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Establishing an Online Community of Practice for Instructors of English as a Foreign Language

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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Communities of practice are entities that emerge for the purposes of learning and advancement of knowledge in a particular area. They emerge under all circumstances, even adverse situations. Because they can spawn great innovation and knowledge advancement, organizations need to cultivate and establish environments that allow them to develop. Currently, communities of practice have moved into the online world, in which their members use computer mediated communication to collaborate with each other.

In January, 2002, a virtual community was formed to enable teachers of English as a Foreign Language to collaborate on learning and applying various computing technologies in language teaching. This community is known as Webheads in Action. Because many teachers with this interest are geographically disbursed, this distributed community allows the members to contact others with similar interests in this field. This virtual community also considers itself a community of practice because some of its core members are interested in the research and literature in this area.

The literature presents communities of practice as falling within a range of attributes and characteristics. However, this presentation of ranges causes the concept of "communities of practice" to be elusive for members and stakeholders alike. In addition, the difference between communities of practice and virtual communities needs to be delineated.

This dissertation established criteria that distinguish distributed communities of practice from other types of virtual communities. The author derived the criteria from theory, and conducted a case study that compared communities of practice theory with the virtual community of Webheads in Action. Based on this analysis, this dissertation refined and furthered develop theory of distributed communities of practice.

This case study opened the debate on general criteria, as well as a benchmarking system, for communities of practice. It provided guidelines for future study in the areas of methodology and criteria refinement with respect to multiple case studies.

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Introduction

Statement of the Problem to be Investigated and Goal to Be Achieved

Problem Statement

Communities of practice (CoPs) are entities that emerge and evolve for the purposes of learning and solving authentic problems (Liedtka, 1999; Wick, 2000; Wenger, 1998). Wenger (1998) notes that CoPs have always existed and will emerge even under the most adverse situations; however, they can be powerful entities for accomplishing problem solving and learning. Current trends in knowledge management cite the implementation of CoPs in organizations as a way to advance knowledge, as well as add flexibility to the rigid, hierarchical structures of these organizations (Saint-Onge & Wallace, 2003).

For this reason, enabling and cultivating their emergence and continuation should be a priority among organizations (Wenger & Snyder, 2000; Saint-Onge & Wallace, 2003). Learning is situated in authentic practice, which is created via group collaboration and interaction (Herrington & Oliver, 2000). All learning and social activity that takes place in communities of practice is completely authentic.

The author based the following assessment on ten years of experience as an EFL (English as a Foreign Language) instructor in private industry, as well as an additional

five years experience as an EFL instructor in one of two technical universities in one of Germany's leading technological regions. Furthermore, he presented at conferences in the area of using Internet technology for language teaching for the International Association of Teaching English as a Foreign Language (IATEFL), which is one of two leading English as a Foreign Language teaching associations internationally.

These conferences gave him regular exposure to EFL teaching situations and issues throughout Europe. The conferences provided a rich exchange of information between the participants; however, their duration was only for one weekend. The time and expense of traveling to a different country each year lowered the number of regular participants.

Also, it was evident at these conferences, including the conferences specializing in computing technology and language teaching, that most instructors in this field were novices in computing technology. Thus, EFL teachers interested in collaboration and learning about using computing technology in their field tended to be geographically dispersed. In order to collaborate and learn together, an online, or distributed CoP enabled collaboration and interaction, changing from a short time of intense communication at a live conference to a longer period of collaboration and mutual work among the participants.

Addressing this need, Webheads in Action (WIA) was founded during January to March of 2002 as an online course in community building for EFL teachers. Specifically, the course focused on the use of online development tools and environments with respect to the needs of EFL (English as a Foreign Language) and ESL (English as a Second Language) teachers. WIA continued as an online community (i.e., a virtual community) after the course was ended. Continuation of a community

after termination of a project is a common event in the formation of CoPs (Wenger & Snyder, 2000). Although some of its participants joined the community independently, the WIA community emerged from a community of EFL instructors and students interested in improving writing through the use of online tools: Writing for Webheads (W4W). Emergence from existing networks is also a common way for CoPs to form (Bradshaw, Powell, & Terrell, 2004; Lesser & Everest, 2001; McDermott, 1999; McDermott & O'Dell, 2001; Wenger, McDermott, & Snyder, 2002). WIA has since continued as a virtual community with weekly synchronous meetings, scheduled conferences, and an asynchronous discussion forum (Schlager, Fusco, & Schank, 2002).

