Critical Thinking, Cognitive Presence, and Computer Conferencing in Distance Education

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Abstract

This article describes a practical approach to judging the nature and quality of critical discourse in a computer conference. A model of a critical community of inquiry frames the research. A core concept in defining a community of inquiry is cognitive presence. In turn, the practical inquiry model operationalizes cognitive presence for the purpose of developing a tool to assess critical discourse and reflection. Encouraging empirical findings related to an attempt to create an efficient and reliable instrument to assess the nature and quality of critical discourse and thinking in a text-based educational context are presented. Finally, it is suggested that cognitive presence (i.e., critical, practical inquiry) can be created and supported in a computer conference environment with appropriate teaching and social presence.

Introduction

The adoption of computer-mediated communication (CMC) in higher education has far outpaced our understanding of how this medium should best be used to promote higher-order learning. Many scholars are now trying to remedy this deficiency in our understanding by studying interactions, perceptions, and outputs of participants engaged in the use of CMC for educational purposes.

A major challenge facing educators using CMC is the creation of a critical community of inquiry—the hallmark of higher education—within a virtual text-based environment. A community of inquiry is an extremely valuable, if not essential, context for higher-order learning. Such a community involves (re)constructing experience and knowledge through the critical analysis of subject matter, questioning, and the challenging of assumptions (Dewey 1959; Lipman 1991). This is consistent with the premise that an educational learning experience is both collaborative and reflective. Our research group has, therefore, focused on developing the means to assess the nature and quality of critical, reflective discourse that takes place within a text-based educational environment.

Theoretical Context

The conceptual framework for this study is described in a previous paper (Garrison, Anderson, and Archer 2000). This framework for a community of inquiry consists of three overlapping core elements and is intended to be applied to improving the practice of computer conferencing in higher education.

Here, we focus on the genesis and manifestation of the cognitive presence concept. Cognitive presence is defined within the framework of a community of inquiry, but is grounded in the critical thinking literature and is operationalized by the practical inquiry model described below.

Critical thinking and practical inquiry. The ultimate value of a tool to assess cognitive presence depends on the use of the model of critical thinking (i.e., practical inquiry) and its ability to reflect educational practice. It is important to recognize that cognitive presence focuses on higher-order thinking processes as opposed to specific individual learning outcomes. This research is an exploration of the nature and quality of cognitive presence, as defined and assessed by the phases (i.e., process) of a generalized model of critical thinking: practical inquiry.

Critical thinking is both a process and an outcome. As an outcome, it is best understood from an individual perspective—that is, the acquisition of deep and meaningful understanding as well as content-specific critical inquiry abilities, skills, and dispositions. Judging the quality of critical thinking as an outcome within a specific educational context is the responsibility of a teacher as the pedagogical and content expert. As a product, critical thinking is, perhaps, best judged through individual educational assignments. The difficulty of assessing critical thinking as a product is that it is a complex and (only indirectly) accessible cognitive process. However, and most relevant here, from a process perspective it is assumed that acquiring critical thinking skills would be greatly assisted by an understanding of the process. Moreover, it is assumed that facilitating the process of higher-order learning online could be assisted through the use of a tool to assess critical discourse and reflection.

More specifically, the critical thinking perspective employed here is comprehensive and includes creativity, problem solving, intuition, and insight (Garrison and Archer 2000). From this view, Garrison, Anderson, and Archer (2000) constructed a parsimonious practical inquiry model that was deemed of particular value in studying the formal educational context It is this model that guides the methodology of this research on assessing cognitive presence (i.e., critical inquiry) in an online, computer conference environment.

Practical inquiry is grounded in experience but includes imagination and reflection leading back to experience and practice (Dewey 1933). This recognition of the shared and private worlds of the learner is a crucial concept in understanding the creation and support of cognitive presence for educational purposes. The first dimension of the model (see Figure 1) reflects this continuum between action and deliberation. The second dimension represents the transition between the concrete and abstract worlds. This is the perception-conception dimension. These are the cognitive processes that associate facts and ideas. The practical inquiry model defines four phases essential to describe and understand cognitive presence in an educational context. Although developed independently, these phases are not dissimilar to the basic structure of inquiry suggested by Duffy, Dueber, and Hawley (1998) in their article on critical thinking and the design of online conferencing systems.

