ATHABASCA UNIVERSITY

TRIGGER ANALYSIS IN COMPUTER MEDIATED CONFERENCING

BY

KRISTA R. POSCENTE

A thesis submitted to the

Athabasca University Governing Council in partial fulfillment

Of the requirements for the degree of

MASTER OF DISTANCE EDUCATION

Athabasca, Alberta

April, 2003

ATHABASCA UNIVERSITY

The undersigned certify that they have read and recommend to the Athabasca University Governing Council for acceptance a thesis "TRIGGER ANALYSIS IN COMPUTER MEDIATED CONFERENCING" submitted by "KRISTA R. POSCENTE" in partial fulfillment of the requirements for the degree of MASTER OF DISTANCE EDUCATION.

Patrick J. Fahy, Ph. D.

Supervisor

Terry Anderson, Ph. D.

Committee Member

Robert Spencer, Ph.D.

Committee Member

Date: ____________________, 2003

DEDICATION

I would like to dedicate this thesis to my family whose love brings meaning to my life - my husband Paul, my children Michael, Dana & Sophia, my mother Joan, my father Dennis and my sister Allison.

ABSTRACT

The purpose of this study was to investigate the characteristics of trigger messages that initiate discussion in Computer Mediated Communications (CMC) asynchronous text conferencing. A total of one thousand and twenty-eight messages from the text transcripts of three different graduate level courses were analyzed. Two text analysis models were used to investigate observed on-line interaction behaviour: the Text Analysis Tool (*TAT;* Fahy 2001; Fahy 2002a; Fahy 2002b), and the *Community of Inquiry* model (Anderson, Rourke, Garrison, & Archer, 2001; Archer, Garrison, Anderson & Rourke, 2001; Garrison, Anderson & Archer, 2000; Garrison, Anderson & Archer; 2001; Rourke, Anderson, Garrison, & Archer, 2001). While triggers were found to be distinguishable by the presence of open-ended questions, the occurrence varied significantly among the courses. Two of the courses had seven times the number of *true triggers* than the other course. Further analysis of instructor and student messages revealed evidence of significantly more interpersonal communication. Although other factors could exist, it was argued that the variation in the proportion of triggers and level of interpersonal communication was an indication of the *maturity* of the CMC communities.

ACKNOWLEGDEMENTS

I would like to acknowledge and to express my gratitude to Pat Fahy, my thesis supervisor. During an informal FireTalk audio-conference, Pat sparked my interest in text-analysis. That interest was renewed with Pat Fahy and Jon Baggaley's course "Seminar Topics in Educational Conferencing." My text-analysis path was established when Pat hired me for his research team. Pat's research work taught me the skills to undertake this thesis project. Working on Pat's research team was definitely my most enjoyable and professionally rewarding experience in the Masters of Distance program.

I am also grateful to Bob Spencer, my advisor, for navigating me through my Masters. If Bob had not directed me to "Seminar Topics in Educational Conferencing," I would have missed an incredible research opportunity.

I am especially grateful to Jon Baggaley. Courses with Jon challenged me beyond my comfort zone and transformed my future. From Jon, I learned that my scientific background was an asset in distance education, not a liability. The Internet skills I learned from Jon are now my employable skills.

Lastly, I would like to acknowledge Terry Anderson for agreeing to be on my committee. I have appreciated his informal guidance and encouragement to keep the big picture in mind.

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CHAPTER I

INTRODUCTION

Asynchronous text-based Computer Mediated Communications (CMC) conferences are used extensively in distance education and training, as a means of providing student-student and instructor-student interaction. CMC overcomes the barriers of time and distance to provide asynchronous opportunities for communication. Such communication allows for the development of a rich educational community. However, CMC can be an intimidating medium for students who are unfamiliar with the technology. The posted text is permanent and does not disappear like the spoken word. Such permanence can cause anxiety, especially when no one returns the communication.

As a student in the MDE program, the author experienced all of the above features of CMC. Initiating discussion on the CMC board was not always easy for her, yet some of her peers generated discussions easily. The variation in the number of responses to postings on conferencing boards became an intriguing observation of on-line communication. This observation was reconfirmed as the author worked as a Research Assistant (RA) in the Athabasca University Centre for Distance Education, in text-analysis and online interaction projects of various kinds. The lack of understanding of postings which trigger responses versus those which do not, and a general lack of existing previous research in this area, became apparent and provided the original impetus for this study.

Purpose

The purpose of the study was to explore the frequencies and characteristics of *trigger postings* in asynchronous CMC conferences in a moderated, graduate-level, academic on-line course environment. The study focused on observing, identifying, and describing patterns which may occur in *true triggers* and *true duds*. *True triggers* and *true duds* (see glossary) were defined by combining the observed progression and structure of a CMC conference (Fahy, 2001) with the notional indicators of *cognitive presence* triggers as described in the *cognitive presence* model (Anderson, Rourke, Garrison, & Archer, 2001; Archer, Garrison, Anderson & Rourke, 2001; Garrison, Anderson & Archer, 2000; Garrison, Anderson & Archer; 2001; Rourke, Anderson, Garrison, & Archer, 2001). Once identified, the *true triggers* and *true duds* were scrutinized to reveal any *structural or communication patterns* that may occur.

Background

Understanding *triggers* is important because the presence of *triggers* is thought to be critical to the initiation of higher-level thinking in CMC conferences (Garrison et al, 2000; Garrison et al. 2001). While higher-level thinking is difficult to measure, the *Community of Inquiry* model defines *triggers* as the initial event of *cognitive presence* (Anderson et al., 2001; Archer, Garrison et al., 2001; Garrison et al., 2000; Garrison et al.; 2001; Rourke et al., 2001). Higher-level thinking or *cognitive thought* is the cornerstone of university graduate courses.

In the *cognitive presence* model Garrison et al. (2000; 2001) describe a *triggering event* conceptually as a problem-posing event; the *triggering event* indicates a problem or issue for discussion. The indicators of Garrison et al.'s *triggering events* are "presenting background questions that culminate in a question, asking questions, and messages that take discussion in new direction." (A more detailed description for the *Community of Inquiry* model follows in the Glossary section of this proposal, below, and in Chapter 2)

The *Community of Inquiry* model provides a useful conceptual framework for understanding the emergence of higher-level cognitive thought in text-based CMC conferences. Preliminary research using the *Community of Inquiry* model for text-analysis used a smaller sample size, a problem that this thesis addressed (Anderson et al., 2001; Archer, Garrison et al., 2001; Garrison et al., 2000; Garrison et al., 2001; Rourke et al., 2001).

Another text-analysis tool is the *TAT* (Fahy 2001; Fahy 2002a; Fahy 2002b). This tool uses the sentence as the unit of textual analysis. Fahy (2002a) reports acceptable discriminant capability and reliability with the *TAT*. (A description of the *TAT's categories* follows in the glossary section; a fuller discussion occurs in Chapter 2). As described in Chapter 3, it was assumed here that a combination of the *TAT* and the *Community of Inquiry* models could provide a more reliable, discriminant tool for measuring and understanding the triggers or the process associated with higher-level *cognitive thought* processes in CMC environments. In combination, the *TAT* reveals communication patterns and volumes of interaction, and the *Community of Inquiry* model would provide evidence of *cognitive presence*.

<u>Research questions</u>

The study was designed to describe the frequency and character of *true triggers* and to distinguish these from *true duds* (see *Glossary*) in text-based CMC conferences in graduate-level university courses, and to describe differences in notional and structural contexts of the occurrence of these elements of CMC discourse. Lack of such data represents an important gap in the literature and the weakness of understanding CMC as a teaching tool.

The study explored five principal questions:

1) What is the frequency of *true triggers*, operationally defined here as messages which both generate four or more responses and satisfy Garrison et al.'s (2000; 2001) *trigger* criteria?
2) What is the frequency of *true duds*, operationally defined here as messages which do not generate any responses and yet satisfy Garrison et al.'s *trigger* criteria?
3) What communication patterns are contained in *true triggers*, as revealed by the *TAT* analysis?
4) What communication patterns are contained in *true duds*, as revealed by the *TAT* analysis?
5) What do the patterns observed suggest about online communication behaviours which appear to encourage or discourage responses from others (i.e., the linguistic and social behaviours which "*trigger*," versus those which do not)?

Major Assumptions

Exploring the characteristics of *triggers* in CMC conferencing requires the recognition of the following assumptions:

- Higher-level distance education university courses require critical discourse supported by sustained interaction. In this case CMC supports the interaction.
- *Triggers* may be associated with the initiation of higher-level thinking, as defined in the *Community of Inquiry* model. (The *CI* model is further described in the Glossary section of this proposal, below, and in Chapter 2.)

Significance

The study was significant in attempting to assess and understand how higher-order thinking is initiated (*triggered*) in text-based educational environments. Understanding the initiation or *triggering* process for critical discourse in CMC environments may lead to identification and development of strategies for facilitation by moderators of higher order learning in on-line courses (Garrison et al., 2001). The study also yielded empirical evidence of higher order thinking skills, a description of social interaction patterns, conferencing behaviour, and possible strategies for enhancing CMC in on-line learning environments.

Delimitations

The study was based on redacted text transcripts from the moderated asynchronous CMC conferences from two Athabasca University graduate level Masters of Distance Education on-line courses, and from an on-line professional development course for teachers and trainers offered by another Alberta post-secondary institution.

Glossary

The following definitions are important in understanding the research:

- *Community of Inquiry:* a learning community which enhances *cognitive presence* through collaborative and reflective communication (Garrison, 2002*;* see Chapter 2 for more detail).
- *Cognitive trigger:* evocative messages that "ask questions" or "take the discussions in new directions" as defined in the *cognitive presence* model of the *Community of Inquiry* (Garrison et al., 2000; Garrison et al., 2001).

- *Conference: for purposes of this study, a conference refers to an asynchronous on-line text-based discussion.*
- *Interpersonal communication:* personal or "friendly" or "intimate" interaction between individuals (Walther, 1996).
- *Interrater reliability: "*the extent to which different coders, each coding the same content, come to the same coding decisions" (Rourke, L., Anderson, T., Garrison, D.R., & Archer W., 2001). This refers to independent coding.
- *Kappa:* "the proportion of agreement after chance agreement is removed from consideration" (Cohen, 1960*;* see Chapter 2 for more detail).
- *Levels:* the depth of discussion which can be observed by measuring the placement of messages within chronological threads of an asynchronous text discussion (Fahy, 2001*;* see Chapter 2).
- *Maturity:* is assumed to be the product of experience, skills and comfort level of participants in CMC text-based conferences.
- *Notional analysis:* refers to analysis of content and other elements which are not structural. This includes analysis of abstract, collective, qualitative and speculative transcript components.
- *Rater reliability*: the extent to which coders agree with regard to a proofing method of coding, where one coder codes the transcript and a second recodes the same material. When discrepancies occurred, the discrepancies were recorded and used for calculating *kappas* and *rater reliability*. A discussion of the discrepancies between the raters ensued to determine a joint code. The joint coding produced the final *TAT* result for the study.

- *Redacted text transcripts*: those which have personal identifying information removed (except for gender).
- *Social interaction patterns:* "how individual members of the conference perform and interact " in text-based messages exchanged asynchronously (Fahy, 2001).
- *Structural analysis:* refers to analysis of transcript elements which are quantitative, concrete, objective, and less subject to interpretation or judgment.
- *Structural trigger:* a message which generates four or more responses as observed by measuring the chronological threads of an asynchronous text discussion (Fahy, 2001). Four responses was chosen as four reflects the average number of responses ($\mu_{responses} = 0.7$) plus twice the standard deviation ($\sigma_{responses} = 1.5$).
- *Text Analysis Tool (TAT):* classifies transcript sentences into one of five categories: 1) *questioning*, 2) *statements*, 3) *reflections*, 4) interpersonal coaching and *scaffolding*, and 5) *citations/quotations* (Fahy, 2001; Fahy 2002a; Fahy 2002b*;* see Chapter 2 for more detail).
- *True dud:* displays the defined characteristics of a *cognitive trigger*, but does not generate any responses (see Chapter 2 for more detail).
- *True trigger:* displays both the defined characteristics of a *cognitive trigger* and the functional characteristics of a *structural trigger* (see Chapter 2 for more detail).

Study Design and Methodology

Procedures. The study analysed the redacted text transcripts of the complete CMC conferences from two Master's of Distance Education courses, and one three-week professional training course. The *TAT* model was used to code the entire transcripts at the sentence level. Next, the transcripts were coded on *cognitive presence* criteria, gender, progression, level and the number of responses generated using the message unit (see Chapter 3 for more detail). *True triggers* and *true duds* were identified (see Glossary and Chapter 2). The identified *true triggers* and *true duds* were scrutinized to determine any existing communication and structural patterns. The study attempted to identify any associated factors contributing both to *true triggers* and *true duds*.

Coding Process. Coding occurred using both sentence and message units. Sentences were coded using the *TAT* model (Fahy, 2001; Fahy, 2002a; Fahy 2002b). Messages were also coded for *cognitive presence* criteria (Garrison et al., 2000; Garrison et al., 2001). ATLAS.ti software was used for recording, categorizing and statistical analysis of the coding. The first coding process involved employing the *TAT* tool. To ensure accuracy and reliability, each conference was coded and proofed by two individuals. This agreed upon joint coding became the final *TAT* result (see Chapter 3). The second level of coding was at the message unit (see Chapter 3).

Instruments and Coding. The researcher used ATLAS.ti to record and subsequently to analyze the *TAT* and *cognitive presence* categories present in the transcript material under study (Fahy, 2001; Fahy, 2002a; Fahy 2002b, Anderson et al., 2001; Archer, Garrison et al., 2001; Garrison et al., 2000; Garrison et al., 2001; Rourke et al., 2001). The results of the *TAT* analysis were compared with the *Community of Inquiry* model (Anderson et al., 2001; Archer et al., 2001;Garrison et al., 2001; Garrison et al., 2000; Garrison et al., 2001; Rourke et al., 2001). The training and piloting of the *TAT* and *Community of Inquiry* models will be discussed further in Chapter 3.

Organization of Thesis

The remainder of this thesis consists of four additional chapters. The second chapter is a literature review of the literature on the uses and interpretation of interaction generated in CMC, with emphasis on pedagogical models such as the *Community of Inquiry* model, and models of structural analysis of online interaction such as the *TAT* model. The third chapter describes the research method used here, including the dual coding process using both the *TAT* and *cognitive presence* models. The fourth chapter summarizes the findings. The final chapter discusses the conclusions and recommendations, and concludes with suggestions for further research.