Goal

The goal of this dissertation was to analyze a virtual community of instructors of English as a Foreign Language (EFL) and English as a Second Language (ESL), established for mutual learning and testing of Web-based tools in language instruction. This virtual community (viz., Webheads in Action) considered itself a distributed community of practice, and its development over the time period of January 2002 to the end of January 2003 was compared to CoP theory by means of a case study. The case study compared the communication, collaboration, documentation, and interaction with nine characteristics that distinguish CoPs from other types of virtual communities. From this analysis, new theory, insights, and recommendations for further research with respect to distributed CoPs were developed (Wenger, 1998; Wenger, McDermott, & Snyder, 2002).

Relevance and Significance

Communities of practice form irrespectively of organizational support (Wenger, 1998). They are a natural group phenomenon that self-organizes, and their purpose may or may not be beneficial to an organization (Lave & Wenger, 1991; Wenger, 1998; Wenger, McDermott, & Snyder, 2002). Because CoPs can be sources of innovation, businesses and other organizational entities have recognized that CoPs are beneficial to them; however, they need to learn how to cultivate their growth (Ardichvilli, Page, & Wentling, 2002; Dubé, Bourhis, & Jacob, 2005; Gongla & Rizzato, 2004; Snyder, Wenger, & De Sousa Briggs, 2003; Vaast, 2004). This potential source of innovation has moved CoPs into an area of great interest for organizations (Powell, Koput, & Doerr, 1996; Saint-Onge & Wallace, 2003; Stamps, 1997; Wick, 2000).

Wenger, McDermott, and Snyder (2002) also cited the current instability of working in companies. They pointed out that CoPs, with their collegiality of learning relationships, can provide stable professional contacts in a working climate with constantly shifting personnel.

Brown and Duguid (1991) noted that traditional training methods and procedural documentation inadvertently lower workers' skills by trying to prescribe complex working practices into a series of steps. Stamps (1997) revealed that traditional instructional design teams were three levels removed from actual practice. Instructional designers usually obtained their information from process analysts, as opposed to from those directly involved in practice.

Based on the literature review in Chapter 2, the author found no direct study that compared CoP theory to a virtual community with the specific goal of gaining insight on how a community of practice would emerge within this virtual environment. Case

studies of emergent development of teams, groups, and communities in private industry and university courses were carried out. Also, aspects of emergence (e.g. reflection and emergence in existing communities) were studied. Other studies cited the founding and implementation of a CoP, and they calculated metrics, such as message length and number of messages posted (Eick & Dias, 2005: Gray, 2004; Storck & Storck, 2004, Saint-Onge & Wallace, 2003). These studies cited classic CoP literature (Brown, Collins, & Duguid,1989; Lave & Wenger, 1991; Wenger 1998); however, no study attempted this theoretical to actual comparison — in other words, a whole CoP approach (Hoadley & Pea, 2002). Furthermore, this dissertation considered the difference of other forms of online organization (e.g., virtual teams) to distributed CoPs (Duarte & Snyder, 2001; Lipnack & Stamps, 2000; Rubenstein Montano, 2004; Teigland & Wasko, 2004; Vaast, 2004).

The reviewed studies analyzed and classified communication within online communities (e.g., social network analysis); however, they did not address or develop specific criteria that distinguish distributed CoPs from other types of online communities. Wenger, McDermott, and Snyder (2002) examined a globally distributed community of Shell Oil. Based on this case study, they recommended structuring the community to compensate for the difficulties presented by distance and online communication. Saint-Onge and Wallace (2003) described an organizationally implemented, distributed CoP of insurance agents dispersed throughout Canada. However, these recommendations focused on the communication structure and implementation aspects of distributed CoPs, rather than examining the aspects that make the virtual community a CoP.