(Insert Figure 1 about here)

The phases of the practical inquiry model are the idealized logical sequence of the process of critical inquiry and, therefore, must not be seen as immutable.

- The first phase (lower quadrant) of the model reflects the initiation phase of critical inquiry and is considered the triggering event. Here an issue, dilemma, or problem that emerges from experience is identified or recognized. In an educational context, the teacher often explicitly communicates learning challenges or tasks that become triggering events. However, in a more democratic and nonhierarchical application of computer conferencing, any group member may purposively or indirectly add a triggering event to the discourse. A critical role of the teacher (actualizing teacher presence) is to initiate, shape, and, in some cases, discard potentially distracting triggering events so that the focus remains on the attainment of intended educational outcomes.
- The second phase of the process is exploration. In this phase, participants shift between the private, reflective world of the individual and the social exploration of ideas. Early in this phase, students are required to perceive or grasp the nature of the problem, and then move to a fuller exploration of relevant information. This exploration takes place in a community of inquiry by iteratively moving between the private and shared worlds—that is, between critical reflection and discourse. At the end of this phase, students begin to be selective with regard to what is relevant to the issue or problem. This is a divergent phase characterized by brainstorming, questioning, and exchange of information.
- The third phase, integration, is characterized by constructing meaning from the ideas generated in the exploratory phase. During the transition from the exploratory phase, students will begin to assess the applicability of ideas in terms of how well they connect and describe the issue or event under consideration. Again, students move repeatedly between reflection and discourse. This phase is the most difficult to detect from a teaching or research perspective. Evidence of the integration of ideas and the construction of meaning must be inferred from communication within the community of

inquiry. This phase requires active teaching presence to diagnose misconceptions, to provide probing questions, comments, and additional information in an effort to ensure continuing cognitive development, and to model the critical thinking process. Often students will be more comfortable remaining in a continuous exploration mode; therefore, teaching presence is essential in moving the process to more-advanced stages of critical thinking and cognitive development.

- The fourth phase is a <u>resolution</u> of the dilemma or problem by means of direct or vicarious action. In most noneducational settings, this means implementing the proposed solution or testing the hypothesis by means of practical application. In an educational context, however, the concept is somewhat more difficult. It usually entails a vicarious test using thought experiments and consensus building within the community of inquiry. As will be noted subsequently, progression to the fourth phase requires clear expectations and opportunities to apply newly created knowledge. Educationally, the end of this phase may require moving on to a new problem with the assumption that students have acquired useful knowledge. In a less-contrived situation, the results of the application phase lead to further problems and new triggering events, thus causing the process to start over. At this point, there may be an intuitive leap apparently shortcutting the logical inquiry cycle. This process of apparent skipping of phases or making conceptual leaps introduces the concepts of intuition and insight covered in more depth elsewhere (Garrison and Archer 2000).

In summary, the practical inquiry model reflects the critical thinking process and the means to create cognitive presence. The genesis and context of cognitive presence is more fully explained in Garrison, Anderson, and Archer (2000) but, suffice it to say here, it is operationalized through the practical inquiry process. Cognitive presence is defined as the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry (Garrison, Anderson, and Archer 2000). In other words, cognitive presence reflects higher-order knowledge acquisition and application and is most associated with the literature and research related to critical thinking.

Assessing Cognitive Presence

Cognitive presence (manifested through the practical inquiry process) has the potential to assess the quality of critical inquiry in terms of providing a means to assess the systematic progression of thinking over time. Our focus is on the process of critical thinking within a group dynamic as reflected by the perspective of a community of inquiry. While assessing critical thinking as both process and product is important educationally, it is the process of critical thinking that is of particular importance in terms of asynchronous text-based communications technology, such as computer conferencing.

Assessing critical thinking also raises an issue germane to assessment of the quality of the process. Duffy, Dueber, and Hawley (1998) argue that critical thinking research must move beyond assessment of structure to assessment of quality. They suggest that evaluators of critical thinking in a CMC context look for absolute characteristics such as accuracy, significance, logic, depth, completeness, and adequacy—as if these factors have absolute meaning outside the context in which they evolve. We reject this notion as being too circumscribed by algorithmic notions of cognitive development. Rather, we look for more heuristic models of assessment in which the process is judged by participants, especially teachers. One of the characteristics of the community of inquiry (Lipman 1991) is that members question one another, demand reasons for beliefs, and point out consequences of each other's ideas—thus creating a self-judging community when adequate levels of social, cognitive, and teacher presence are evident.

