the data and they become a summary of the research data as it is analysed, with the node structure defining the main themes emerging as a result of the study. By the time the data has been read through several times and categorised and recategorised and the node structure changed and refined to suit the emerging data, the results can be easily analysed, with a clear supportive commentary from the study's participants collected at major nodes. The nodes which stored the most data give an immediate way of defining the main results of the research.

The conference transcript, entered into a NUDIST or NVivo database within the ‘tree’ of categories, or nodes, cover the main conceptual framework of the study. The categories act as descriptors for conference analysis, and are ways of classifying the electronic text. The conference messages are often categorised at more than one node if the content of the message contains units of meaning that relate to different aspects of the study. The conference message data collected is thus analysed qualitatively into categories which are the framework of the content analysis and also serve to store and tally message frequency as well as analyse their meaning.

#### **4) Stimulated recall**

Instead of using the text of the online conference for analysis, another research strategy being investigated is the use of selected messages, posted originally by the participant and later analysed by the researcher as having relevance to the purpose of the research. These messages can be shown to the participant during an interview process to prompt recall of the behaviour or cognitive process that had occurred at an earlier time. The researcher is using a form of content analysis to identify key points of online interaction and to select messages to be used in this research method. Such a stimulated recall technique similar to that developed by Marland, Patching & Putt (1992) has been successfully used by Smith (2000) with vocational education and training students identifying learning strategies.

Using this technique, online researchers are working with learners using their postings to the online learning community to identify the metacognitive, cognitive, and social/affective strategies they employed as they interacted online. In her investigation of deep and surface learning, Gerbic (2003) has used the stimulated recall approach in interviews with students to develop a detailed picture of how they go about

participating in their online discussions. Selecting messages to stimulate students' recall of particular aspects of the class online interaction, or having the students select such points in their online conferences has been a successful tool in helping students recall and articulate the learning they have undertaken.

## **Ethical issues in Research of the Online Environment**

As content analysis of computer conferences is increasingly used as a research technique, Ethics Committees have begun to view the use of such text with greater caution and concern. Though they are essentially protecting the conference participants from harm, particularly protecting their privacy and confidentiality, their determination that all writers of conference text should provide consent for analyzing their text without (particularly teacher) coercion, can establish a barrier for use of conference data in research. There is a need for Ethics Committees to strike a better balance between protecting the rights of students and balancing the broader interests of the community.

The relative newness of this research field means that although members of an Ethics Committee will generally have experience of email and the Internet, they may have no experience of the online conference, and have not participated in a computer mediated discussion. Online classes are certainly not in the public arena, like many Internet chatrooms. They are a private space in the sense that they are password protected and are generally only accessed by learners, teachers and guests. On the other hand, the conference space is generally open to everyone in the class and is therefore not like an email discussion where conversation can often only be one to one. Failure to understand these features of the computer conference may result in unduly stringent and restrictive requirements for ethics consents, for example, restricted access by the researcher to the discussion and Learner Management System statistics of use, long and detailed information statements and complicated protocols relating to consents and interviews. Where the study is qualitative, and many are in this area, then the methodologies may be unfamiliar to committee members and this lack of familiarity inclines them towards conservatism in their decision making.

The expanding use of e-learning in education and the workplace makes this an important field of research, and there is now widespread acknowledgement (eg Owston, 1997 and Windschitl, 1998) of the need to develop new knowledge of and insight into this medium. In order to facilitate research endeavours, Ethics Committees do need to be mindful of the rights of students but at the same time they need to make informed decisions which means understanding the online environment. Privacy, confidentiality and protection from any resultant disadvantage or advantage as a result of participation or non participation are all important rights that Ethics Committees must seek to protect just as committees must also quite properly address any power issues that may arise between the researcher and students. However, insisting that all students studying online must be warned in advance of any intent of later requests for participant consent to have their online text analysed limits the opportunity of an interactive learning environment inspiring any possible later research analysis as a rich archive of text. The nature of this new environment means that learning can be captured in text but restrictions on researchers seeking consent from participants retrospectively to analyse this text confounds the flexibility of this new source of data. Allowing time to elapse when the archive of conference data no longer holds messages from currently enrolled students is an example of the way these archives may ethically be researched in the future.

Rourke et al (2003) suggest strategies for anonymising conference participants in analyzing conference data which protects the identity of participants though not necessarily protecting their confidentiality. Anderson & Kanuka (2003) describe a research situation in which one participant in a conference refused permission and the whole project was aborted because of the possibility of even removing their messages would mean reading them and thus be acting unethically. They suggest the option of using only messages that have clearly been given consent as the least contentious but query whether only messages of those refusing permission should be removed while those who have given no reply can be included. McCormack, Applebee & Donnan (2003) in describing publication of student online evaluation comments raised the issue of ownership of messages, does that remain in the hands of the message writers? Could a blanket statement provided at the beginning of a conference give access to researchers' use of anonymised archived messages or do those messages have to be understood as research data when



posted? This is an area that online researchers must consider carefully and one that needs discussion in the online community as the new environment provides new possibilities.

## Implications for research

This paper suggests a number of steps for researchers who are considering content analysis as a manageable research tool.

- 1) Ethical permission should be sought early with consideration given to possible strategies to circumvent problems such as non responders whose messages can't be used. Multiple requests or differing means of contact with respondents if organised early in the research process means that message data is not compromised by lack of permission.
- 2) After the purpose for the analysis has been determined by the research questions proposed, existing analysis frameworks should be considered for use or for modification.
- 3) Representative weeks for data collection can be identified as the semester progresses and stages in the learning process are anticipated.
- 4) If a situation occurs where a conference is not very interactive, research staged over a longer period can be considered.
- 5) If other methods of data gathering are being used in a research study eg interviews, surveys, focus groups, conference message data can still be considered as a permanent record of interaction that can be used to stimulate recall in research participants.
- 6) Qualitative data analysis tools such as NUDIST and Nvivo can be used to systematise and facilitate the categorisation of data during content analysis.

Online computer conferences can be exciting new classrooms and as technology improves student access, researchers are potentially provided with a captured environment of textual interaction. Using pragmatic strategies such as those suggested in this paper can make content analysis a rich source of research data and, as ethical considerations are resolved, online classes should provide a means of understanding and constantly improving the learning possibilities of the online environment. Further research into systems that could automate and facilitate content analysis will increase the likelihood of its continued use as a manageable research tool.

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