CHAPTER II

LITERATURE REVIEW

CMC has become an integral component of online distance education. Asynchronous text discussions remove the barriers of time and distance to provide opportunities for students and the instructor to interact. Understanding CMC interaction is essential to understand, assess and improve cognitive on-line learning processes. This chapter will begin with a brief discussion of interaction philosophies. The discussion will then focus on two text analysis models on which this study is based: the *community of inquiry* and the *TAT*. Lastly, this chapter will address some of the methodological issues of text analysis.

Interaction

Several authors have discussed both the necessity of interaction, and the usefulness of CMC for providing interaction in on-line education. Moore (1989) defined the types of interaction found in education. Fulford and Zhang (1993) found that perceived group interaction was a predictor of student satisfaction. Zhu (1996) and Walther (1996) recognized learning as a goal-oriented task where CMC can enhance the didactic task with interaction and collaboration.

Types of Interaction. Moore (1989) identified three types of educational interaction: 1) learner-content, 2) learner-instructor, and 3) learner-learner. Correspondence education concentrates on facilitating learner-content interaction with limited and slow learner-instructor interaction. CMC brought a new dimension to distance education with learner-learner interaction and improved learner-instructor interaction. Learner-learner interaction is increasingly regarded as valuable in an educational context.

Perceptions of Interaction. High-levels of interaction positively influences learning and satisfaction. Interaction engages the learner and prevents "renegade thought patterns" from dominating their cognitive thought or group interactions. In an interactive situation, all learners can be alert and involved whether they contribute personally or not (Fulford and Zhang, 1993).

Fulford and Zhang (1993) examined learner perception of interaction in relation to learner satisfaction. Fulford and Zhang found a predictor of student satisfaction was the perception of overall group interaction. When learners perceive group interaction to be high, they are more like to be satisfied than when they perceive only their own personal interaction to be high.

Goal-directed Learning. "Instruction is most effective when it is in a form of discussions or dialogues wherein learners can interact with peers or mentors who challenge support, and scaffold their learning" (Zhu, 1996). Learning is a goal-directed process that requires learners to engage in collaborative, reflective and self-regulated activities. Interaction with peers and experts encourages social and cognitive development. CMC can facilitate interaction between learners and instructors and "maximize cognitive growth and development."

In this goal-oriented constructive process of learning, the students are actively involved in the knowledge building or meaning negotiation process. CMC not only enhances interaction, CMC allows students to participate in "self-regulated and reflective" activities. The role of the moderator shifts as students become actively involved in the knowledge construction process (Zhu, 1996).

In her study, Zhu (1996) explored the importance of *starters* and *wrappers* as major components of student participation in electronic discussions. After the instructor's introductory questions and reading advice, s*tarters* were students who "provide(d) the class with key themes, issues, or questions leading to the upcoming week's readings." The *wrapper* was "meant to bring some of the discussed issue and questions to some sense of closure." These *starters* and *wrappers* are similar to the *triggers* and *resolution* events in the *cognitive presence* model. However, the *cognitive presence* model does not distinguish between the student and instructor messages. Zhu's *starters* refer strictly to the students' notes. The *cognitive presence* model is discussed in detail later in this chapter.

Zhu's study revealed that a "good starter usually pointed to a few major discussion themes for a weekly discussion." The *wrapper* did not reveal any educational advantages and were ignored by most students. Zhu proposed that a student's learning and reflection was individual and a *wrapper* could not be comprehensive enough to represent all the individual ideas.

Zhu studied the roles of the participants and the types of interaction. Interaction was observed by studying the meanings of "notes." Notes were classified as reflective, comments, discussions, answers, information sharing, scaffolding and question. The *Text Analysis Tool (TAT)* was developed from Zhu's classification of interaction (Fahy, 2001; Fahy, 2002a; Fahy, 2002b). The *TAT* is discussed in detail later in this chapter.

<u>Impersonal and Interpersonal Interaction</u>. Walther (1996) distinguishes between impersonal and interpersonal interaction and CMC's ability to facilitate both. Depending on the desired goal and specified conditions, CMC can contribute either impersonal or interpersonal interaction. According to Walther, "heightened levels of intimacy, solidarity,

and liking" have been observed and documented in CMC. In some circumstances CMC interactions can exceed face-to-face interaction and become "hyperpersonal."

The social development of the community takes longer with CMC than with face-to-face because the rate of social information exchange is less. The lack of non-verbal cues "temporally" retards the expression and deciphering of interpersonal interaction in CMC relative to face-to-face. "Accrual of interpersonal effects is expected to be slower in time and develop in proportion to the accumulation of messages exchanges" (Walther, 1996). Time is necessary for acquiring *social presence,* an integral component of the *Community of Inquiry.* Over time, one can achieve the same or exceed the social level in CMC as face-to-face.

In an educational context, too much interpersonal interaction can detract from the didactic goals. Less interpersonal or socio-emotional interaction is preferable in task oriented CMC. The lack of nonverbal cues in CMC reduces personal and emotional interactivity. According to Walther (1996), too much interpersonal interaction can detract from the group's task. By reducing socio-emotional and non-task related communication, CMC increases the effectiveness of the group's efforts. CMC may help the group focus on the didactic task.

<u>Gender Differences in Interaction</u>. Researchers have attempted to make broad generalizations of gender interaction behaviour in CMC. In a small sample study of fifteen students, Ross (1998) found that females had lower participation rates than males and had less influence on group deliberations. The difference could not be attributed to education level, CMC skills, nor prior course knowledge.

In un-moderated list serve discussions, Herring (1992) found men and women presented different styles of interaction. Women tended to be more supportive or *epistolary*, while men tended to be more critical and oppositional - *expository*. Herring describes the *informational expository schema* as having the following four functional types of macro-segments: 1) identification of problem, 2) proposal of solution, 3) evidence in support of solution, and 4) evaluation of solution. Herring's generalized interactive or *epistolary* schema has the following conventions: 1) link to previous discourse, 2) contentful message, and 3) link to following discourse.

Herring also found evidence of the list-effect, "whereby the communicative practices of the majority of active participants become the normative for the group as a whole." The lists exhibited an overall aligned or opposed orientation depending on the gender composition of the group.

In moderated graduate level CMC, Fahy (2002a) confirmed that women exhibited more *epistolary* communication patterns and men preferred *expository* types of communication. Fahy identified *epistolary* and *expository* discourse by *TAT* indicators. The *TAT* indicators are described in detail in Figure 5. *Epistolary* or feminine discourse was categorized as *vertical* and *horizontal questions* (T1a and T1b), *referential statements* (T2b), *reflections* (T3) and *scaffolding/engaging* (T4). *Expository* or masculine discourse was characterized as *non-referential statements* (T2a), *quotations* (T5a) and *citations* (T5b). *Epistolary* discourse is "more interactionally oriented," while *expository* is "more declamatory than interactive" (Fahy, 2002a).

<u>Teaching Roles in CMC</u>. With CMC interaction, the responsibility of knowledge construction is shared between the students and instructor. Students "generate their understanding based on prior knowledge and current understanding" (Zhu, 1996). The

instructor is no longer a lecturer who dispenses knowledge. The instructor is a mentor and facilitator who guides and scaffolds students' learning.

Fulford and Zhang (1993) attributed the development and maintenance of interactive systems as the responsibility of the teacher. "Maintaining interaction is similar to throwing a ball around: all participants must be alert since no one is sure to whom involvement will come next" (Fulford and Zhang, 1993)

Anderson et al. (2001) developed a model for describing and understanding *teaching presence* in CMC. While the *teaching presence* model acknowledges the collaborative construction of knowledge is shared between the instructor and students, a strong *teaching presence* is necessary to direct discourse to "toward higher levels of learning through reflective participation." *Teaching presence* is defined as having the following categories: 1) design and organization, 2) facilitating discourse, and 3) direct instruction.

In the *teaching presence* model, design and organization activities include building curriculum, designing methods, and establishing time parameters. Modelling appropriate use of the medium and appropriate etiquette are also part of the organizational design of the course. Facilitating discourse is similar to Fulford and Zhang's (1993) metaphor of "throwing a ball around" to maintain interaction. Anderson et al. stated, "facilitating discourse is critical to maintaining the interest, motivation and engagement of the students in active learning." The intellectual and scholarly leadership demonstrated by the teacher defines direct instruction. Direct instruction includes presenting content, focussing the discussion, diagnosing misconceptions and interjecting knowledge. By focussing the discussion, designing methods, and modelling appropriate etiquette, the moderator can reduce Herring's (1996) observed "list-effect."

In the *cognitive presence* model, Garrison et al. (2001) emphasize the importance of the moderator's influence during the initial *triggering* phase and the third *integration* phase. The role of the moderator in the initial phase is to initiate, shape, and focus *triggering* events for the "attainment of intended educational outcomes." During the third phase the moderator needs to actively ensure the continued development of critical thinking and cognitive development by modelling critical thinking, asking questions, and diagnosing misconceptions.

<u>Models for Understanding Interaction Analysis.</u>

The study of interaction analysis is not a new idea. Authors such as Bales (1950) proposed a classification scheme to analyse small "systems of human interaction" and expand the "range of empirical data" of social systems theories. Bales outlined six stages which could be applied to any interaction system. These stages include "problems of orientation, evaluation, control, decision, tension management and integration."

CMC conferencing has become an important tool in the on-line educational environment. While this tool has been quickly implemented, the understanding of how best to utilize CMC conferencing has not advanced as quickly (Garrison, Anderson & Archer; 2001). Two examples of models for studying CMC interaction are the *Community of Inquiry* Model (Anderson, Rourke, Garrison, & Archer, 2001; Archer, Garrison, Anderson & Rourke, 2001; Garrison, Anderson & Archer, 2000; Garrison, Anderson & Archer; 2001; Rourke, Anderson, Garrison, & Archer, 2001) and the *Transcript Analysis Tool (TAT;* Fahy, 2001; Fahy 2002a; Fahy 2002b). The former focuses on conceptual categories, while the later examines elements of interaction (sentences) for specific types of communication.

<u>*Community of Inquiry* Model</u>. The *Community of Inquiry* model provides a framework for "judging the nature and quality of critical discourse in a computer conference" (Garrison et al., 2001). Figure 1 illustrates the three essential elements of the *Community of Inquiry* model. The elements of social presence, *cognitive presence* and *teaching presence* are each essential and overlapping. *Teaching presence* is defined "as the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" (Anderson et al., 2001). *Social presence* in the model is defined as "the ability of learners to project themselves socially and emotionally in a community of inquiry*"* (Rourke et al., 2001).

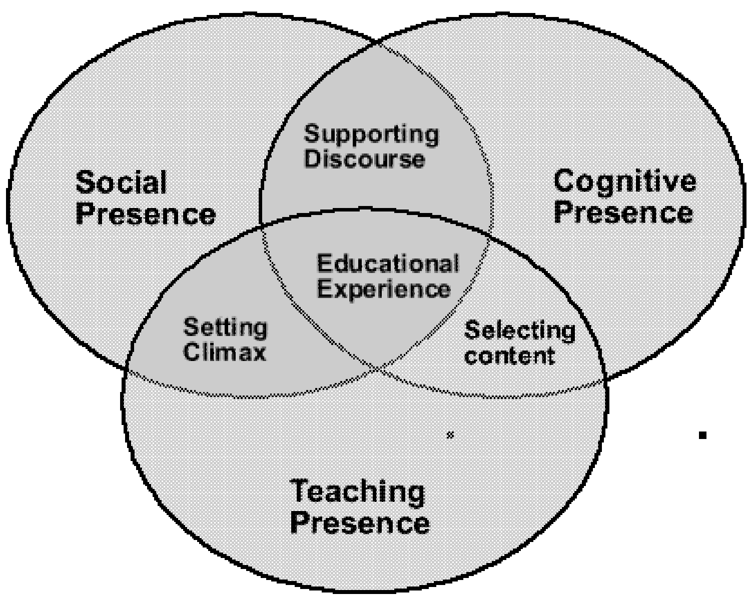


Figure 1: Elements Of The *Community Of Inquiry* Model (Garrison, Anderson & Archer, 2000)

The *cognitive presence* model focuses on higher-level thinking processes. Garrison et al. (2000, 2001) suggest a sequence of four phases essential to describe and understand *cognitive presence* in an educational environment. Figure 2 presents the four phases. The *triggering* event initiates the critical inquiry. During the *triggering* event an issue, problem or dilemma is recognized. *Exploration* is the next phase which is characterized by brainstorming, questioning and the exchange of information. *Integration* occurs when students assess the applicability of ideas. *Resolution* is the end of the phase and requires clear expectations and opportunities to apply newly created knowledge. "The *Practical Inquiry* model reflects the critical thinking process and the means to create *cognitive presence*" (Garrison, et al. 2001).

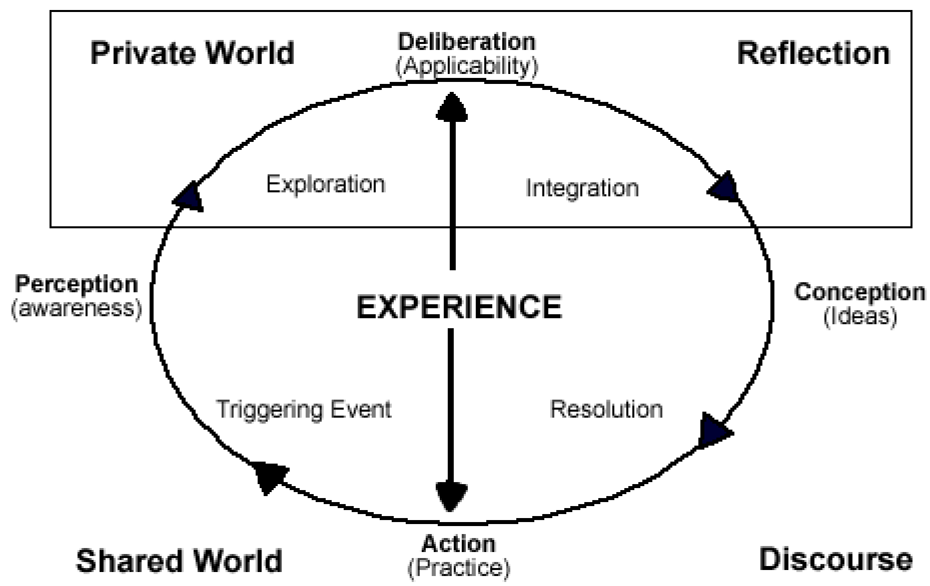


Figure 2: Practical Inquiry Model (Garrison et. al. 2000, 2001)

A critical *community of inquiry* is essential for higher education as it supports higher order learning. A *community of inquiry* is where students listen, build on one another's ideas, challenge one another, and assist each other in drawing inferences. Higher order thinking refers to thinking that is "conceptually rich, coherently organized, and persistently exploratory" (Lipman, 1991). Teaching using a *community of inquiry* approach can "provoke discussion and reflection" (Lipman, 1991). Asynchronous CMC reduces the barriers of distance and time in distance education. CMC provides a forum for collaborative work and supports the development of a *community of inquiry* "capable of supporting effective, higher-order learning" (Kanuka & Anderson, 1998; Garrison, 2002).