Further, we concur with Wells' (1999) observation that "discourse is a means, not an end in itself, and verbal information is valued not for the correctness of the way in which it is formulated, but for its use as a means towards the achievement of some larger purposes" (231). In any educational context, this "larger purpose" can be ethereal and difficult to empirically assess. In a

CMC context, the task is even more difficult due to the lean set of clues contingent upon the transcript of the written text available to the teacher, participants, and educational researchers.

It is the practical inquiry model to assess and guide dialogic writing for the purpose of creating cognitive presence in a community of inquiry. The first task is to generate and validate indices, for purposes of research and teaching, corresponding to each of the phases of the practical inquiry model. Assessing and finding evidence of cognitive presence (via the practical inquiry model) within the transcripts of text-based dialogue produced during formal CMC courses present many methodological challenges.

Most fundamental is the problem of assessing individual thought processes, and even results of group inquiry, through the traces of the process that are made visible and public in the transcript. The process is inevitably inductive and prone to error due to the subjective assessment of the observer. The transcript is valuable in that it provides an accurate record of nearly all the dialogue and interaction that took place. Unlike face-to-face discourse, in CMC there is no body language or paralinguistic communication used by participants to enhance their communication flow, and therefore no need to record and analyze such nonlinguistic communication. However, the use of this asynchronous medium leaves large amounts of ‘‘nonclass” time in which the ideas presented are recreated and explored individually and socially with colleagues and friends. Secondly, observers view only that subset of cognitive presence that the participants choose to make visible in the conference. There may be a variety of technical, access, or deeper social, psychological, and educational inhibitors to participation in the conference, which means that the transcript of the conference is a significantly less-than-complete record of the learning that has taken place within the community of inquiry. Much work needs to be done, using triangulated measures supplemental to the conference transcript, to ensure that the individual and group cognition is more accurately revealed by the investigators' interpretation of the transcript.

<u>Methodology</u>. The method used to assess cognitive presence is content analysis, which Borg and Gall (1989) define as “a research technique for the objective, systematic, and quantitative description of the manifest content of communication” (357). The first step in this research group's

use of this procedure was to develop a set of categories into which segments of messages were coded. As described previously, Garrison's model of critical thinking and practical inquiry provided the substance for our categories (Garrison and Archer 2000). The procedure meant developing a set of descriptors, indicators, and examples for each of the four categories or phases of practical inquiry.

The next step was to develop a systematic procedure for assigning data (segments of the transcripts) to categories. We began by listing the sociocognitive processes that uniquely characterize each of the phases of critical thinking. For instance, "sense of puzzlement" is a sociocognitive process characteristic of the "triggering event" phase. However, these processes, which are somewhat latent, do not facilitate objective and reliable identification by coders. Therefore, we studied several transcripts to determine how these latent processes manifest themselves in the data. This resulted in a list of symptoms, or "indicators," of each of the sociocognitive processes. Indicators are concrete examples of how the sociocognitive processes of each phase manifest themselves in asynchronous, text-based computer conferencing. For example, "asking questions" is a manifest indicator of the latent sociocognitive process "sense of puzzlement." Once this list was complete, we found that some indicators were repeated across multiple categories. "Asking questions," for example, is indicative of both "triggering events" and "exploration," depending on the attitude of the statement. Thus, as an additional aid to categorization, we developed a list of "descriptors" that reflect the general attitude of the phases.

(Insert Figure 2 about here)

The descriptors of the four phases are "evocative," "inquisitive," "tentative," and "committed" (see Figure 2). Descriptors are adjectives that characterize the process that is occurring in the particular phase. For example, the first category (triggering event) is a problem-posing event and, therefore, is considered evocative and inductive by nature in terms of conceptualizing a problem or issue. The second category (exploration) is a search for relevant information and, therefore, reflects an inquisitive and divergent process in the search for ideas to help make sense of a problem or issue. The third category (integration) represents the construction of a possible solution and, therefore, is a tentative conversion or connecting of relevant ideas capable of providing insight into the dilemma. Finally, the fourth category (resolution) is the process of critically assessing the concepts and, therefore, represents a commitment to a solution and deductively testing its validity. Together, the descriptors, indicators, and sociocognitive processes provide sufficient information to facilitate reliable categorization by coders. The guidelines for each of the categories are presented in Tables 1 through 4.