CoPs in a distributed environment are little understood (Alani, Dasmahapatra, O'Hara, & Shadbolt, 2003; Buysse, Sparkman, & Wesley, 2003; Teigland & Wasko, 2004; White, 2004). Currently, there are differing opinions in both terminology of online communities and the viability of CoPs in online environments (Ardichvilli, Page, & Wentling, 2002; Bradshaw, Powell, & Terrell, 2004; Davenport & Hall, 2002; Hung & Nichani, 2002; Rubenstein Montano, 2004; Teigland & Wasko, 2004; Vaast, 2004; White, 2004). As presented in the research questions and derived from the literature review, the author outlined nine criteria that distinguish and delineate distributed CoPs from other types of virtual communities. This dissertation used these nine criteria in developing methods of analysis to determine whether a virtual community was a distributed CoP.

Barriers and Issues

Tradeoffs with respect to CoPs.

Because CoPs were often described as organic entities, they were described in terms of balances between extremes (Gongla & Rizzato, 2004, Kim, 2000; Wenger, McDermott, & Snyder, 2002). In other words, if CoPs drifted too much in either direction toward the endpoints of these extremes, their effectiveness and very existence as learning entities became endangered. Furthermore, this description of CoPs as a set of tradeoffs could make their concept difficult to grasp for members, as well as outsiders and stakeholders. Table 1 lists the tradeoffs inherent in CoPs.

Table 1. Tradeoffs Inherent in CoPs.

Tradeoff	Additional information
Leadership: Too much vs. too little.	Authoritarianism from experts can actually hinder learning (Lave & Wenger, 1991). CoPs need to be cultivated. Complete lack of leadership leads to chaos (Wenger, McDermott, & Snyder, 2002).
Self-identification: Core membership vs. boundary activity	A CoP's core members help to establish community identity and culture. However, core members risk insulating themselves by identifying too much with the community. This insulation causes them to ignore new ideas, which very often come from outside the CoP, that is, from its boundaries (Stamps, 1997; Wenger, 1998; Wenger, McDermott, & Snyder, 2002).
Documentation: information overload vs. too sparse.	Too much documentation during the startup phase of a CoP can kill creativity and the negotiation atmosphere necessary for successful startup (Wenger, McDermott, & Snyder, 2002). Documentation increases the amount of improvisation and complexity people need to grasp to accomplish something (Brown & Duguid, 1991). Wenger, McDermott, & Snyder (2002) warn of the danger of measurement (e.g., trying to quantify knowledge and learning). They recommend anecdotal measurement in the form of stories.
Localness: Familiarity vs. fragmentation.	Subgroup formation is good for expertise and specialization (e.g., virtual teams), but too much of it causes fragmentation (Kim, 2000). Emerging subgroups are a sign of community maturation (Kim, 2000;Dermott, & Snyder, 2002). Wenger, McDermott, and Snyder (2002) recommend local groups that have representatives, who communicate between distributed local groups. However, this can also lead to fragmentation based on geography (Hughes, O'Brien, Randall, Rouncefield, & Tolmie, 2001).

Conflicting issues between CoPs and Virtual Communities

There are several issues applicable to virtual communities. These issues conflict with and possibly hinder development of distributed CoPs within a virtual environment. Currently, most communication in and with virtual communities, including Webheads in Action, is text-based (Preece, 2000). Experts on virtual communities, as well as previous studies, cited the importance of explicit communication norms, that is, more than would be made explicit in physical situations. Explicit norms and procedures compensated for lack of visual cues in a text-based communication environment (Cohen & Mankin, 1999; Haywood, 1998; Knoll & Jarvenpaa, 1998; Lipnack & Stamps, 2000; Mohrman, 1999; Nemiro, 2000; Rheingold, 2000). Preece (2000) noted the difficulty in building consensus using text-based CMC. Kimball and Ladd (2004) emphasized online experiences can cause information overload and frustration, for example, with long messages, frequent messages, topic drifts, and irrelevant postings. Conversely, virtual community experts cited strong relationships that could be established virtually (Preece, 2000; Rheingold, 2000; Walther, 1997).

A key aspect of CoPs is the transfer of implicit, or tacit, knowledge, which is a non-verbal and non-explicit exchange gained by participation in practice or embedded in community stories (Brown & Duguid, 1991; Brown & Duguid, 1996b; Brown & Duguid, 2000; Brown & Duguid, 2001; Cook & Brown, 1999; McDermott, 1999; Saint-Onge & Wallace, 2003; Wenger, McDermott, & Snyder, 2002). Although negotiation among members is also a characteristic of both CoPs and virtual communities, this apparent conflict between implicit knowledge transfer within CoPs and explicit communication norms of virtual communities raised an issue on the

suitability of virtual environments for CoPs (Brown, Collins, & Duguid, 1989; Rubenstein Montano, 2004).