The *cognitive presence* model is notional as it emphasises the content of the verbal interaction. Garrison et al. (2001) define the following stages in Figure 3 for assessing *cognitive presence* at the message level.

Event	Descriptor	Indicators	Sociocognitive Processes
Trigger	Evocative	Recognizing the problem	Presenting background information that culminates in a question
		Sense of puzzlement	Asking questions
			Messages that take discussion in a new direction
Exploration	Inquisitive	Divergence – within the online community	Unsubstantiated contradiction of previous ideas
		Divergence – within a single message	Many different ideas/themes presented in one message
		Information exchange	Personal narratives/descriptions/facts (not used as evidence to support a conclusion)
		Suggestions for consideration	Author explicitly characterizes messages as exploration
		Brainstorming	Adds to established points but does not systematically defend/justify/develop addition
		Leaps to conclusions	Offers unsupported opinions
Integration	Tentative	Convergence – among group members	Reference to previous message followed by substantiated agreement
			Building on, adding to others' ideas
		Convergence – within a single message	Justified, developed, defensible, yet tentative hypotheses
		Connecting ideas, synthesis	Integrating information from various sources
		Creating solutions	Explicit characterization of message as a solution by participant
Resolution	Committed	Vicarious application to real world	None
		Testing solutions	Coded
		Defending solutions	

Figure 3: Categories and Descriptors of *Cognitive Presence* (Garrison et al., 2001)

Garrison et al. (2001) coded twenty-four messages according to *cognitive presence* criteria. Figure 4 presents the relative frequencies of the *cognitive presence* categories.

Garrison et al. found little *resolution* in this study. While the corpus was small, the low frequency of *resolution* is consistent with Zhu's (1996) findings for *wrappers*.

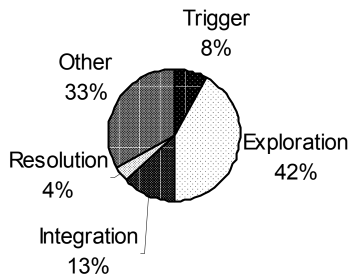


Figure 4: Relative Frequencies for *Cognitive presence* Categories (Garrison et al., 2001)

Text Analysis Tool (TAT). Fahy (2001, 2002a, 2002b) and Fahy et al. (2001) have developed a different model for analysing CMC transcripts. TAT is a method of describing verbal interaction by the type and proportion of the utterances/messages observed. The *TAT* focuses analysis on the topical progression (types and patterns) of sentences. *Parallel triggers* occur when several individuals specifically respond to a posting. *Sequential triggers* occur when a posting generates several levels of discussion (Fahy, 2001). Figure 5 illustrates sequential and parallel progression in CMC conferences. Parallel progression occurs at the same level. The levels increase with sequential progression. Fahy (2001) defined *trigger* responses as postings which generate responses. The *TAT* model provides a method for analysing the structure or types of interaction in CMC transcripts.

Parallel progression		Sequential Progression	
Level 1	Comment A	Level 1	Comment A
Level 1	Comment B	Level 2	Comment B
Level 1	Comment C	Level 3	Comment C
Level 1	Comment D	Level 4	Comment D
	Etc.		Etc.

Figure 5: Progression Type (Fahy, 2001)

The *TAT* evolved from a pioneering model first proposed by Zhu (1996).   Zhu proposed a tool for "facilitating understanding and supporting the social construction of knowledge." While Zhu's theoretical background dealt with the educational needs of children from Kindergarten to grade 12, her classification of interactions can extend to higher-level education. Interactions were classified as reflective, comments, discussion, answers, information sharing, scaffolding and questions.

The *TAT* builds on Zhu's categories of interaction (Fahy, 2001; Fahy 2002a; Fahy 2002b; Fahy, Crawford & Ally, (2001); however, the *TAT* has fewer classifications than Zhu. The *TAT* focuses on the content and interaction patterns at the sentence level of the transcripts. Figure 6 presents and describes the *TAT* classification of sentences.

Category	Description
1A – vertical questions	Questions which assume a correct answer exists, if the right authority can be found to supply it: “[Name], what role would you say you played, using Havelock’s typology?”
1B – horizontal questions	Accepts that there may not be one right answer; others are invited to help provide a plausible or alternate “answer,” or to help shed more light on the question: “Is it a good idea to have your trainers thinking in the same ways a s programmers do?”
2A – non-referential statements	Contain no or very little self-revelation and usually do not invite response or dialog; tone may be didactic; the main intent is to impart facts or information: “Although our office has been in the business of providing program in-service and training workshops since it inception, it is new to the area of computer-mediated communications.”
2B – referential statements	Postings which make direct or indirect reference to elements of preceding statements: “The comments of [Name 1] and [Name 2] here are very apropos a point made in the last unit of this course: pilot testing is critical.”
3 - reflections	Thoughts, judgements, opinions or information which are personal, or usually at least somewhat guarded or private; a tone of self-disclosure is suggested in the sharing process: “At one point I was so desperate I even resorted to drawing myself diagrams, etc., before I would attempt to answer the quiz questions.”
4 – scaffolding and engaging	Intended to initiate, continue, encourage or acknowledge interaction, and “warm” or personalize the discussion; the tone is friendly, even intimate; includes phatics and emoticons: “I will log on for a bit and just say hi! ;-)
5A – quotations and paraphrases	“Every tool carries with it the spirit by which it has been created.”
5B - citations	“Werner Karl Heisenberg, *Physics and Philosophy,* 1958.”

Figure 6: *TAT* Categories (Fahy, 2001; Fahy, 2002a; Fahy, 2002b; Fahy et al., 2001)

Table 1 presents the frequency of *TAT* results of Fahy (2002a) analysis of 354 messages from the transcripts of a moderated graduate level course. The occurrence of *vertical* and *horizontal questions* (T1a and T1b) was rare, a finding which is significant for this study.

Table 1

Frequency of *TAT* indicators (Fahy, 2002a)

TAT category	Total %
T1A – vertical questions	1
T1B – horizontal questions	2
T2A – non-referential statements	52
T2B – referential statements	10
T3 - reflections	21
T4 – scaffolding and engaging	10
T5A – quotations and paraphrases	3
T5B - citations	2

Methodological Issues

Rourke, Anderson, Garrison and Archer (2000), and Fahy (2001; 2002b), discuss methodological problems in text analysis. Both argue that previous transcript work has yielded poor discriminant capability and reliability among raters. A coding instrument must be able to categorize content into discreet categories. Coding discrepancies appear when the categories are unclear. According to Fahy (2001), two causes of poor discriminant capability are complexity of the coding categories, and an inappropriate unit of analysis. Discriminant capability means the tool must be able to distinguish "discrete and useful categories" (Fahy, 2001). However, the tool cannot be so complex as to reduce reliability. A greater number of categories increases the likelihood of ambiguity (Fahy, 2001).

An inappropriate unit of analysis also affects discriminant capability. The *cognitive presence* model is based on analysis at the message unit. Garrison et al. (2001) argued that the messages are clearly demarcated and easily identified. Fahy (2001) favours the sentence unit for its reliability and "ability to detect and describe the nature of the widely varying social interaction, and behaviour of an on-line community." In fact, Fahy (2001) states that the sentence unit is the only appropriate unit for analysis of the content of CMC transcripts

(Fahy, 2001). The *TAT* model is an appropriate analysis tool with discriminant capability and reliability at the sentence level of measurement, with eight coding categories (Fahy, 2001).

However, Fahy (2002b) has suggested an alignment of the *TAT* with the *cognitive presence* model as a way to detect indirect indicators of higher-order thinking within the text of an on-line conference. Fahy compared the *TAT* and *Community of Inquiry* models and confirmed the "*Community of Inquiry* model applies to actual interactive behaviour observable among CMC participants." The different approaches to transcript analysis provided similar conclusions regarding the content and processes occurring in conferences. Specifically, *exploration,* predominates, followed by *integration.* Occurrences of *triggers* and *resolution* vary. Fahy suggested more research is needed to determine the reasons for this variation in *triggers* and *resolution.*

<u>Measuring Interrater and Rater Reliability</u>. There are two commonly reported statistics for measuring interrater and rater reliability. Rourke et al. (2000) reports that percent agreement statistic is the most common and simplest method for reporting interrater reliability. Measuring rater reliability is based on the same calculation as interrater reliability, with a slight modification to "m" below. Recall interrater reliability is based on independent coding and *rater reliability* is based on a proofing method of coding (see Glossary). Percent agreement is calculated by using Holsti's (as cited in Rourke et al., 2000) coefficient of reliability (C.R.).

$C.R. = 2m / n_1 + n_2$, where

m = the number of coding decisions upon which the two coders agree (independent coding)

m = the number of coding decisions upon which rater 2 agreed with rater 1 (modified for proofed coding)

n_1 = the number of coding decisions made by rater 1

n_2 = the number of coding decisions made by rater 2

A minimum acceptable percent agreement is 80% (Rife, Lacy, and Fico, as cited in Rourke et al., 2001).

Another conservative statistic for measuring interrater reliability is Cohen's kappa (1960). The kappa (κ) is the "proportion of agreement after chance agreement is removed from consideration" (Cohen, 1960). The formula for calculating kappa (κ) is as follows:

$$\kappa = \frac{\rho_o - p_c}{1 - p_c}$$

p_c - the proportion of units for which agreement is expected by chance (joint probability)

ρ_o – the proportion of units in which the judges agree

Kappa values of greater than 0.75 are representative of excellent agreement (Cappozzoli, McSweeney, & Sinha, as cited in Rourke et al. 2001). The kappa has been a reported measure of inter-rater reliability in the *Community of Inquiry* model (Anderson et al., 2001; Archer, Garrison et al., 2001; Garrison et al., 2000; Garrison et al., 2001; Rourke et al., 2001); however, Rourke et al. argued the chance agreement is negligible with 12 indicators. Recall the *TAT* model has eight indicators, which greatly reduces the possibility of chance agreement.

Proofing method. The proofing method was a coding-recoding process . The transcripts were coded using the *TAT* by any of four coders. A second coder reviewed the coded transcript and noted any disagreements. The recorded discrepancies were used to calculate reliability and *kappas*. Once discrepancies were noted, a discussion between the two coders resolved them and resulted in an agreed coding for each sentence. The agreed coding produced the final *TAT* result.

Comparing Sample Means. The analysis of variance is the most popular statistical method for comparing sample means. Analysis of variance is an inferential tool to determine significant differences. In a one-way or single factor analysis there can be several samples: however, there is only one independent variable and one dependent variable. The dependent variable corresponds to the measured characteristic of the subject. An ANOVA is set up to test a null hypothesis. For example, if there were four comparisons the null hypothesis would be H_o: $\mu_1 = \mu_2 = \mu_3 = \mu_4$. One can only reject the null hypothesis if the determined F-value exceeds the critical value (Huck, 2000).

Summary

Understanding the nature of CMC interaction is important to the support and development of rich cognitive experiences in on-line education. CMC provides the opportunity for asynchronous instructor-student and student-student distance interaction. The students and the instructor share the responsibility for constructing knowledge. However, the instructor is responsible for providing and maintaining a framework which encourages rich cognitive interaction. A high level of interaction maintains student motivation and interest.

CMC is a unique medium requiring interaction in an environment which is characterized by the lack of non-verbal cues. As such, the CMC online community develops slower than a face-to-face group. However, by reducing personal and emotional interactivity, the lack of non-verbal cues increases the effectiveness of the group's didactic efforts.

There are two useful models for observing and interpreting CMC interaction. The *cognitive presence* model is a method for indirectly assessing critical inquiry in on-line CMC. The *TAT* is a method for categorizing sentence types and interaction patterns. Examining the communication patterns from CMC text transcripts with both the *TAT* and the *cognitive presence* model can reveal information about the communities' interaction and critical thought processes.

CMC interaction is initiated with a *trigger* or a *starter*. Both the *TAT* and the *Community of Inquiry* model recognize the preliminary event in CMC interaction. Understanding *triggers* is important to appreciating the initial processes of critical thinking in on-line distance education.

CHAPTER III

METHODOLOGY

The study was designed to identify and analyse messages which initiate or *trigger* discussion in CMC. Specifically, the study attempted to quantify the occurrence of *true triggers,* and through analysis of *true triggers* gain understanding of the associated interaction patterns. *True triggers* display the notional characteristics of *cognitive presence triggers* and also generate four or more responses (see Glossary*;* Garrison et al., 2000; Garrison et al., 2001).

Conference participants

The participants in this study were indirectly observed from redacted text transcripts (see Glossary) from three different courses. One course, the non-Athabasca University course, was the first course in a professional development program for on-line teachers offered through a non-degree granting Alberta post-secondary institution. The conferences in the Non-AU course were three weeks in length and were conducted concurrently. The non-AU course:

- was three weeks in length;
- was the first of six courses;
- had no educational prerequisites;
- was attended by enrolees who had undergraduate degrees, were either teachers (K-12), instructors, or trainers. Many were e-learning managers, information technology types, or instructional designers;
- had Canadian and US enrolees.

The Athabasca University courses were both from the Masters of Distance Education (MDE) program. The AU courses were beyond introductory level courses. Conferences in the thirteen weeklong AU courses ran sequentially. One AU course was the third of five required core courses in the MDE program. The other AU course was an optional course with no pre-requisites. However, students in the optional AU course were familiar with CMC (P. J. Fahy, personal communication February 3, 2003). The AU moderators were both experienced CMC facilitators and the students had prior experience with CMC. In all the courses the exact age of the students is unknown. However, one can infer that the students are mature given that they are teaching professionals in the non-AU course and graduate students in the AU courses. The average age of Athabasca MDE students is approximately forty-four years.