(Insert Tables 1 through 4 about here)

An important step in assigning data to categories is determining the unit of analysis (Henri 1991). After experimenting with several types of units, we found that a message-level unit, corresponding to what one participant posted into one thread of the conference on one occasion, was the most appropriate for our goals. Messages are clearly demarcated in the transcript; therefore, multiple coders can reliably identify when a coding decision is required. The use of smaller, submessage level units, as implemented by some researchers, can make the procedure burdensome because a number of these units require a decision by each coder. Furthermore, if these units cannot be reliably identified—as is often the case with even such apparently obvious units as the sentence—another factor is introduced that reduces the reliability and, hence, validity of the study. The message as unit is also attractive because the length and content of the message is decided upon by its author, rather than by coders. Finally, a complete message provides coders with sufficient information to infer underlying cognitive processes. Submessage level units may be introduced in future confirmatory studies if increased precision is warranted. A full discussion of this issue is found in Rourke et al. (in press).

However, a unit of this length may contain contradictory categorization cues or evidence of multiple phases of cognitive presence. Therefore, we have developed two heuristics for coders: <u>code</u>

down (i.e., to the earlier phase), if it is not clear which phase is reflected; and code up (i.e., to the later phase), if clear evidence of multiple phases is present. We justify this procedure by noting that higher levels of critical thinking, such as integration and resolution, borrow characteristics and process from previous phases.

Three one-week exchanges from two computer conference courses were compiled to test the efficacy of the tool. The first transcript was taken from a graduate-level course in workplace learning. This thirteen-week course was divided into weeklong, self-contained discussions that focused on one or two issues. Fourteen people participated in this discussion, including the instructor, two student moderators selected from the group, and eleven other students. The discussion was led by the student moderators, whose functions included stimulating discussion, adding pedagogical comment, and weaving and summarizing the discussion. The instructor passively monitored the interaction, becoming active only to close the discussion by summarizing the students' messages with reinforcement and expert advice. A total of fifty-one messages were posted during the conference week.

The second and third weeklong transcripts (weeks one and nine) were taken from a graduate-level course in health promotions. This thirteen-week course was led by an instructor who actively guided the discussions with questions and expert advice. In the second transcript, the instructor and six students exchanged twenty messages. In the third transcript, the instructor and four students exchanged twenty-four messages.

Two graduate students coded the transcript selections. One of the coders was involved in the refinement of the tool. The second coder was hired specifically for this coding task. The principal investigators discussed the coding protocol with the coders, who then coded the first transcript selection. The coders were encouraged to refine the protocol as they coded. Their results were evaluated for interrater reliability and modifications were made to the coding scheme based on suggestions from the coders. The second transcript was then coded. Again, results were evaluated for interrater reliability and modifications made to the scheme. Finally, the third transcript was coded according to the revised scheme.

<u>Results</u>. The coding decisions of the two coders were evaluated for interrater reliability using Holsti's (1969) coefficient of reliability (CR) and Cohen's (1969) kappa (k). CR is a percent-agreement measure in which the number of agreements between the first coder and the second coder are divided by the total number of coding decisions. Cohen's kappa is a chance-corrected measure of interrater reliability (Capozzoli, McSweeney, and Sinha 1999). In calculating kappa, reliability is reported after accounting for the possibility of chance agreement between coders. In our five-category coding scheme, this is a significant concern. Our results for each of the three transcripts were <u>CR</u> = .45, .65, and .84; and <u>k</u> = .35, .49 and .74.

Riffe, Lacy, and Fico (1998) indicate that content studies generally report chance-corrected reliability figures in the .80 to .90 range. However, they note that this criterion applies primarily to categories and coding systems that have been used extensively. They add that "research that is breaking new ground with concepts that are rich in analytical value may go forward with reliability levels somewhat below that range" (131). After three training sessions, our interrater reliability reached a high of <u>k</u> = .74.