Another issue is that virtual community and virtual team literature discuss clearly defined roles for participants as vital for virtual community and virtual team success (Bradshaw, Powell, & Terrell, 2004; Cascio, 1999; Eom & Lee, 1999; Kim, 2000; Knoll & Jarvenpaa, 1998; Nemiro, 2000; Preece, 2000). However, in the case of CoPs, attempts at establishing prescribed workgroups can upset the emerging learning relationships among individuals. Recognition and nurturing was recommended (Brown & Duguid, 1991). On the other hand, self-definition and negotiation of roles of expertise define an individual's place within a CoP (Lesser & Everest, 2001; Wenger, 1998). However, roles that are too rigorously defined can disturb the natural movement between novice and expertise necessary within CoPs (Bradshaw, Powell, & Terrell, 2004; Kim, 2000; Lave & Wenger, 1991; Preece, 2000). The conflicting characteristics between CoPs and virtual communities are summarized in Table 2.

In general, frequent and informal contact enables implicit knowledge transfer, which is critical for transfer of learning in CoPs. Virtual communities, because of limited face-to-face contact, require communication that is more explicit than usual face-to-face contact. Moreover, this same situation also exists in teleconferencing and telephone conversations. Wenger, McDermott, and Snyder (2002) cited the formation of distributed CoPs and the use of CMC as the principal mode of communication, despite these drawbacks.

Table 2. Summary of Conflicting Characteristics Between Communities of Practice and Current Virtual Communities.

Conflicting Characteristic	Communities of Practice	Virtual Communities
Role Definition	Roles should be established; however, flexibility of movement within types and degree of expertise must be maintained. Roles should not be prescribed.	Roles need to be clearly defined because of distance and lack of visual cues.
Transfer of Implicit Knowledge	Implicit knowledge transfer takes place between members via direct interaction and story telling.	Lack of visual cues in text-based CMC and Web-based CMC prescribes explicit communication, as well as explicit establishment of communication norms.

Theoretical Proposition and Research Questions to Be Investigated

Theoretical Proposition

Based on the literature review in Chapter 2 and the resulting unique identifiers of distributed CoPs, as illustrated in Figure 1 (p. 13) and described in Table 3 (p. 14); this dissertation investigated the following theoretical proposition (Yin, 1993, Yin 1994):

- Theoretical Proposition: The virtual community Webheads in Action exhibits behavior of a distributed community of practice if it possesses all nine characteristics unique to distributed CoPs. Instances of negative or tangential behavior with respect to the nine characteristics weaken, or

possibly negate, the theoretical proposition that distributed CoP behavior is exhibited by this virtual community.

The author regarded this theoretical proposition as a data analysis guideline, with which he used to focus on the topic (Yin, 1993; Yin 1994). In other words, the theoretical proposition functioned as a tool to increase the author's alertness in finding not only examples in the data that matched the characteristics, but data that ran counter to the theoretical characteristics (Miles & Huberman, 1994). In addition, the subsequent research questions focused on broader issues of CoP theory with respect to the identifying characteristics. Furthermore, the literature review in Chapter 2 cited the relevance of examining distributed CoPs with respect to their characteristics with the purpose of identifying and understanding distributed CoPs.

Research Questions

Chapter 3 detailed the methodology, in which the unique identifiers were classified as independent variables. The movement of these variables over time determined the degree of these unique characteristics or their absence, as well as generated detailed analysis on the following research questions:

- Research Question 1#: In what ways does the observed virtual community correspond to theoretical aspects of communities of practice? How are these theoretical aspects represented or not represented in the virtual community of WIA? How do they deviate? To what degree are each of these characteristics represented in WIA?

Table 3 (p. 14) lists the identifying characteristics of distributed CoPs that differentiate them from other types of virtual communities. This gives rise to the second research question.

- Research Question #2: In what ways can a community of practice, whose interactions are mainly carried out online, evolve with the founding of a virtual community designed specifically to enhance the emergent aspects of a community of practice (Wenger, 1998)?