Table 2 summarizes the number of conferences, the number of words, the number of messages per course, the number of students and the respective gender from which the study's transcripts came.

Table 2

Distribution of Conferences

Course	Non-AU	AU 1	AU 2	Total
		Number of conferences		
All messages	3	3	5	11
		Number of words		
All messages	23,695	100,903	127,195	251,793
		Number of messages		
All messages	146	339	543	1028
		Number of Students		
All	17	24	30	77
Males	4	11	13	29
Females	13	13	17	48

Analysis Tools

The tools of analysis were the *TAT* at the sentence level, and the *cognitive presence* model at the message level. ATLAS.ti was used for recording and analyzing the data. Excel spreadsheets were used to record and refine the ATLAS analysis as well as calculate ANOVA results.

Transcripts

All identifying personal information related to the authors was redacted before the study began. Figure 7 is a screen capture of ATLAS.ti which illustrates the redacted text and recorded coding. The large central column displays the redacted text. One can see that student-24 is responding to student-19 and student-20. The right column displays the recorded codes. The uppermost code corresponds to *exploration* (garr-explore).

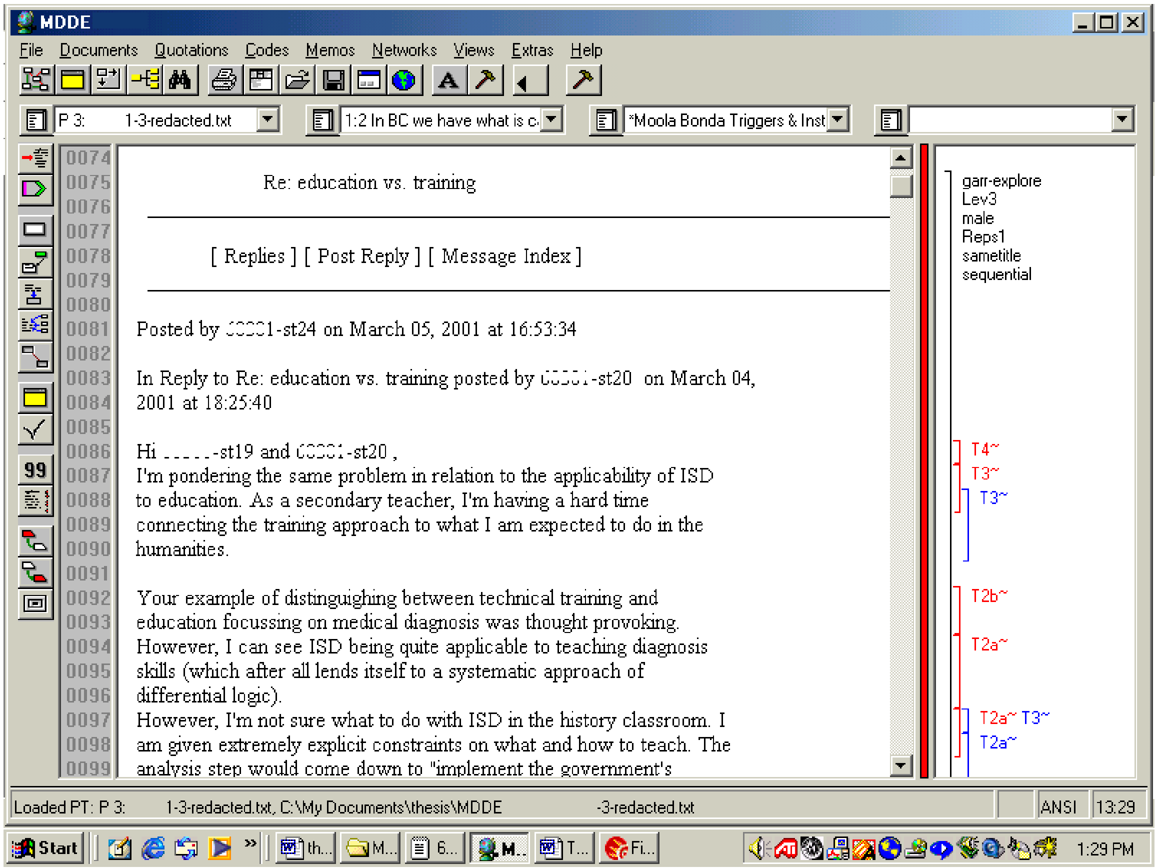


Figure 7: Screen Capture of Text-Analysis Coding In ATLAS.ti

<u>*TAT* Coding at the Sentence Level</u>

The transcripts were first analysed at the sentence level using the *TAT* model. The right column of Figure 7 above presents the recording of the *TAT* codes in ATLAS.ti. The first *TAT* code: T4 (*scaffolding/engaging*) corresponds to the sentence “Hi –st19 and –st20.” The next two codes correspond to reflective sentences (T3).

<u>Multiple *TAT* Codes</u>. The use of multiple *TAT* codes per sentence was permitted. The following sentences demonstrate the need for multiple codes.

1. *In this overview Malhouta maps out the difference between adaptive versus generative learning as presented by Senge(1990) and if Senge is correct, then adaptive learning may be an* — T2a, T5a, T5b

insufficient strategy in a rapidly changing and unpredicatble world.

2. *I wanted to also say that if you broadened the definition of "education" and "learning" to cover day-to-day life and work (and aren't we all life-long learners, after all?), I know from a personal perspective that any projects I've worked on have benefitted greatly from many heads working together, while those that have been done in isolation are always lacking in some way.* T2a, T4

The first sentence presents how *quotations* (T5a) and *citations* (T5b) can occur in a *statement* (T2a). The second sentence reflects bracketed *scaffolding* (T4) inside a *statement* (T2a). To code the sentence correctly and not break up the T2a, multiple codes are required. Approximately eight percent of the sentences used multiple codes.

Reliability calculations were based on one agreed code for a sentence. In the second example above, if the second coder decided the sentence was simply a T2a, the coding was considered an agreement. Multiple codes were ignored for reliability calculations. The effect of not accounting for multiple codes would be negligible considering a) the low occurrence of multiple codes in sentences (less than 10%), and b) the fact that on many multiple codes the raters agreed. Using a conservative estimate of *rater agreement* of 70% for sentences with multiple codes, the difference in reliability would be approximately 2%.

Reliability of *TAT* coding. To ensure accuracy, a team of four trained research assistants (RA) were involved in the *TAT* coding process. The RAs were senior MDE students who had completed most of the course requirements for their degree. The RAs were recruited from either of two senior MDE courses: 1) on educational conferencing or 2) writing a thesis proposal.

Training of Research Assistants. The training process involved a sample coding of two or three short transcripts. There were two slightly different approaches to training and each will be described separately. The first approach used an experienced mentor for transcript analysis comparisons. The mentor worked with the trainee in learning and applying the training process. Trainees compared their transcripts with another trainee for the alternate training approach.

Each RA coded a short transcript in ATLAS.ti and then recorded the results in an Excel spreadsheet. The results of a different RA or mentor were also recorded in the spreadsheet for comparison purposes and the calculations of kappa and percent agreement. Disagreements were noted and discussed between the two coders. Phone conversations proved to be the easiest medium for discussing coding disagreements.

Once discrepancies were clarified, the coding training continued with a new sample transcript. The training process involved either two or three sample exercises depending on the RA's aptitude. Production (non-training) coding began once the RA was comfortable with the *TAT* and acceptable percent agreements and kappa values were achieved. Training ensured the coders understood and achieved the normative standard for *TAT* coding before commencing production coding.

Production Coding. Production coding proceeded slightly differently from the training exercise. Rather than working together to discuss the coding of each sentence, one coder independently encoded the material and another independently reviewed the first coder's results. Where there was no disagreement, no discussion occurred; where there were discrepancies, the two coders consulted by phone on the discrepant sentences. This method reduced the time required for both coding and checking, and minimized the incidence of "coder drift," the tendency for coders to conform to each other's interpretations of the coding instrument, apart from the normative standard achieved in training (Marston, Zimmerer, and Vaughan, 1978).

The Excel spreadsheet of recorded differences was used to calculate the percentage of agreement and kappas. Using the proofing method, the percentage agreement among the coders ranged from 75% to 99% and kappas of 0.62 to 0.93 (Cohen, 1960). The high agreement and kappas reflects the *reliability* of the TAT tool (Cappozzoli, McSweeney, & Sinha, as cited in Rourke et al. 2001).

The issue of validity is of paramount importance to this study. Because of the importance of validity, a sample reliability test using independent coding was conducted to test the validity of the proofing method. For the sample reliability test, two separate coders coded five hundred lines or one hundred and twenty-three sentences from one of the AU-2 conferences. A comparison of the independent coding revealed a percent agreement of 94% and a kappa of 0.93 (Cohen, 1960). The comparable reliability agreements and kappa values for proofing and independent coding attested to the validity of the proofing method. The sample reliability test also supports Marston's (1978) findings.

The percent agreement and the kappa can be used to measure the different training approaches. The RA who compared her training samples with those of another trainee obtained the lowest kappas and percent agreements. The RAs who compared their training sample to a mentor eventually achieved percent agreements over 95%.

Cognitive Presence and Structural Coding at the Message Level. Next the transcripts were analyzed at the message level, and coding was recorded in ATLAS.ti. Each message was coded according to gender, progression type (sequential or parallel), number of responses generated, the level of the posting (where level 1 initiated a thread), and *cognitive* *presence* criteria. The previous Figure 7 illustrates the ATLAS recording at the message level. In the example shown in Figure 7:

- the message was *exploration* (garr-explore) according to the *cognitive presence* model;
- the student was male;
- the message occurred at level 3; and
- the message had one response.

Reliability of *Cognitive Presence* Coding. There was no training per se for the *cognitive presence* coding. The researcher applied the criteria of the *cognitive presence* model based on Garrison et al.'s (2000; 2001) papers. The criteria were regarded as self-explanatory. However, not all the "sociocognitive processes" of the *cognitive presence triggering* event (see Figure 3) were easily recognizable. Finding messages that "take discussion in new directions" was difficult without looking at the structure of the conference. Pinpointing the change of direction could not always be observed directly in the message, but the direction change was reflected in responses to the message. The researcher used response content to determine the messages that "take discussion in new directions."

The researcher was the only coder for structure and *cognitive presence* criteria for the non-AU, the AU-1, and one of the AU-2 conferences. To test the accuracy and reliability of the message level coding a different RA coded two of the AU-2 conferences. To prepare *cognitive presence* coding, the RA read "Critical thinking, cognitive presence, and computer conferencing in distance education" (Garrison et al., 2001). In a phone conversation, the researcher described to the RA how to observe "messages that take discussions in new directions."

Once the different RA completed the *cognitive presence* coding the researcher then proofed the RA's *cognitive presence* coding and recorded disagreements in Excel to calculate kappa and percent agreement. Percent agreement was ranging from 84% and 95%. The kappas were 0.65 and 0.72 for the two conference transcripts (Cohen, 1960). The percent agreement and kappa demonstrate the validity and reliability of the coding process tool (Cappozzoli, McSweeney, & Sinha, as cited in Rourke et al. 2001).

<u>True Triggers and True Duds</u>

Once the *TAT,* structure and *cognitive presence* criteria were coded in the transcripts, the presence of *true triggers* became clear. The researcher determined that responses are necessary to identify *cognitive presence triggers* and she began to realize that all the *cognitive presence triggers* needed responses to demonstrate the initiation of discussion; i.e., *triggers* are identified by what they produce.

A *true trigger* satisfied both observed structural and notional criteria in the transcripts. The following Figure 8 presents the discrepancy between *structural triggers* (Fahy, 2001) and *cognitive presence triggers* (Garrison et al., 2000; Garrison et al.2001). Message A and Message B are both *structural triggers,* with eight and nine responses respectively. However, only Message B displays the *cognitive presence trigger* characteristics. As such, Message B is the only *true trigger* because Message B displays *cognitive presence trigger* elements while also generating more than four responses.

Similarly, Message G is the only *true dud*. According to structural criteria, Messages C, E, G, I, and J are all *non-triggers* because they elicited no responses. However, only Message G displays the notional characteristics of intending to evoke discussion. Messages that display *cognitive presence trigger* elements and do not generate any responses are *true duds*.

Illustration of CMC structure

		Code	
	Number of Responses	Level	*Cognitive presence*
Message A	9	1	Exploration
* Message B	8	2	Trigger
@ Message C	0	3	Exploration
@ Message D	1	3	Exploration
O message E	0	4	Exploration
@ Message F	1	3	Exploration
O message G	0	4	Trigger
@ Message H	2	3	Exploration
O message I	0	4	Exploration
# Message J	0	5	Integration

Figure 8: Illustration of CMC Structure

The number of responses needed to identify a *true trigger* was an arbitrary decision based on the observed number of responses per message as shown in Table 3. The median number of responses was 0. In other words more than half of the messages did not elicit any responses. The average number of responses was 1.4 with a standard deviation of 2.2. Once identified, the study observed the frequency of *true trigger* occurrence and endeavoured to determine the structural and communication patterns within the *true triggers* and *true duds.*

Table 3

Distribution of the Number of Responses Messages Received

	Non-AU	AU 1	AU2	Total
Number of Responses	# of Messages	# Messages	# Messages	# Messages
0	80	146	257	483
1	28	52	106	186
2	15	37	72	124
3	10	23	34	67
4	2	17	21	40
5+	11	64	53	128
	146	339	543	1028

Modal Number of Responses	0.0
Average Number of Responses	1.4
Variance	5.0
Standard Deviation	2.2

Analysis

The ATLAS.ti query tool was used for calculating the totals of the various codes. The ATLAS.ti query tool could isolate any combination of identified criteria. Figure 9 illustrates the implementation of the query tool. In Figure 9, the query result to determine the quantity of T1a (*vertical questions*) is thirty-six. This result is visible in the lower left corner of the screen, and the thirty-six *questions* are visible in the lower right column.