Content analysis is a difficult process under the best of circumstances. It is challenging to ask coders to determine, based on manifest transcript evidence, which of four latent critical-thinking phases a student is operating in. It has been argued that interrater reliability is invariably low in these types of studies because of the "latent projective" nature of what is, in essence, an internal cognitive process (Potter and Levine-Donnerstein 1999). This challenge was compounded by the methodological weakness of a small sample size. That is, we coded only ninety-five messages from groups of thirteen, six, and four students.

As noted, the first two transcripts were used to refine the coding scheme. The focus then turned to the third transcript coded with the coding schema refined with benefit of insights gained from the previous training. Coding results for the third transcript are presented in Table 5. These data represent a general indication of the relative frequency of each of the categories. The first coder's decisions are read horizontally; the second coder's decisions are read vertically. Numbers on the diagonal indicate agreement between the coders. Numbers off the diagonal indicate disagreement.

(Insert Table 5 about here)

In Table 5, the column labeled trigger indicates that coder 2 categorized two messages as triggering events: one of which coder 1 categorized as trigger, the other as explore. The column labeled explore indicates that coder 2 categorized ten messages as exploration; of these ten, coder 1 categorized eight as explore, one as integrate, and one as other. Numbers on the diagonal indicate agreement between the coders. The column labeled integrate indicates that coder 2 categorized three messages as integration; of these three, coder 1 categorized one as explore and two as integrate. The column labeled resolution indicates that coder 2 and coder 1 both coded the same single message as resolution. Coding discrepancies occurred in each of the categories; however, the main source of discrepancies in each round of coding was between exploration and integration.

Discussion

To summarize, it was found that the first phase of practical inquiry, trigger, had 8% of the responses (see Figure 3). This would seem to be reasonable, considering the problem or issue is very likely to be well framed by the teacher in an educational context. The second phase, exploration, had the highest frequency (42%) of coded responses in the transcripts. This is also not surprising, and it is consistent with previous research. That phase is a brainstorming phase whereby people feel free to share their insights and contribute relevant information. Perhaps because of the democratic nature of the medium and the way it is used, most of the conversation in a computer conference is of a sharing and comparing nature (Kanuka and Anderson 1998). However, the frequency of the responses dropped rapidly in the integration (13%) and resolution (4%) phases.

(Insert Figure 3 about here)

The issue worthy of special consideration is why the frequency of responses for integration, and especially resolution, were so few. Certainly integration would seem to be more challenging than exploration for most learners. Integration requires time for reflection to synthesize information. It also may be more risky to offer tentative solutions or hypotheses in that their ideas may be rejected. While this may seem reasonable, the virtual absence of responses associated with resolution is harder to explain.

Several factors may explain why so little attention was focused on resolution. The first set of possibilities is associated with the instructional design and facilitation. That is, it may have not been a goal of the lesson that week, or the content did not lend itself well to advanced inquiry (e.g., an introductory course). However, there may have been deficiencies in the facilitation in terms of guiding and shaping the discourse toward higher-order cognitive activities, such as the testing of ideas and resolution.

The second explanation for the lack of resolution responses could be that the medium (i.e., computer conferencing) does not support this kind of activity. Application or testing of ideas is difficult in a face-to-face educational context given its vicarious, and even contrived, aspects. Perhaps this is even more challenging in an asynchronous text-based communication environment.

Finally, it could be that the practical inquiry model was not appropriate for framing the type of educational experience reflected in the transcripts of the computer conference analyzed here. The model is based upon the work of John Dewey and, therefore, has a pragmatic focus to it (Garrison and Archer 2000)—that is, it considers education to be based on lived experiences, and learning in an educational context is to be applied to real-life situations. However, other critical-thinking models are based on abstract logical thinking processes, such as deductive thinking and analysis of arguments, with little consideration of critical discourse (Garrison and Archer 2000). The practical inquiry model corresponds to the educational beliefs and the nature of desired learning outcomes valued by the present researchers. The model is not inconsistent with that revealed by Gunawardena, Lowe, and Anderson (1997). We believe such a model and approach to education is more appropriate where applied knowledge is valued—particularly adult, continuing, and higher education.