In his volume, Wenger based his theories on observation of a claims processing department in a medical insurance company. Therefore, the community's interaction with respect to its artifacts (i.e., technology, policies, procedures, informal methods, etc.) and its members was principally conducted in a face-to-face manner. WIA's members reside on every continent of the globe, most of whom have never met face-to-face. Because the community's artifacts exist mainly in the form of published Web sites and communication logs, analysis of these artifacts with respect to CoP theory's unique identifiers should generate insight on how CoPs evolve online.

- Research Question #3: In what ways does the interaction and community understanding of the community members with its artifacts, specifically CMC and Web technology, aid the community in reaching its learning goals? In which ways do these tools help or hinder this interaction?

The WIA community's use and understanding of the technology were revealed through detailed analysis of its communication.

Unique Identifiers of Distributed Communities of Practice

As developed from the literature review in Chapter 2, Figure 1 displays the unique identifiers, which form the basis for the methodology described in Chapter 3. The top level describes this study's unit of analysis, that is, a potential DCoP (distributed community of practice). The main level and sub-level depict supporting concepts that theoretically and uniquely identify a DCoP, that is, these identifiers differentiate a DCoP from other types of virtual community (VC). Sublevel identifiers are supporting concepts of their respective main level identifier.

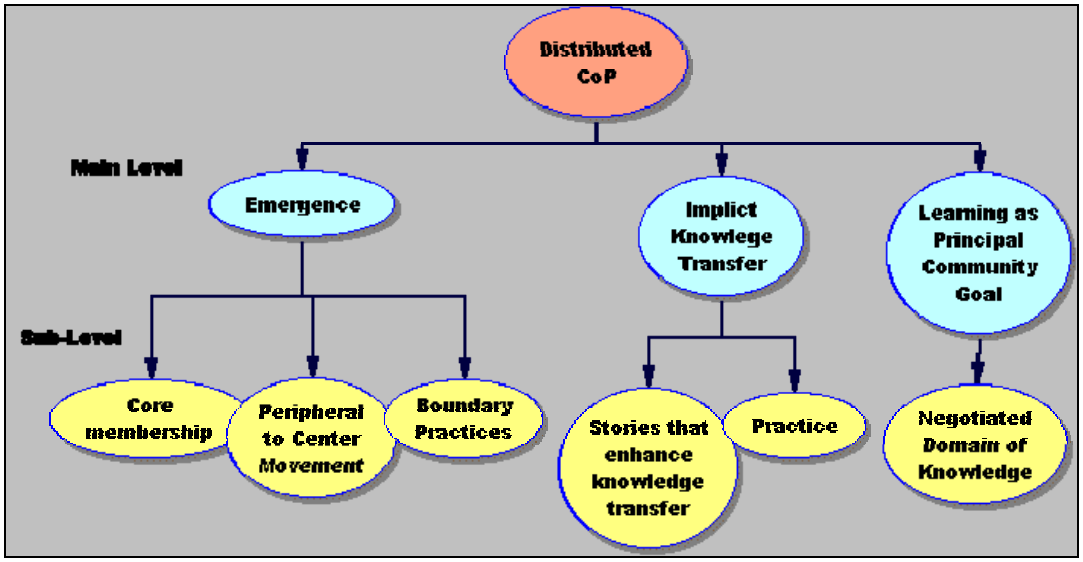

Figure 1. Visual Arrangement and Initial Classification of Unique Identifiers of CoPs.

Table 3 contains a short description of each of the unique identifiers displayed in Figure 1. The description summarizes the meaning of each identifier, which are derived from the literature review in Chapter 2. Chapter 2 contains detailed discussion and derivation of these theoretical identifiers.

Table 3. Unique Identifiers of Distributed CoPs.