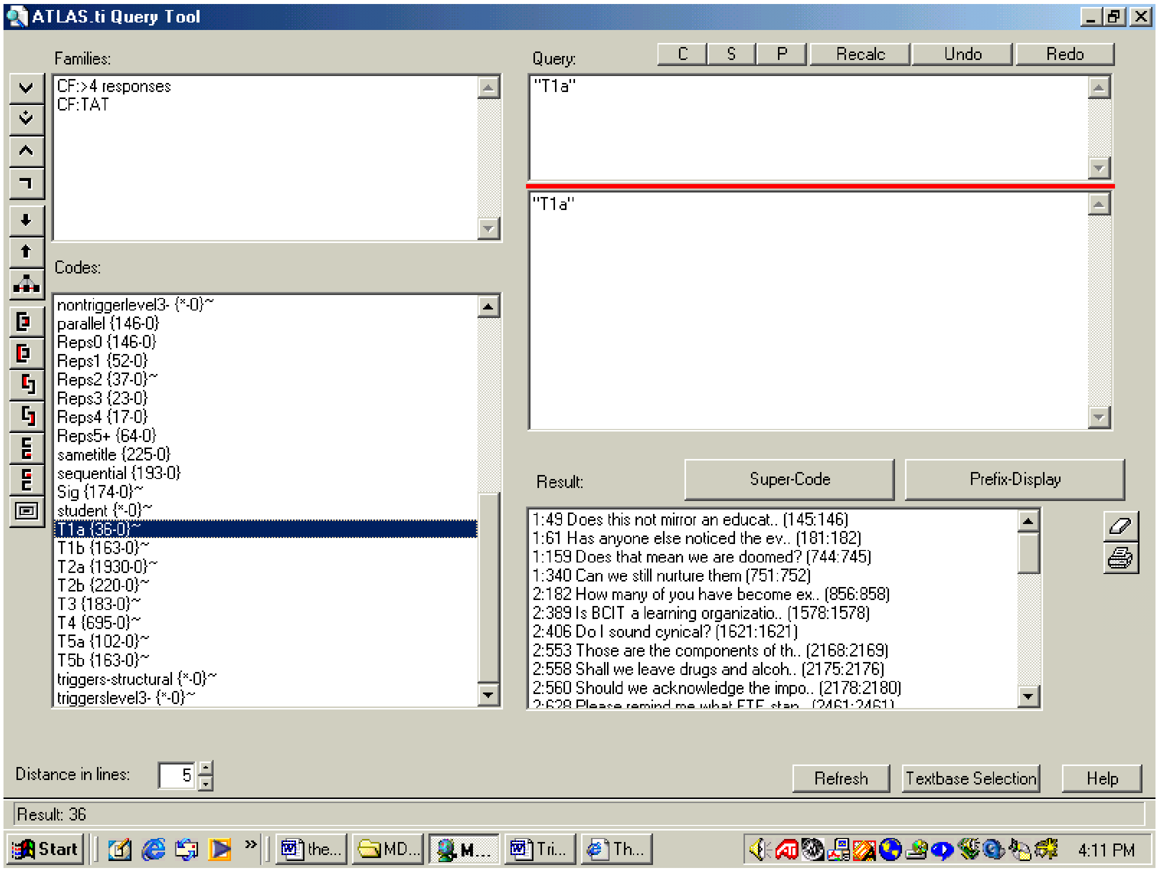
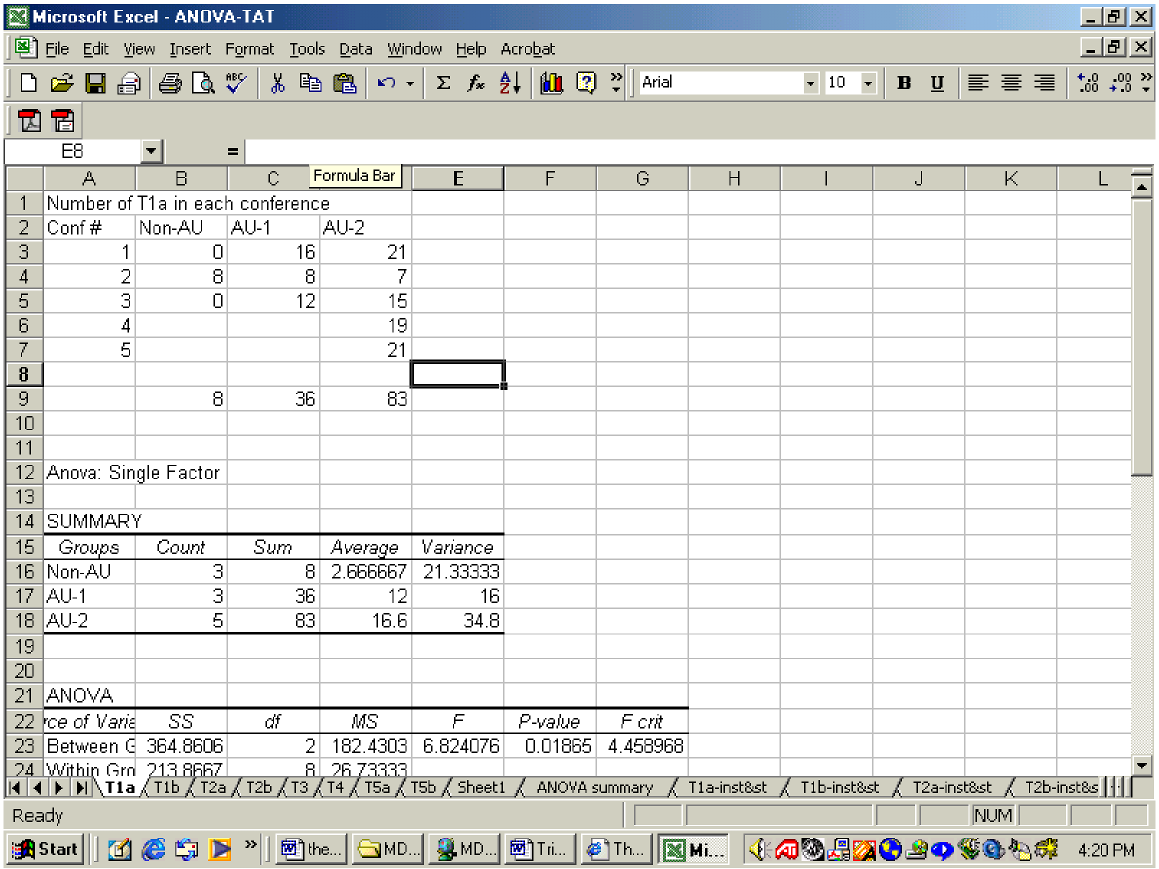


Figure 9: Screen Capture of the ATLAS.ti Query Tool

ATLAS.ti provided frequency counts and cross tabulations. However, additional statistics were calculated in MS Excel, once the results of the query tool analysis were methodically recorded in an MS Excel spreadsheet. Figure 10 presents the Excel recording of the frequency of T1a (vertical questions) for each conference. A separate worksheet in the Excel file was created for each *TAT* indicator. Additional worksheets were created to record the *TAT* indicators for *true triggers, true duds,* students and instructor messages. Similar files were made for the *cognitive presence* indicators.



	A	B	C	D	E	F	G
1	Number of T1a in each conference						
2	Conf #	Non-AU	AU-1	AU-2			
3	1	0	16	21			
4	2	8	8	7			
5	3	0	12	15			
6	4			19			
7	5			21			
8							
9		8	36	83			
10							
11							
12	Anova: Single Factor						
13							
14	SUMMARY						
15	Groups	Count	Sum	Average	Variance		
16	Non-AU	3	8	2.666667	21.33333		
17	AU-1	3	36	12	16		
18	AU-2	5	83	16.6	34.8		
19							
20							
21	ANOVA						
22	rce of Varia	SS	df	MS	F	P-value	F crit
23	Between G	364.8606	2	182.4303	6.824076	0.01865	4.458968
24	Within Gro	213.8667	8	26.73333			

Figure 10: Screen Capture of an Excel Worksheet recording the frequency of T1a in each conference

Analysis of Variance. The "data analysis tool" of Excel was used to calculate the analysis of variance for the many different queries of this study. Figure 10 above, illustrates the output from the "data analysis" tool. In Figure 10, the resulting ANOVA indicates that the null hypothesis can be rejected F(.05,2,8) = 6.82. In other words, the difference in frequency of T1a (vertical questions) between the courses is significant.

ANOVA is used to statistically determine if sample means are significantly different. A one-way ANOVA tests one independent variable. In the case above the independent variable is the *TAT* code - T1a (vertical questions) and the courses are the dependent variable. The F factor is calculated by dividing the MS (between groups) by the MS (within groups).

The MS is the result dividing the sum of the square (SS) by the degrees of freedom. The degrees of freedom is the number of groups (between or within) less one.

<u>Summary</u>

The methodology of the study was designed to investigate the frequency and nature of *true triggers* in graduate level CMC conferences. The redacted transcripts from two mid-level Masters of Distance Education courses and an introductory professional training course for educators were analysed. The analysis involved eleven redacted transcripts with a total of 1028 messages and 252,000 words.

Two separate models were utilized to study the transcripts. The *TAT* was applied at the sentence level to investigate the types of interactions and communication patterns. The *cognitive presence* model at the message level was applied to indirectly observe critical thinking. The messages were also coded by level of occurrence, number of responses received, gender and progression type. ATLAS.ti was the software used to record and tabulate the coding. MS Excel was the software used to record the results of the ATLAS queries and to calculate the analysis of variance for various criteria.

Once the coding process was completed, the frequency and characteristics of *true triggers* and *true duds* were determined. The analysis also investigated the communication patterns of instructor and student messages. Analysis of variance calculations determined significant differences between the courses for a variety of independent variables including *TAT* and *cognitive presence* elements.

CHAPTER IV

RESULTS

The study evaluated all messages, *true triggers* and *true duds,* and instructor and student messages. This section will report the findings of the analysis. Possible explanations and discussion about the findings will follow in the next chapter.

The first part of the results will report information about the entire corpus. This section will include information about the number of messages posted, the *TAT* distribution, and the distribution of *cognitive inquiry* elements. Statistical analysis identified any significant differences between the three courses. For clarity, significant differences appear shaded in the tables.

The second section of the results is dedicated to a discussion of *true triggers* and *true duds.* The frequency and *TAT* distribution will be reported for both *true triggers* and *true duds*. Significant differences will be reported. Next, *true triggers* and *true duds* will be compared.

Significant course differences are reported by the frequency of messages, the *TAT* distribution within all messages, and frequency of *true triggers*. To isolate the source of the differences, instructor and student interaction patterns were explored. Significant course differences will be reported. Lastly, an overall summary of the entire results is provided.

All Messages

Table 4 reveals differences in the number of students and the gender composition between the three courses. The non-AU course has the least number of students. As well, the non-AU course is female dominated with a female moderator and a female student population of 82%. The AU courses both have male moderators and have almost gender balanced student populations. The gender proportions have been stated simply as an observation. This study did not attempt to evaluate gender difference in CMC conferences.

Table 4

Course demographics

	Non-AU		AU 1		AU 2		All Courses
	Number of Students						
	N	%	N	%	N	%	N
All	17		24		30		68
Males	4	18	11	46	13	43	25
Females	13	82	13	54	17	57	43

Frequency of Messages. Table 5 presents the frequency of all messages, instructor messages and student messages. Significant course differences (p < .05, see Appendix A for statistical results) existed within the total messages posted and the number of student postings. The shorter Non-AU course, with concurrent conferences (all conferences were "open" throughout the course), had the least number of total messages and student postings.

Table 5

Frequency of Messages

	Number of Messages						
	Non-AU		AU 1		AU 2		All Courses
	N	%	N	%	N	%	N
All	146		339		543		1028
Instructor	41	28	25	7	90	17	156
Student	105	72	314	93	453	83	872

Distribution of TAT Codes. The first stage of text analysis applied the *TAT* tool using the sentence unit to the entire text transcripts. Recall the *TAT* indicators as vertical questions (T1a), *horizontal questions* (T1b), *non-referential statements* (T2a), *referential statements* (T2b), *reflections* (T3), *scaffolding/engaging* (T4), *quotations* (T5a) and *citations* (T5b; Fahy 2001; Fahy 2002a). Table 6 reports the *TAT* distribution for all messages.

Significant course differences ($p < .05$, see Appendix B for statistical results*)* were found for T1a (vertical questions), T1b (horizontal questions), T2a (*non-referential statements*), T4 (*scaffolding/engaging*), and T5b (*citations*). There were no significant differences with T2b (referential statements), T3 (*reflections*) and T5a (*quotations*).

Table 6

TAT Distribution within messages

	Non-AU		AU 1		AU 2		All
	N	%	N	%	N	%	%
T1a: vertical questions	8	0.5	36	1.0	83	1.4	1.2
T1b: horizontal questions	29	2.0	163	4.7	174	2.9	3.3
T2a: non-referential statements	755	51.5	1930	55.3	3768	62.2	58.6
T2b: referential statements	101	6.9	220	6.3	432	7.1	6.8
T3: reflections	100	6.8	183	5.2	142	2.3	3.9
T4: scaffolding/engaging	313	21.3	695	19.9	837	13.8	16.8
T5a: quotations	118	8.o	102	2.9	172	2.8	3.6
T5b: citations	43	2.9	163	4.7	447	7.4	5.9
Total *TAT* codes	1467		3492		6055		

* Highlighted cells represent statistically significant course differences.

The statistically significant ($p < .05$) data revealed that the non-AU course had the:

- most T4 *(scaffolding/engaging*),
- least T1a (*vertical questions*),
- least T1b (*horizontal questions*),
- least T2a (*non-referential statements*), and
- least T5b (*citations*).

Compared to the other courses, the AU 2 course had significantly ($p < .05$):

- fewer T4 (*scaffolding/engaging*),
- more T1a (vertical questions),
- more T2a (*non-referential statements*), and
- more T5b (*citations*).

The AU 1 course had the most T1b (horizontal questions; $p < .05$).

Distribution of *Cognitive Presence* Codes. The next stage of text analysis included coding for *cognitive presence* indicators (Garrison et al., 2000; Garrison et al., 2001), using the message as the unit. Recall the *cognitive presence* indicators are *triggers, exploration, integration, resolution* and *other*. Table 7 presents the *cognitive presence* code distribution for all messages.

An ANOVA on each event revealed significant ($p < .05$, see Appendix C for statistical results) course differences in the frequency of *exploration*, *integration* and *other*. The AU1 course had the least *exploration* and the most *integration*. The AU2 course had the opposite with the most *exploration* and least *integration*. The Non-AU course had the most *other*.

Table 7

Cognitive Presence Distribution within Messages

Course	Non-AU		AU 1		AU 2	
	N	%	N	%	N	%
Trigger	8	5.4	42	12.2	68	12.5
Exploration	91	61.5	200	58.0	390	71.7
Integration	17	11.5	58	16.8	57	10.5
Resolution	1	0.7	1	0.3	0	0.0
Other	31	20.9	44	12.8	29	5.3
Total *Cognitive Presence*	148		345		544	

* Highlighted cells represent statistically significant course differences.