In any case, for a computer conference to serve as an educational environment, it must be more than undirected, unreflective, random exchanges and dumps of opinions. Higher-order learning requires systematic and sustained critical discourse where dissonance and problems are resolved through exploration, integration, and testing. The guide (i.e., practical inquiry model) must be the full cycle of the critical-thinking process, which includes interactions between the public shared world and the private reflective world. The complexity and challenge of facilitating this educational process in an asynchronous text-based environment necessitates skilled facilitation. Collaborative learning in an educational sense is more than a mindless free-for-all. Interaction must be coordinated and synergistic. This requires an understanding of the medium of communication, the process of higher-order learning, and the critical role of teaching presence in attaining higher-order learning outcomes.

Conclusion

The goal of this research was to create an efficient and reliable electronic assessment tool that could expeditiously provide important teaching and learning information with regard to the nature and quality of the critical-thinking process (i.e., cognitive presence) as reflected in a computer-conference transcript. It is concluded that the findings are encouraging, and that this tool is worth further investigation. We anticipate this could be a valuable tool for researchers or teachers to use to assess and confirm the nature of the discourse appropriate for their desired learning outcomes. We remain challenged by the difficulty of measuring latent variables (especially those described as latent projective) and by the need to develop tools that effectively deal with large numbers of messages generated during longer-term computer conferencing courses. However, we also think that the process of evaluating transcripts using analysis frameworks, such as that presented here, offer invaluable insights into the nature of learning and teaching in this increasingly popular educational medium.

This article has proposed a practical inquiry model with descriptors, indicators, and examples that could serve as a framework for future research in a quest to better understand the cognitive nature of the teaching and learning transaction in an asynchronous text-based conferencing environment. In this quest, much systematic and empirical research is required. The research reported here is merely a map of the territory intended to provide direction for future research focusing on the facilitation of higher-order learning. Our intent is to continue to focus our research on facilitation issues, with the assumption that higher-order learning can be developed in a computer-conference environment with appropriate teacher presence (design, facilitation, and assessment). We believe such an approach is capable of refining the concept and model presented here to the point where it can be a reliable and useful instructional tool for realizing higher-order educational outcomes.

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Table 1. Triggering Events

Descriptor	Indicators	Sociocognitive processes
Evocative	Recognizing the problem	Presenting background information that culminates in a question
	Sense of puzzlement	Asking questions Messages that take discussion in new direction

Example:

It has been argued that the only way to deliver effective distance education is through a systems approach. However, this approach is rarely used. Why do you think that is?

Table 2. Exploration

Descriptor	Indicators	Sociocognitive processes
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 message as exploration—e.g., “Does that seem about right?” or “Am I way off the mark?”
	Brainstorming	Adds to established points but does not systematically defend/justify/develop addition
	Leaps to conclusions	Offers unsupported opinions

Example:

One reason I think it is seldom used is that it is too complicated to get cooperation. Another may be the mind-sets of those in charge to change practices.

Table 3. Integration

Descriptor	Indicators	Sociocognitive processes
Tentative	Convergence—among group members	Reference to previous message followed by substantiated agreement, e.g., “I agree because…”
		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—textbook, articles, personal experience
	Creating solutions	Explicit characterization of message as a solution by participant

Example:

We also had trouble getting cooperation. Often the use of new tools requires new organizational structures. We addressed these issues when we implemented a systems approach, and I think that’s why we were successful.

Table 4. Resolution

Descriptor	Indicators	Processes
Committed	Vicarious application to real world	None
	Testing solutions	Coded
	Defending solutions	

Example:

A good test of this solution would be to … and then assess how …

Table 5. Coding Results for Third Transcript

	Coder 2						
		Trigger	Explore	Integrate	Resolution	Other*	Total
Coder 1	Trigger	1					1
	Explore	1	8	1			10
	Integrate		1	2			3
	Resolution				1		1
	Other		1			8	9
Total		2	10	3	1	8	24

Note:

CR = 83.33%, k = .74

* messages that were coded as "not cognitive presence"