Identifier	Description
1. Emergence	The organic development of a CoP, as opposed to being prescribed or managed (Brown & Duguid, 1991; George, Iacono, & Kling, 1995; Wenger 1998; Wenger, McDermott, & Snyder, 2002).
2. Core Membership (supporting concept of Emergence)	Experts, leaders, and most active members of a community. Although other types of communities also have core membership, CoP core members must be concerned with accepting and enabling newcomers, as well as paying attention to activities on the boundaries of the CoP (Wenger, McDermott, & Snyder, 2002). In addition, there needs to be evidence of rotating expertise, as opposed to having the expertise concentrated with the same individuals (Behnke, 2001; Lave & Wenger, 1991; Lesser & Everest, 2001; Lesser & Prusak, 2002; Liedtka, Haskins, Rosenblum, & Weber, 1997; Rheingold, 2000).
3. Peripheral to Center Movement (supporting concept of Emergence)	Movement to expertise as evidenced by novices acquiring skills and specialization (Gieselman, Stark, & Farruggia, 2000; Lave & Wenger, 1991; Wenger, 1998).
4. Boundary Practices (supporting concept of Emergence)	Evidence of the community's interaction with outside communities and members on the boundary (Brown & Duguid, 1996a; McDermott, 1999; Wenger, 1998).
5. Transfer of Implicit Knowledge	Non-verbal and non-explicit knowledge gained via practice, which includes collaborative production of artifacts, as well as stories (Brown & Duguid, 1996b; Brown & Duguid, 2000; Brown & Duguid, 2001).
6. Practice (supporting concept of Transfer of Implicit Knowledge)	Active learning by engaging in doing something. (Brown and Duguid, 2001)
7. Stories (supporting concept of Transfer of Implicit Knowledge)	Stories contain 3 elements as described by Wenger, McDermott, and Snyder (2002): 1) an activity in skill-learning, problem-solving, or innovating, 2) a new method, relationship, or insight generated by this activity, and 3) how value was created from this resource. Such stories provide indirect evidence of implicit knowledge transfer.
8. Knowledge Domain	A negotiated and identified domain of knowledge (by the CoP's members) is necessary for a CoP. (Wenger, McDermott, & Snyder, 2002).
9. Learning as Principal Goal (supporting concept of Knowledge Domain)	Learning and advancement of knowledge in a given area takes precedence over task orientation. Task-based activities can exist as sub-goals (Eom & Lee, 1999; George, Iacono, & Kling, 1995; Lipnack & Stamps, 2000).

Referring to Figure 2 and Table 3, the main level identifiers describe the three broad concepts that identify distributed CoPs as derived from Wenger, McDermott, and Snyder (2002). First, emergence describes the organic development of a CoP that is not prescribed by organizational behavior, such as, management policy or initiative. The three supporting concepts of core membership, peripheral to center movement, and boundary practices represent the fluid movement between outside the DCoP and its center. The second main level concept portrays knowledge transfer that cannot be codified. This is evidenced indirectly by the supporting concepts of stories and practice, which are the activity of knowledge building – akin to learning by doing. Finally, the a DCoP's primary goal is learning, which is supported by its negotiation of its knowledge domain (Lave & Wenger, 1991; Wenger, 1998).

Assumptions, Limitations and Delimitations of the Study

Because CoPs are organic by nature, it is difficult, if not impossible, to determine their lifetimes at the onset of their formation (Wenger, McDermott, & Snyder, 2002). Therefore, this dissertation examined data gathered from WIA for a period of one year between January 2002 to the end of January 2003. Due to CoPs' emergent characteristics, a researcher can control neither the CoP itself nor its output. Because of these limitations, the case study approach was used.

Another limitation of the study pertained to implicit knowledge transfer. There is no known method of directly measuring implicit knowledge transfer. According to the literature, implicit knowledge transfer takes place during practice (i.e., active collaboration) or telling community stories (Brown & Duguid, 1996b; Brown & Duguid, 2000; Brown & Duguid, 2001). Therefore, this study was conducted under the

assumption that the presence of community stories and practice in the data analysis indicate the occurrence of implicit knowledge transfer.

The author's role as a participant researcher was also a limitation. However, this was necessary in order to gain support from the WIA community in conducting the study (See Chapter 3, **Reliability and Validity**, *Researcher's Role as Participant Observer)*

This dissertation included the following delimitations. It only addressed the characteristics of virtual communities that were unique to CoPs, but not other aspects (e.g., characteristics common to both CoPs and virtual communities). An additional delimitation concerned identification of type of virtual community if the study did not support the theoretical proposition and the first research question. In other words, this study identified Webheads in Action (WIA) as either a distributed CoP or another type of virtual community without specifying what the other type of virtual community was.