True Triggers and *True Duds*

The next stage of the analysis was to investigate *true triggers* and *true duds*. First the number of occurrences was evaluated and analysed. Table 8 reflects the proportion of *true triggers* and *true duds* per conference between the courses. The smaller proportion non-AU *true triggers* was significant ($p < .05$, see Appendix A for statistical results) when compared to the AU courses. The AU courses averaged seven times more *true triggers* than the non-AU course. There was no significant difference in the number of *true duds* among the courses.

Table 8

Proportion of *True Triggers* and *True Duds per Conference*

Course	Non-AU		AU 1		AU 2		Total
			Number of Messages				
	N	Ratio	N	Ratio	N	Ratio	N
Total conferences	3		3		5		11
True triggers	3	1.0	20	6.7	37	7.4	60
True duds	2	0.7	9	3.0	7	1.4	18

* Highlighted cells represent statistically significant course differences.
** Ratio represents the ratio of messages per conference

*TAT* Distribution within *True Triggers*. Table 9 reflects the distribution within the triggers. An analysis of variance did not reveal any significant differences ($p < .05$, see Appendix B for statistical results) between the courses. When *true triggers* were compared to all the other messages, *horizontal questions* (T1b) were the only significant *TAT* indicator ($p < .05$, see Appendix D for statistical results). As a percentage *horizontal questions* (T1b) occurred almost four times as often in *true triggers* as all other messages.

Table 9

TAT Distribution within *True Triggers*

	Non-AU		AU1		AU2		Total for Triggers	Total for All Messages
	N	%	N	%	N	%	%	%
T1a: vertical questions	2	10.5	3	2	9	2	2.2	1.2
T1b: horizontal questions	5	26.3	35	23.3	40	8.7	12.8	3.3
T2a: non-referential statements	5	26.3	64	42.7	314	68.6	61.1	58.6
T2b: referential statements	1	5.3	15	10	8	1.7	3.8	6.8
T3: reflections	1	5.3	5	3.3	9	2	2.4	3.9
T4: scaffolding/engaging	5	26.3	20	13.3	29	6.3	8.6	16.8
T5a: quotations	0	0	3	2	13	2.8	2.6	3.6
T5b: citations	0	0	5	3.3	36	7.9	6.5	5.9
Total TAT codes	19		150		458			

*TAT* Distribution within *True Duds* Next *true duds* were analysed. Table 10 reflects the *TAT* distribution within *true duds*. There are no statistical significant differences between the three courses ($p < .05$).

Table 10

TAT Distribution within *True Duds*

	Non-AU		AU1		AU2	
	N	%	N	%	N	%
T1a: vertical questions	0	0.0	1	2.0	5	9.8
T1b: horizontal questions	3	21.4	9	17.6	7	13.7
T2a: non-referential statements	1	7.1	5	9.8	16	31.4
T2b: referential statements	1	7.1	9	17.6	6	11.8
T3: reflections	2	14.3	5	9.8	2	3.9
T4: scaffolding/engaging	5	35.7	19	37.3	10	19.6
T5a: quotations	1	7.1	0	0.0	1	2.0
T5b: citations	1	7.1	3	5.9	4	7.8
Total TAT codes	14		51		51	

True Triggers Compared to *True Duds*. When the *TAT* distribution between *true triggers* and *true duds* is analysed, no significant differences are revealed ($p < .05$).

Level of Occurrence

Table 11 presents the level at which *true triggers* and *true duds* occurred. Analysis of variance determined the level a *true trigger* occurs is significant ($p < .05$, see Appendix E for statistical results). True triggers occurred at all levels, but sixty-six percent of true triggers occurred at the first two levels (Level 1 & Level 2; see Glossary and Chapter 2 for explanations of *levels*) of the transcripts. Analysis of variance did not reveal any statistical significance in the level a *true dud* occurred.

Table 11

Level of Occurrence of *True Triggers* and *True Duds*

Course	Outside		AU 1		AU 2		All
	Number of Messages						
	N	%	N	%	N	%	N
All messages	146		339		543		1028
True triggers	3	2	20	6	37	7	60
True duds	2	1	9	3	7	1	18
	Structural Level of Occurrence of Triggers and True Duds						
	N	%	N	%	N	%	%
Level 1							
True triggers	2	67	4	20	11	30	28
True duds	0		0		0		0
Level 2							
True triggers	0		3	15	20	54	38
True duds	2	100	1	11	1	14	22
Level 3							
True triggers	1	33	5	25	4	11	17
True duds	0		0		4	57	22
Level 4							
True triggers	0		2	10	0		3
True duds	0		0		1	14	6
Level 5							
True triggers	0		1	5	0		2
True duds	0		2	22	1	14	17
Level 5+							
True triggers	0		5	25	2	5	12
True duds	0		6	67	0		33
	Structural Level of Occurrence of All Messages						
	N	%	N	%	N	%	
All messages							
Level 1	43	30	15	4	23	4	
Level 2	54	37	53	16	157	29	
Level 3	23	16	53	16	163	30	
Level 4	10	7	51	15	96	18	
Level 5	5	3	41	12	55	10	
Level 5+	11	7	126	37	49	9	

Moderator Postings

Instructor postings were identified and analyzed to determine if the moderators' interaction behaviour was different among the courses. First the frequency and *TAT* distribution of instructor postings and *true triggers* were investigated. Lastly the results of the *cognitive presence* analysis were studied.

Proportion of Instructor Postings. There was no significant difference in the proportion of messages posted per conference among instructors (see Table 12). However the proportion of *true triggers* generated did vary significantly among the instructors ($p < .05$, see Appendix A for statistical results). The non-AU instructor generated the least number of triggers with an average of 0.7 *true triggers* per conference, and the AU 2 instructor generated the most (2.6 *true triggers* per conference). *True duds* were rare in the instructor postings, with only one occurrence from the non-AU moderator.

Table 12

Proportion of Instructor Postings per conferences

	Non-AU		AU 1		AU 2		Totals
	Number of messages						
	N	Ratio	N	Ratio	N	Ratio	N
Number of Conferences	3		3		543	5	11
Instructor Messages	41	13.7	25	8.3	90	18	156
True triggers	2	0.7	5	1.7	13	2.6	20
True duds	1	0.3	0	0	0	0	1

* Ratio – represents the frequency of messages per conference.

Tat Distribution Within All Instructor Postings.

Table 13 shows the TAT distribution of the instructor postings. An analysis of variance of each TAT indicator does not reveal any significant differences (See Appendix B) in moderator postings.

Table 13

TAT Distribution within Instructor Messages

	Non-AU		AU 1		AU 2	
	TAT Distribution within Instructor Messages					
	N	%	N	%	N	%
T1a: vertical questions	1	0	0	0	16	3
T1b: horizontal questions	12	5	13	6	37	6
T2a: non-referential statements	72	29	106	51	281	47
T2b: referential statements	22	9	17	8	81	13
T3: reflections	5	2	3	1	5	1
T4: scaffolding/engaging	98	40	56	27	95	16
T5a: quotations	23	9	5	2	22	4
T5b: citations	13	5	7	3	65	11
Total TAT codes	246		207		602	

TAT Distribution Within Instructor *True Triggers*. Table 14 reflects the *TAT* distribution within instructor *true triggers*. An analysis of variance of each TAT indicator reveals no significant difference for all but one TAT indicator – T5a (*quotations;* $p < 0.05$, see Appendix B). The AU2 moderator was the only moderator to use T5a (*quotations*) and *citations* (T5b) in his *true triggers*. The use of *quotations* and *citations* in the AU2 moderator *true triggers* reflects the moderator's modelling of desired student behaviour.

Table 14

TAT Distribution within Instructor *True Triggers*

	Non-AU		AU 1		AU 2	
	TAT Distribution within Instructor True Triggers					
	N	%	N	%	N	%
T1a: vertical questions	0	0	0	0	6	7
T1b: horizontal questions	2	50	10	50	20	24
T2a: non-referential statements	1	25	8	40	27	33
T2b: referential statements	1	25	2	10	5	6
T3: reflections	0	0	0	0	0	0
T4: scaffolding/engaging	0	0	0	0	6	7
T5a: quotations	0	0	0	0	13	16
T5b: citations	0	0	0	0	5	6
Total TAT codes	4		20		82	

<u>*Cognitive Presence* Distribution Within Instructor Postings</u>. The following table 16 presents the distribution of *cognitive presence* codes within the instructor postings. An analysis of variance of each Garrison event revealed no significant difference with triggers, *integration*, and *resolution* ($p < 0.05$, see Appendix C for statistical results). However there is a significant difference ($p < 0.05$, see Appendix C) between *exploration* and *other*. The non-AU moderator has the most *exploration* and *other*.

Table 15

Cognitive presence Distribution within Instructor Postings

Course	Non-AU		AU 1		AU 2	
	Garrison Event					
	N	%	N	%	N	%
Trigger	4	9.8	6	24.0	21	23.3
Exploration	16	39.0	5	20.0	31	34.4
Integration	8	19.5	11	44.0	30	33.3
Resolution	1	2.4	1	4.0	0	0.0
Other	12	29.3	2	8.0	8	8.9
Total	41		25		90	

<u>Student Postings</u>

The next step in the analysis was to evaluate the student messages. Similarly to the instructor postings, student postings were evaluated according to frequency, *TAT* distribution and *cognitive inquiry* distribution.

<u>Frequency</u>. The proportion of student postings, student *true triggers*, and student *true* duds varied significantly between the courses ($p < 0.05$, see Appendix A*;* see table 16). When different student populations were accounted for the difference was still significant ($p < 0.05$). The students in the AU1 course posted the most messages. Students in the AU1 and AU2 courses posted sixteen times more *true triggers* and three times more *true duds* than the non-AU students. Recall that although the conference durations were similar, the non-

AU course was only three weeks duration compared to thirteen weeks for the AU courses. The non-AU course conferences were concurrent.

Table 16

Proportion of Student Postings per Conference

	Non-AU		AU 1		AU 2	
	N	Ratio	N	Ratio	N	Ratio
Conferences	3		3		5	
Student Messages	105	35	314	104.7	453	90.6
True triggers	1	0.3	15	5.0	24	4.8
True duds	1	0.3	9	3.0	5	1

- Ratio – represents the frequency of postings per conference.

TAT Distribution of Student Postings. Analysis of variance of the *TAT* indictors in student postings revealed significant differences ($p < 0.05$, see Appendix B for statistical results) in T1a, (*vertical questions*), T1b (*horizontal questions*), T2a (*non-referential statements*), T4 (*scaffolding/engaging*), and T5b (*citations*). Table 17 reveals the *TAT* distribution of student postings. The non-AU students asked the least questions (T1a and T1b). The AU2 students have the most *non-referential statements* (T2a) and *citations* (T5b). The AU1 students had the most *scaffolding* (T4).

Table 17

TAT Distribution within Student Messages

	Non-AU		AU1		AU2	
	N	%	N	%	N	%
T1a: vertical questions	7	0.6	29	1.3	67	1.2
T1b: horizontal questions	17	1.4	146	6.4	137	2.5
T2a: non-referential statements	683	55.9	1247	54.9	3487	63.9
T2b: referential statements	79	6.5	141	6.2	351	6.4
T3: reflections	95	7.8	88	3.9	137	2.5
T4: scaffolding/engaging	215	17.6	480	21.1	742	13.6
T5a: quotations	95	7.8	7	0.3	150	2.8
T5b: citations	30	2.5	133	5.9	382	7.0
Total TAT codes	1221		2271		5453	

<u>*Cognitive presence* Distribution of Student Postings</u>. Analysis of variance of the *cognitive presence* distribution within student postings revealed significant differences ($P < 0.05$, see Appendix C) in *exploration*, *integration* and *other*. The AU 2 students had the most *exploration* and the least *integration* and *other*. Conversely, the non-AU students had the least *integration* and the most *other*.

Table 18

Cognitive Presence Distribution within Student Messages

Course	Non-AU		AU 1		AU 2	
			Cognitive Presence Category			
	N	%	N	%	N	%
Trigger	3	3	32	10	46	10
Exploration	75	71	195	61	359	79
Integration	9	8	47	15	27	6
Resolution	0	0	0	0	0	0
Other	19	18	47	15	21	5

<u>Summary</u>

The summary of the results will be explained in three parts. The first part of the study dealt specifically with *true triggers.* Next instructor messages and student messages results will be summarized.

The interesting items discovered about true triggers are as follows:

- *Horizontal questions* (T1b) were the only *TAT* indicator that distinguished *true triggers* from all other messages (see Table 9).
- *True triggers* did not vary in *TAT* composition, but did vary in frequency amongst the courses. Even considering the shorter course length, the non-AU course had fewer *true triggers* than compared to the number found in the AU courses (see Table 8).

- Most *true triggers* occurred in the first two levels of a conference (see Table 12).

While the *TAT* distribution did not vary amongst the instructors, the *cognitive presence* did vary. Moderator postings had the following differences:

- The frequency and *TAT* distribution of *true triggers* varied amongst the instructors. The non-AU instructor had the least *true triggers* (see Table 12) and the AU 2 instructor was the only moderator to use *citations* and *quotations* in his *true triggers* (see Table 13).
- The non-AU instructor had the most *exploration* and *other cognitive inquiry* indicators when compared to the AU moderator's postings (see Table 14).

Student postings displayed the following differences:

- The student messages displayed the most variation amongst the courses. The non-AU students posted proportionally a third fewer messages, sixteen times fewer *true triggers* and at least one-third fewer *true duds* (see Table 15).
- The non-AU students asked the least number of *questions* (T1a and T1b), and used the least *citations* (T5b). The AU 2 students had the most *non-referential statements* (T2a) and least *scaffolding/engaging* (T4; see Table 16).
- When compared using the *cognitive presence* model, The AU 1 students had the most *integration* and the least *exploration*. The non-AU students had the most *other* (see Table 17).

The study revealed possible differences in the presence of higher-level cognitive thought between the courses. The fewer *true triggers* in the non-AU course could be an indication of lesser cognitive thought.   The next chapter of this thesis will discuss possible reasons for the differences between the courses.

CHAPTER V

DISCUSSION

The task of this study was to gain understanding of *triggers* as indicators of *cognitive presence* in CMC text-based conferencing. The study used two text analysis models to identify and evaluate the nature of *true triggers*: the *community of inquiry* and the *TAT*. Initially the researcher simply wanted to quantify and identify the characteristics of *true triggers*. While the results revealed that the structural *TAT* nature of *true triggers* did not vary, the frequency of *true triggers* varied significantly between the courses. The researcher then searched for variations in interaction patterns between the moderators and then the students to help explain the varied occurrence of *true trigger*s.