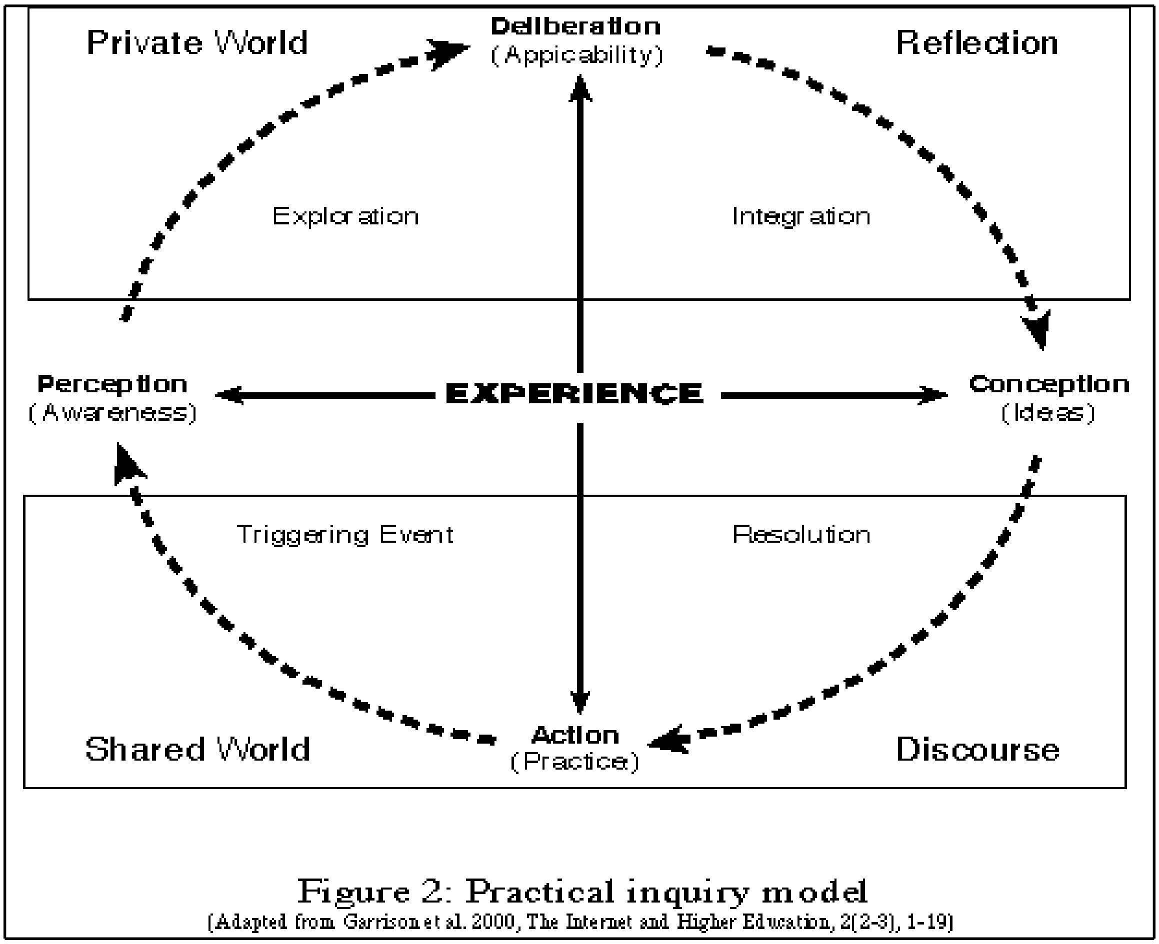

Figure 1. Practical Inquiry Model

Adapted from Garrison, Anderson, and Archer (2000), <u>The Internet and Higher Education</u> 2 (2–3), 1–19.