A final delimitation was this study did not use direct observation as a data gathering method. (Wenger, 1998; Preece, 2000). First, logs of asynchronous and synchronous communication provided more detailed and complete records of communication. Second, online observation would have consisted of monitoring one or more application programs of synchronous communication. Alternating and resizing windows, as well as shifting between windows reading text, would reduce an observer's effectiveness. Finally, observation of synchronous communication could reveal timing of messages (e.g., reflection, typing speed, someone called away from the computer by a distraction), none of which pertained to the more broadly defined characteristics of CoPs addressed in this study.

Definition of Terms

Artifact – Wenger (1998) describes artifacts as representations or encoding of learning, which can either be non-physical or physical. Examples are technology, media, documents, and procedures.

Cognitive Apprenticeship – Cognitive apprenticeship is the process of forming generalizations resulting from learning in authentic situations and in context (Brown, Collins, & Duguid, 1989).

Cognitive Theory – Cognitive theory is defined as learning theory that is concerned with the internal mental processes of individuals (Cobb & Bowers, 1999; Knowles, Holton, & Swanson, 1998).

Community – According to Preece (2000), a community is a group of individuals that can be analyzed in total, in smaller groups, or individually.

Community of Practice (CoP) – A CoP is a community dedicated to learning and advancing knowledge and know-how in a given subject area and among its members (Lave & Wenger, 1991; Lesser & Everest, 2001; Wenger, 1998; Wenger, McDermott, & Snyder, 2002).

Distributed Community of Practice (DCoP) – A distributed CoP is a community of practice that cannot rely on face-to-face communication as its primary form of

communication; thus, it uses computer mediated communication (CMC) and/or telecommunication (Wenger, McDermott, & Snyder, 2002).

Documentation – Documentation is composed of explicit and written records and distribution of information in either hard copy or electronic form (Wenger, McDermott, & Snyder, 2002). Examples include written procedures, records of conversations, Web sites, discussion forums, chat logs, databases, and summaries.

Domain of Knowledge – Knowledge domain refers to the collective knowledge area that a community of practice occupies itself with developing and advancing. (Wenger, McDermott, & Snyder, 2002)

Emergence – For this study, emergence is defined as the organic and evolutionary development of a community, in contrast to planned or structured development. It is evidenced by rotating leadership and expertise based on the current situation and learning goals (Wenger, 1998). Leadership in an emerging environment is demand driven and situational, in contrast to being established.

English as a Foreign Language (EFL) -- English as a Foreign Language comprises the discipline of English language learning and instruction in countries, where English is not the official language.

English as a Second Language (ESL) -- English as a Second Language comprises the discipline of English language learning and instruction in countries,

where English is the official language. Learners are usually immigrants and native speakers of languages other than English.

Explicit Knowledge – Explicit knowledge is knowledge that is symbolically represented, as well as recognized consciously as being knowledge (Brown & Duguid, 1991; Brown & Duguid, 1996b; Brown & Duguid, 2000; McDermott,1999).

Facilitation – Facilitation is a leadership function that assumes the role of moderator, mentor, or coach. Facilitation is similar to consultation, in which a leader relies on expertise, as opposed to authority (Bielaczyc & Collins, 1999; Palloff & Pratt, 1999; Rogers, 2000; Squire & Johnson, 2000).

Implicit or Tacit Knowledge – Implicit knowledge is knowledge gained via practice (i.e., performance, experience, and doing) that is not conscious or recognized by an individual as being knowledge (Brown & Duguid, 1991; Brown & Duguid, 1996b; Brown & Duguid, 2000; Cook & Brown, 1999; McDermott,1999; McDermott and O'Dell, 2001).

MOO (object-oriented multi-user domain) – An MOO is a synchronous discussion environment that employs visual metaphors of place and physical objects to help users orient themselves in a virtual environment (see MUD) (Schlager, Fusco, & Schank, 2002).

MUD (multi-user domain) – An MUD is a synchronous discussion environment that employs text-based metaphors of place and physical objects to help users orient themselves in a virtual environment (see MOO) (Schlager, Fusco, & Schank, 2002).

Negotiated Meaning – Negotiated Meaning is the shared understanding of a group of people, that is, their shared interpretation of an area or piece of knowledge. This shared understanding is gained via collaboration and conversation by the group members (Dalgarno, 2001; Lave & Wenger, 1991; Wolfson & Willinsky,1998).