Nature of *True Triggers* and *True Duds*

Not surprisingly, the results of the analysis of eleven conferences from three courses revealed that *horizontal questions* (T1b) consistently distinguish *true triggers* from all *other* messages. “Asking questions” is one of the indicators of *cognitive presence triggers.* The results support the compatibility of the *TAT* and the *cognitive presence* model. Modifying the *cognitive presence trigger* indicator slightly to read “asking open ended questions” would broaden an alignment of the two models.

The study also revealed that sixty-six percent of *true triggers* occurred at the first two levels in a conference. This statistic is not surprising, as one would expect most discussions to begin early in the structure of the conference.

Course Variation of *True Triggers*

The study revealed that *true triggers* occurred seven times more often than in the AU courses. There were many differences between the AU courses and the non-AU course that could attribute to the reduced frequency of triggers. The most obvious difference was the lack or prior CMC experience of the non-AU moderator and its students. Other differences include the nature and duration of the programs. While the education levels of the students were similar, the AU courses were more academic. The non-AU course was also only three weeks long as compared to the AU courses which were thirteen weeks long. The AU courses were part of a graduate program, whereas the non-AU course was a professional development or training program. Another notable difference was the gender composition of the group. The non-AU course was female dominated and the AU courses were gender balanced. However, one must caution against making broad generalizations based on gender.

Maturity of the Community. The non-AU community was not as *mature* in CMC experience as the AU communities. The moderators and the students in the AU courses were experienced CMC users. This contrasts to the lack of CMC experience of the moderator and students in the non-AU course.

The *social presence* of the non-AU community did not have time to develop. Recall, the non-AU course was introductory. Also, the absence of verbal cues in CMC communication retards and protracts the rate of development of interpersonal interaction (Walther, (1996). The development of interpersonal interactions takes time with CMC. Students in the non-AU course were unfamiliar with on-line text-based asynchronous communication. The higher frequency of *true triggers* in the AU courses could be a reflection of the *maturity* of the communities. Further research about how the maturation process of a CMC and the development of *cognitive presence* is needed.

Moderator Differences. Next the study investigated moderator posting for any indications that could account for varying *true trigger* quantities. The *TAT* analysis of the moderators' postings did not reveal any significant differences. However, *TAT* analysis of moderator *true triggers* reflects that the AU-2 moderator was the only moderator to use *quotations* (T5a) in his true triggers.

Cognitive presence analysis of instructor messages revealed differences in the *other* category. The non-AU moderator averaged more than three times the amount of *other* messages than the AU moderators. Recall, the moderator is responsible for focussing interaction and modelling critical thinking (Anderson et al., 2001). The higher frequency of *other* in the non-AU moderator's messages could indicate higher interpersonal communication. High levels of interpersonal interaction detract from the didactic goal and detract from the groups' effectiveness (Walther, 1996).

Student Differences. *TAT* analysis of the student postings revealed many differences. The non-AU students had the least questions (T1a and T1b) and *citations* (T5b). Not surprisingly, the groups that asked the least number of questions developed the least number of course *true triggers*. The non-AU students were predominantly female.

Fahy (2002a) regards questions (T1a and T1b) as *epistolary* and typical of feminine discourse. In this study, the predominately female group did not demonstrate *epistolary* behaviour. Recall *epistolary* behaviour is "more interactionally oriented" (Fahy, 2002a). Students in the non-AU course were unaccustomed to the non-verbal text communication of

CMC. *Epistolary* behaviour takes time to develop in CMC and the time necessary to develop interpersonal CMC skills was not afforded to the non-AU students (Walther, 1996).

One interesting observation is the fact that the AU-2 students had the most *citations* (T5b). This parallels the AU-2 moderator's use of references in his *true triggers.* This is likely a reflection of the modelling behaviour of the moderator. Further research is needed to determine the effects of on-line moderator modelling behaviour.

Cognitive presence analysis of messages revealed significant differences in every category except *cognitive presence triggers.* The non-AU course had the least *integration* and the most *other*. Again the higher *other* may be a reflection of higher interpersonal communication in the non-AU students which detracted from the group's didactic tasks (Walther, 1996). The AU-2 students had the most *exploration* and least *other.* The AU-1 students had the most *integration*.

<u>Strategies</u>

The study revealed the importance of open-ended questions for initiating discussion. However, open-ended questions are not the only factor contributing to triggers. The evidence suggests that the *maturity* of the community could also play an important role in how triggers are responded to. Students and moderators need time to familiarize themselves with the potentially intimidating text-only medium. The absence of non-verbal cues temporally retards the development of interpersonal communication (Walther, 1996). *Social presence* is essential to the *Community of Inquiry* and requires time to develop (Anderson et al., 2001; Archer et al., 2001;Garrison et al., 2001; Garrison et al., 2000; Garrison et al., 2001; Rourke et al., 2001).

The moderator's role of modelling appropriate behaviour may possibly have been demonstrated in the study. The students of the moderator who used *quotations* (T5a; Table 14) in his *triggers* were the students with the most *citations* (T5b; Table 17). In this study, the behaviour mirrored by the moderator's appears to have been reflected by the students. Modelling appropriate behaviour is an advantageous strategy for moderators.

Lastly, the study found little evidence of *resolution* of the issues or problems in the transcripts (Table 7). Garrison et al.'s (2001) also found little resolution. Zhu (1996) also found *wrappers* to have no educational advantage as students mostly ignored the *wrapper*. Zhu proposed that no *wrapper* could be comprehensive enough to incorporate the ideas of every class member. Perhaps *resolution* occurs more in the private world of the individual than the shared world of the conference board.

<u>Suggestions for Improving the *Community of Inquiry* Model</u>

Both the *TAT* model and the *community of inquiry* model performed well in this study. Percentage agreements and kappa values ranged from good to excellent for both models (see Chapter 3). Suggested improvements to the *community of inquiry* model are based on the experience of working with both the *TAT* and the *cognitive presence* model.

The first modification would include the CMC conference structure for identifying *triggers*. Not only should a *trigger* show notional characteristics of initiating discussion. A *trigger* needs to show empirical evidence of initiating discussion. Such evidence would be the number of responses received, which in turn indicates conference participants were in fact prompted to respond.

The other modification of the *cognitive presence* model would be to reword the indicator "asking questions" to "asking open-ended questions." This slight modification would incorporate the findings from this study. *Horizontal questions* (T1b) were the only distinguishing *TAT* indication for *true triggers.*

Suggestions for Further Research

This study revealed the following areas for further research:

- How does the *maturity* of the community affect *cognitive presence*? Which *cognitive presence* indicators are reflective of the *maturity*? How does maturity of the community affect the *TAT?* Which *TAT* indicators are reflective of the maturity? The study indicated that *triggers* could be a barometric measure of *maturity*. If *triggers* are a reflection of the *maturity*, what ranges of occurrences correspond to various levels of experience?
- If the *social presence* and *teaching presence* models were applied to the study's transcripts, what evidence about the *maturity* of the *community of inquiry* would such an analysis reveal*?*
- How does gender composition of the community affect *cognitive presence*?
- How does different observable moderator behaviour affect *cognitive presence*? The non-AU moderator and the non-AU students had the most *other.* Can the non-AU students' high level of *other* messages be attributed to the moderator's high use of *other?* Does the high use of moderator *other* diminish the presence of *triggers* or any other indicators of *cognitive presence*?
- Can structural evidence assist the identification of the remaining *cognitive presence* indicators namely *exploration, integration* and *resolution*?
- What patterns of TAT indicators are found in the remaining *cognitive presence* indicators namely *exploration, integration* and *resolution*?

- What moderator interaction patterns are reflected in student interaction behaviour? The AU2 moderator was the only moderator to use *quotations* (T5a) in his *true triggers*. Is the higher presence of *citations* (T5b) in the AU2 students' postings attributable to the moderators use of *quotations* (T5a)?

Chapter Summary

The nature of messages which *trigger* cognitive discussions in CMC was investigated with two different text analysis tools: the *TAT* and the *community of inquiry.* The analysis revealed that *true triggers* are characterized by open-ended questions (T1b), yet the occurrence of *true triggers* can vary significantly. *True duds* have more interpersonal communications of *reflections* (T3) and *scaffolding/engaging* (T4) than *true triggers.*

The study also revealed variation in the frequency of *true triggers.* Possible explanations for the variation include *maturity* of the community, differences in moderator behaviour, as well as differences in student interaction behaviour. How these factors affect *cognitive presence* is a topic for further inquiry.

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APPENDIX A

<u>Frequency of Messages Analysis of Variance</u>

Appendix A summarizes the ANOVA results for all the tests dealing with quantities of messages. Table 19 summarizes the results of the one way analysis of variance applied to the number of messages, the number of instructor messages, and the number of student messages. The courses are the independent variable and each ratio and averages form dependent variable. Two ANOVA tests were conducted to test the null hypothesis, Ho: $\mu_{non\text{-}AU} = \mu_{AU1} = \mu_{AU2}$. The ANOVA results demonstrate significant differences between the number of messages – F(.05,2,8) = 6.8 and the number of student messages F(.05,2,8) = 11.0.

Table 19

Analysis of variance of the Frequency of Messages

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Number of All Messages						
Between Groups	8310.9	2	4155.4	6.8	0.0	4.5
Within Groups	4879.9	8	610.0			
Number of Duds						
Between Groups	8.7	2	4.3	2.5	0.1	4.5
Within Groups	13.9	8	1.7			
Number of Instructor Messages						
Between Groups	176.3	2	88.2	2.6	0.1	4.5
Within Groups	275.3	8	34.4			
Number of Student Messages						
Between Groups	8456.3	2	4228.2	11.0	0.0	4.5
Within Groups	3085.9	8	385.7			

Table 20 demonstrates that the number of triggers is significantly different for the non-AU course compared to AU1 and AU2. The AU courses are not significantly different.

Table 20

Analysis of Variance Summary of *True Trigger* Distribution

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
All courses						
Between Groups	82.9	2	41.4	3.5	0.1	4.5
Within Groups	93.9	8	11.7			
Non-AU to AU1						
Between Groups	48.2	1	48.2	9.3	0.0	7.7
Within Groups	20.7	4	5.2			
Non-AU to AU2						
Between Groups	76.8	1	76.8	6.1	0.0	6.0
Within Groups	75.2	6	12.5			
AU1 to AU2						
Between Groups	1.0	1	1.0	0.1	0.8	6.0
Within Groups	91.9	6	15.3			

APPENDIX B

TAT Analysis of Variance

Appendix B summarizes the results for all the TAT ANOVA tests using the course as the independent variable. The following tables correspond to the results of the one way analysis of variance applied to the *TAT* data. Each *TAT* indicator is the dependent variable. In all eight ANOVA tests were conducted to test the null hypothesis, Ho: $\mu_{\text{non-AU}} = \mu_{\text{AU1}} = \mu_{\text{AU2}}$. for all messages, *true triggers, true duds*, instructor postings and student postings.

All Messages. Table 21 summarizes the ANOVA results for *TAT* indicators in all messages. The ANOVA results suggest we can reject the null hypothesis for

- T1a: Vertical Questions -$F(.05,2,8) = 6.8$,
- T1b: *Horizontal questions* – $F(.05,2,8) = 8.4$,
- T2a: *Non-referential statements* - $F(.05,2,8) = 12.6$,
- T4: *Scaffolding/engaging* - $F(.05,2,8) = 7.4$, and
- T5b: *Citations* - $F(.05,2,8) = 6.4$.

The results suggest failure to accept the null hypothesis for T2b (*referential statements* – $F(.05,2,8) = 2.5$, T3 (*reflections*) - – $F(.05,2,8) = 2.5$ and T5a (*quotations*) $F(.05,2,8) = 0.5$.

Table 21

Analysis of Variance Summaries of the *TAT* distribution in All Messages

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
T1a - Vertical Questions						
Between Groups	364.9	2	182.4	6.8	0.0	4.5
Within Groups	213.9	8	26.7			
T1b - Horizontal Questions						
Between Groups	3014.0	2	1507.0	8.4	0.0	4.5
Within Groups	1432.1	8	179.0			
T2a - Non-referential statements						
Between Groups	485642	2	242821.0	12.6	0.0	4.5
Within Groups	153680.5	8	19210.1			
T2b - Referential statements						
Between Groups	5312.2	2	2656.1	2.5	0.1	4.5
Within Groups	8438.5	8	1054.8			
T3 - Reflections						
Between Groups	2108.7	2	1054.3	3.4	0.1	4.5
Within Groups	2455.9	8	307.0			
T4 - Scaffolding/Engaging						
Between Groups	24321.6	2	12160.8	7.4	0.0	4.5
Within Groups	13142.5	8	1642.8			
T5a - Quotations						
Between Groups	56.7	2	28.3	0.1	0.9	4.5
Within Groups	4355.9	8	544.5			
T5b - Citations						
Between Groups	10670.0	2	5335.0	6.4	0.0	4.5
Within Groups	6690.5	8	836.3			

True Triggers. Table 22 summarizes the one-way ANOVAs of the *TAT* distribution within triggers. No significant differences were found with any *TAT* indicator.

Table 22

Analysis of Variance Summaries of *TAT* Distribution in *True Triggers*

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
T1a - Vertical Questions						
Between Groups	2.7	2	1.4	0.6	0.6	4.5
Within Groups	19.5	8	2.4			
T1b - Horizontal Questions						
Between Groups	154.8	2	77.4	2.5	0.1	4.5
Within Groups	251.3	8	31.4			
T2a - Non-referential statements						
Between Groups	7757.5	2	3878.8	2.3	0.2	4.5
Within Groups	13530.1	8	1691.3			
T2b - Referential statements						
Between Groups	35.8	2	17.9	2.4	0.2	4.5
Within Groups	59.9	8	7.5			
T3 - Reflections						
Between Groups	4.4	2	2.2	0.3	0.8	4.5
Within Groups	66.1	8	8.3			
T4 - Scaffolding/Engaging						
Between Groups	44.8	2	22.4	1.0	0.4	4.5
Within Groups	182.1	8	22.8			
T5a - Quotations						
Between Groups	14.7	2	7.3	1.2	0.3	4.5
Within Groups	47.9	8	6.0			
			1.4	0.6	0.6	4.5
T5b - Citations			2.4			
Between Groups	82.7	2				
Within Groups	221.5	8				

<u>True Duds</u>. Eight one-way analysis of variance of each *TAT* indicator follows in Table 23. The results suggest to reject the null hypothesis for *reflections* (T3) - F(.05,2,8) = 5.6 and *scaffolding/engaging* (T4) – F(.05,2,8) = 5.9.