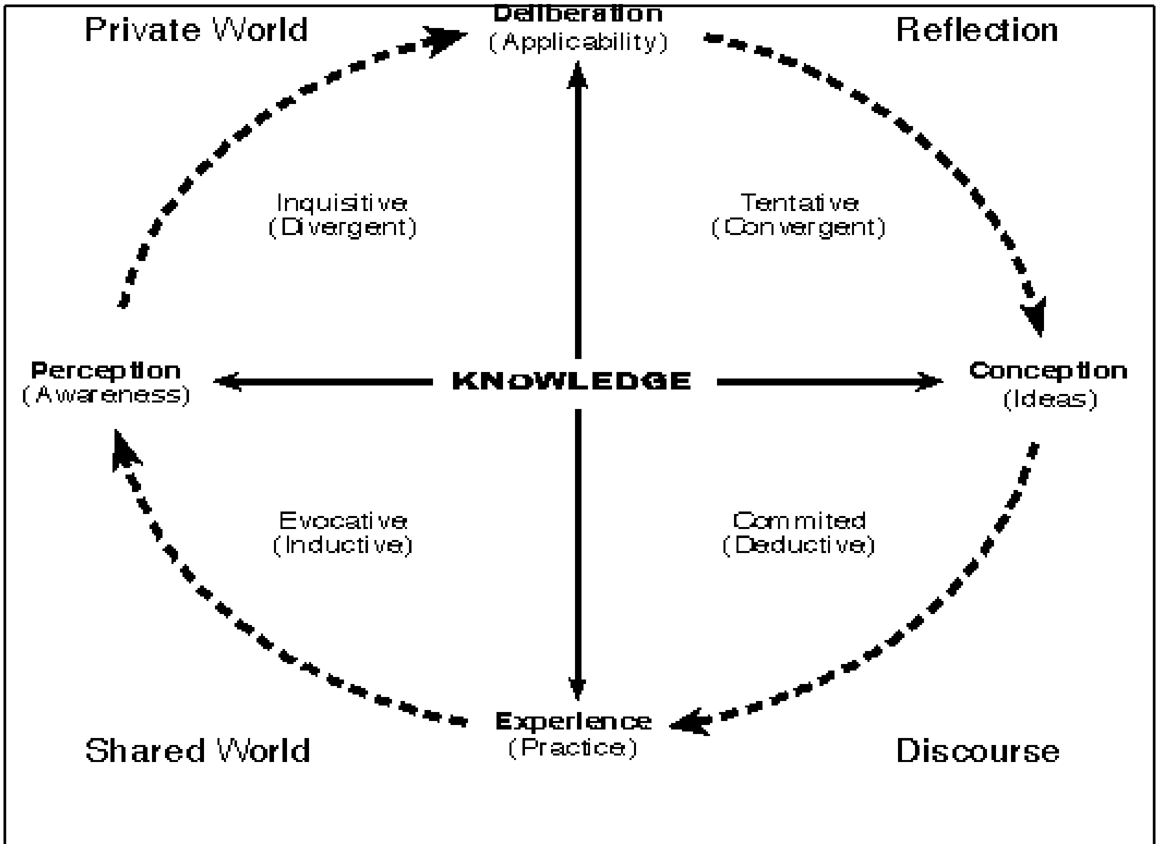

Figure 3: Cognitive presence descriptors

Figure 2. Cognitive Presence Descriptors

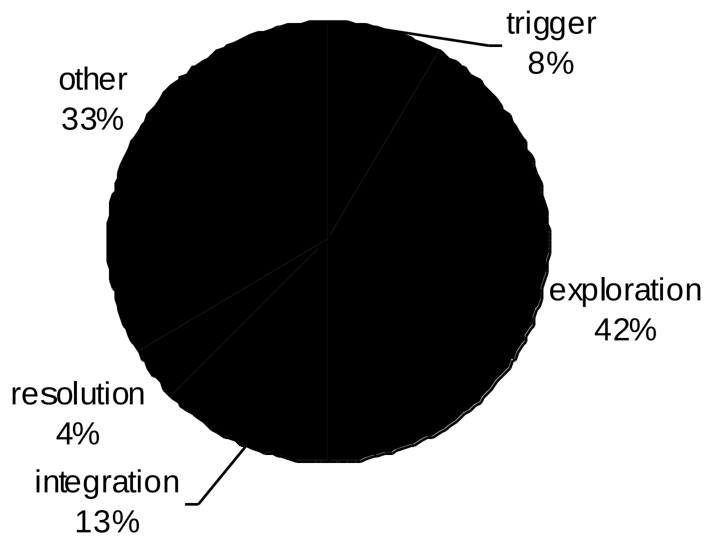

Figure 3. Relative Frequencies for Cognitive Presence Categories