Table 23

Analysis of Variance Summaries of *TAT* Distribution in *True Duds*

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
T1a - Vertical Questions						
Between Groups	2.1	2	1.0	0.7	0.5	4.5
Within Groups	12.7	8	1.6			
T1b - Horizontal Questions						
Between Groups	7.0	2	3.5	1.2	0.3	4.5
Within Groups	23.2	8	2.9			
T2a - Non-referential statements						
Between Groups	42.8	2	21.4	1.9	0.2	4.5
Within Groups	88.1	8	11.0			
T2b - Referential statements						
Between Groups	11.3	2	5.6	1.6	0.3	4.5
Within Groups	27.5	8	3.4			
T3 - Reflections						
Between Groups	3.1	2	1.6	4.9	0.0	4.5
Within Groups	2.5	8	0.3			
T4 - Scaffolding/Engaging						
Between Groups	56.4	2	28.2	5.9	0.0	4.5
Within Groups	38.1	8	4.8			
T5a - Quotations						
Between Groups	0.3	2	0.2	0.7	0.5	4.5
Within Groups	1.9	8	0.2			
			1.0	0.7	0.5	4.5
T5b - Citations			1.6			
Between Groups	0.7	2				
Within Groups	7.5	8				

Instructor Messages

Table 24 summarizes the ANOVA results for *TAT* indicators in the instructor messages. The ANOVA results suggest we cannot reject the null hypothesis for any of the TAT indicators.

Table 24

Analysis of Variance Summaries of the *TAT* distribution in Instructor Messages

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
T1a - Vertical Questions						
Between Groups	25.3	2	12.6	3.4	0.1	4.5
Within Groups	29.5	8	3.7			
T1b - Horizontal Questions						
Between Groups	5.8	2	2.9	0.2	0.8	4.5
Within Groups	105.9	8	13.2			
T2a - Non-referential statements						
Between Groups	601.5	2	300.8	1.3	0.4	5.8
Within Groups	1166	5	233.2			
T2b - Referential statements						
Between Groups	260.8	2	130.4	1.5	0.3	4.5
Within Groups	702.1	8	87.8			
T3 - Reflections						
Between Groups	1.0	2	0.5	0.2	0.8	4.5
Within Groups	18.7	8	2.3			
T4 - Scaffolding/Engaging						
Between Groups	454.3	2	227.2	2.1	0.2	4.5
Within Groups	861.3	8	107.7			
T5a - Quotations						
Between Groups	54.2	2	27.1	1.8	0.2	4.5
Within Groups	118.5	8	14.8			
			12.6	3.4	0.1	4.5
T5b - Citations			3.7			
Between Groups	283.4	2				
Within Groups	313.3	8				

Instructor True Triggers. Table 25 summarizes the ANOVA results for *TAT* indicators in the instructor *true triggers*. The ANOVA results suggest we cannot reject the null hypothesis for any of the TAT indicators except *quotations* (T5a) – F(.05,2,8) = 9.2.

Table 25

Analysis of Variance of the *TAT* Distribution in Instructor *True Triggers*

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
T1a - Vertical Questions						
Between Groups	3.9	2	2.0	1.5	0.3	4.5
Within Groups	10.8	8	1.4			
T1b - Horizontal Questions						
Between Groups	21.6	2	10.8	2.4	0.1	4.5
Within Groups	35.3	8	4.4			
T2a - Non-referential statements						
Between Groups	49.6	2	24.8	2.3	0.2	4.5
Within Groups	86.5	8	10.8			
T2b - Referential statements						
Between Groups	0.8	2	0.4	0.3	0.7	4.5
Within Groups	11.3	8	1.4			
T4 - Scaffolding/Engaging						
Between Groups	4.2	2	2.1	0.9	0.5	4.5
Within Groups	19.5	8	2.4			
T5a - Quotations						
Between Groups	18.4	2	9.2	23.0	0.0	4.5
Within Groups	3.2	8	0.4			
T5b - Citations						
Between Groups	2.7	2	1.4	65535.0	-	4.5
Within Groups	0	8	0.0			

Student Messages

Table 26 summarizes the ANOVA results for *TAT* indicators in student messages. The ANOVA results suggest we can reject the null hypothesis for

- T1a: Vertical Questions -F(.05,2,8) = 7.0,
- T1b: *Horizontal questions* – F(.05,2,8) = 8.5,
- T2a: *Non-referential statements* – F(.05,2,8) = 16.0,

- T4: *Scaffolding/engaging* - F(.05,2,8) = 13.8, and
- T5b: Citations - F(.05,2,8) = 7.2.

The results suggest failure to accept the null hypothesis for T2b (*referential statements* – F(.05,2,8) = 3.13, T3 (*reflections*) - – F(.05,2,8) = 3.9 and T5a (*quotations*) F(.05,2,8) = 0.0.

Table 26

Analysis of Variance Summaries of the *TAT* Distribution in Student Messages

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
T1a - Vertical Questions						
Between Groups	246.1	2	123.1	7.0	0.0	4.5
Within Groups	139.9	8	17.5			
T1b - Horizontal Questions						
Between Groups	3080.5	2	1540.3	8.5	0.0	4.5
Within Groups	1457.5	8	182.2			
T2a - Non-referential statements						
Between Groups	430137	2	215068.5	16.0	0.0	4.5
Within Groups	107341.9	8	13417.7			
T2b - Referential statements						
Between Groups	4030.6	2	2015.3	3.1	0.1	4.5
Within Groups	5148.1	8	643.5			
T3 - Reflections						
Between Groups	2130.9	2	1065.4	3.9	0.1	4.5
Within Groups	2213.9	8	276.7			
T4 - Scaffolding/Engaging						
Between Groups	30098.9	2	15049.4	13.8	0.0	4.5
Within Groups	8747.9	8	1093.5			
T5a - Quotations						
Between Groups	11.6	2	5.8	0.0	1.0	4.5
Within Groups	3139.3	8	392.4			
T5b - Citations						
Between Groups	8269.77	2	4134.9	7.2	0.0	4.5
Within Groups	4615.867	8	577.0			

APPENDIX C

Cognitive Inquiry Analysis of Variance

Appendix summarizes the results of the *cognitive inquiry* ANOVAs. The following tables correspond to the results of the one way analysis of variance applied to the *Cognitive Inquiry* data. The courses are the independent variable and each *Cognitive Inquiry* indicator is the dependent variable. In all five separate ANOVA tests were conducted to test the null hypothesis, Ho: $\mu_{\text{non-AU}} = \mu_{\text{AU1}} = \mu_{\text{AU2}}$ for all messages, instructor postings and student postings.

All Messages. Table 27 summarizes the ANOVA results for *cognitive presence* indicators in all messages. The ANOVA results suggest we can reject the null hypothesis for

- *Exploration*-F(.05,2,8) = 8.0,
- *Integration*- F(.05,2,8) = 13.7, and
- *Other*- F(.05,2,8) = 9.7.

The evidence does not support rejecting the null hypothesis for *cognitive presence triggers* - F(.05,2,8) = 4.00 or Resolution - F(.05,2,8) = 0.9.

Table 27

Analysis of Variance Summaries of the *Cognitive Presence* Distribution in All Messages

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Triggers						
Between Groups	268.3	2	134.2	4.0	0.1	4.5
Within Groups	267.9	8	33.5			
Exploration						
Between Groups	4353.6	2	2176.8	8.0	0.0	4.5
Within Groups	2185.3	8	273.2			
Integration						
Between Groups	283.5	2	141.7	13.7	0.0	4.5
Within Groups	82.5	8	10.3			
Resolution						
Between Groups	0.3	2	0.2	0.9	0.4	4.5
Within Groups	1.3	8	0.2			
Other						
Between Groups	150.6	2	75.3	9.7	0.0	4.5
Within Groups	62.1	8	7.8			

Instructor Messages. Table 28 summarizes the ANOVA results for *cognitive presence* indicators in instructor messages. The ANOVA results suggest we can reject the null hypothesis for

- *Exploration* - F(.05,2,8) = 6.64,
- *Other* - F(.05,2,8) = 7.35.

The evidence does not support rejecting the null hypothesis for *cognitive presence triggers* - F(.05,2,8) = 2.47, or Integration – F(.05,2,8)=1.82.

Table 28

Analysis of Variance Summaries of the *Cognitive presence* Distribution in Instructor Messages

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Triggers						
Between Groups	18.2	2	9.1	2.5	0.1	4.5
Within Groups	29.5	8	3.7			
Exploration						
Between Groups	40.0	2	20.0	6.6	0.0	4.5
Within Groups	24.1	8	3.0			
Integration						
Between Groups	23.4	2	11.7	1.8	0.2	4.5
Within Groups	51.3	8	6.4			
Resolution						
Between Groups	0.3	2	0.2	0.9	0.4	4.5
Within Groups	1.3	8	0.2			
Other						
Between Groups	18.1	2	9.1	7.4	0.0	4.5
Within Groups	9.9	8	1.2			

Student Messages. Table 29 summarizes the ANOVA results for *cognitive presence* indicators in student messages. The ANOVA results suggest we can reject the null hypothesis for

- *Exploration* - F(.05,2,8) = 9.01,
- *Integration* - F(.05,2,8) = 37.89, and
- *Other* - F(.05,2,8) = 18.78.

The evidence does not support rejecting the null hypothesis for *cognitive presence triggers* - F(.05,2,8) = 4.14.

Table 29

Analysis of Variance Summaries of the *Cognitive Presence* Distribution in Student Messages

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Triggers						
Between Groups	171.1	2	85.5	4.1	0.1	4.5
Within Groups	165.5	8	20.7			
Exploration						
Between Groups	4358.8	2	2179.4	9.0	0.0	4.5
Within Groups	1934.8	8	241.9			
Integration						
Between Groups	282.9	2	141.4	37.9	0.0	4.5
Within Groups	29.9	8	3.7			
Other						
Between Groups	185.3	2	92.6	18.8	0.0	4.5
Within Groups	39.5	8	4.9			

APPENDIX D

True Trigger and True Dud Analysis of Variance

Appendix D summarizes the results of ANOVAs where *true triggers* or *true duds* were the independent variable. Table 30 summarizes the results of eight different one way analysis of variance applied to the *True Trigger* data. *True triggers* and *true duds* were the independent variables and the TAT indicator was the dependent variable. The null hypothesis, Ho: $\mu_{trigger} = \mu_{non\text{-}trigger}$ was tested. Of the eight tests only one indicator is significant. One should reject the null hypothesis for *horizontal questions* (T1b) - $F(.05,1,20) = 5.5$. The results indicate to fail to reject the null hypothesis for all *other TAT* indicators.

Table 30

ANOVA Summaries of the *TAT* Proportion Between *True Triggers* and All Other Messages

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
T1a - Vertical Questions						
Between Groups	8.0	1	8.0	1.3	0.3	4.4
Within Groups	119.7	20	6.0			
T1b - Horizontal Questions						
Between Groups	136.5	1	136.5	5.5	0.0	4.4
Within Groups	493.1	20	24.7			
T2a - Non-referential statements						
Between Groups	16.9	1	16.9	0.2	0.7	4.4
Within Groups	1652.2	20	82.6			
T2b - Referential statements						
Between Groups	0.2	1	0.2	0.1	0.8	4.4
Within Groups	61.8	20	3.1			
T3 - Reflections						
Between Groups	0.4	1	0.4	0.2	0.7	4.4
Within Groups	45.7	20	2.3			
T4 - Scaffolding/Engaging						
Between Groups	1.0	1	0.9	0.0	0.8	4.4
Within Groups	501.1	20	25.1			
T5a - Quotations						
Between Groups	4.0	1	4.0	3.2	0.1	4.4
Within Groups	24.7	20	1.2			
T5b - Citations						
Between Groups	0.8	1	0.8	0.9	0.4	4.4
Within Groups	17.6	20	0.9			

- True Dud and True Triggers. Analysis of variance between *true triggers* and *true duds* revealed no significant differences.

Table 31

Analysis of Variance Summaries of the *TAT* Proportion Between *True Triggers* and *True Duds*

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
T1a - Vertical Questions						
Between Groups	0.2	1	0.2	0.0	0.9	4.4
Within Groups	161.3	20	8.1			
T1b - Horizontal Questions						
Between Groups	2.0	1	2.0	0.1	0.8	4.4
Within Groups	659.6	20	33.0			
T2a - Non-referential statements						
Between Groups	227.8	1	227.8	2.5	0.1	4.4
Within Groups	1834.6	20	91.7			
T2b - Referential statements						
Between Groups	0.3	1	0.3	0.1	0.7	4.4
Within Groups	56.4	20	2.8			
T3 - Reflections						
Between Groups	13.2	1	13.2	2.5	0.1	4.4
Within Groups	106.6	20	5.3			
T4 - Scaffolding/Engaging						
Between Groups	59.9	1	59.9	1.3	0.3	4.4
Within Groups	934.0	20	46.7			
T5a - Quotations						
Between Groups	2.7	1	2.7	0.9	0.3	4.4
Within Groups	58.6	20	2.9			
T5b - Citations						
Between Groups	5.2	1	5.2	1.3	0.3	4.4
Within Groups	83.2	20	4.2			

APPENDIX E

Analysis of Variance of True Triggers and True Duds

Table 32 summarizes the ANOVA results for the level of occurrence of *true triggers* and *true duds*. The level of occurrence was the independent variable with *true triggers* and *true duds* each as the dependant variable. Two separate ANOVAs tested the null hypothesis, Ho: $\mu_{Level1} = \mu_{Level2} = \mu_{Level3} = \mu_{Level4} = \mu_{Level5} = \mu_{Level5+}$. The ANOVA demonstrated a significant difference $F(.05,5,20) = 3.6$ for *true triggers*. There was no significant difference for *true duds*.

Table 32

Analysis of Variance of the Level of Occurrence for *True Triggers* and *True Duds*

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
True Triggers						
Between Groups	33.9	5	6.8	3.6	0.0	2.4
Within Groups	114.4	60	1.9			
True Duds						
Between Groups	2.2	5	0.4	1.3	0.3	2.4
Within Groups	20.9	60	0.3			