Network of Practice (NoP) – A network of practice is a more loosely organized and informal entity than a CoP. It can be described as a communication network of individuals in the same knowledge domain; however, communication and discussion takes precedence over practice. From an organizational viewpoint, a CoP is positioned between an NoP and a conventional organization (Brown & Duguid, 2001; Teigland & Wasko, 2004; Vaast, 2004).

Online community – (see Virtual Community).

Participant Researcher – According to Yin (1993), participant researchers are members of the organization, on which they conduct research. Advantages consist of insider viewpoints and access to materials not available to outsiders; however, their effect on reliability of a given study must be delineated and carefully considered.

Practice – Practice is defined as the process and use of frameworks, ideas, tools, information, styles, language, and stories that are shared by a CoP's members. It is similar to "learning by doing" (Brown & Duguid, 1996a; Wenger, McDermott, & Snyder, 2002).

Reflection – Reflection is the verbalization of thought processes that takes place during collaboration (Gieselman, Stark, & Farruggia, 2000; Wolfson & Willinsky, 1998).

Scaffolding – Scaffolding is the difference between what learners can learn on their own and learning with experts (Lave & Wenger, 1991).

Tacit knowledge – (see Implicit Knowledge).

Virtual Community – A virtual, or online, community includes the following components: people, shared purpose, policies, and a computer system (Preece, 2000).

Virtual Community of Practice (VCoP) – (see Distributed Community of Practice).

Virtual Team – Using CMC as the primary form of communication, a virtual team is a group formed to complete a specific task, and it is discontinued once the task has been completed (Lipnack & Stamps, 2000).

Summary

Communities of practice (CoPs) are entities whose purpose is to advance both the knowledge of its participants, as well as to advance knowledge in the subject area, with which the community is concerned. Members of distributed CoPs communicate primarily via computer-mediated communication with little face-to-face contact.

Chapter 1 described the formation of a virtual community of teachers of English as a Foreign Language (EFL) and English as a Second Language (ESL), who were interested in applying technology in language teaching. The community is called Webheads in Action (WIA).

Based on criteria that differentiate distributed CoPs from other types of virtual communities, the author conducted a case study that compared WIA with CoP theory, specifically nine aspects that identify uniquely CoPs. Because there are areas, in which CoP theory and good practice in CMC conflict; this dissertation generated insight into these conflicting areas. In addition, CoPs were presented as organic areas, which need to achieve a state of "homeostasis" between a range of extremes in several areas. This dissertation attempted to further develop theory in distributed CoPs by producing criteria, in which distributed CoPs can be compared and examined.

Chapter 2 presents the background literature and development of the nine unique identifiers of CoPs, as well as compares distributed CoPs to other types of virtual communities. Furthermore, aspects common to both distributed CoPs and other types of virtual communities were exposed and examined. Chapter 3 outlines the iterative methodology employed in this case study, and Chapter 4 discusses the results of the data analysis. Finally, Chapter 5 presents the conclusions and recommendations based on the data analysis.

Chapter 2

Review of the Literature

Historical Overview of the Theory and Research Literature

Communities of practice trace their roots to social constructivism and Vygotsky's zone of proximal development, in which, collaboration, negotiated meaning, facilitation, and shared goals are social constructivist learning principles (Hung, 2002, Lave & Wenger, 1991; Wolfson & Willinsky,1998). Dalgarno (2001) defined this type of constructivism as dialectical. This contrasts with conventional constructivism, which focuses on an individual's cognitive processes with respect to the previously mentioned principles (Herrington & Oliver, 2000; Knowles, Holton, & Swanson, 1998; Oliver & Herrington, 2000; McAlpine, 2000; Palloff & Pratt, 1999; Persichitte, 2000; Squire & Johnson, 2000). Social constructivist learning addresses ill-structured problems and is implemented via group collaboration. Authentic problems, by their nature, are ill structured and require non-linear approaches (Herrington & Oliver, 2000). Petraglia (1998) argued that the learners themselves need to be convinced of a learning situation's authenticity before it can be successfully implemented. Given the number of available World Wide Web teaching tools and constant new developments, online collaboration by EFL professionals in order to share knowledge and learn about these tools qualifies as an ill-structured and non-linear problem.

Coppola (1999) studied technical writers and recommended that a discourse community based on social constructivism be set up among the members. Coppola pointed out that technical writing is essentially a social act. Language teaching is an engaging social act because instructors teach and develop materials for a tool (viz., language), whose sole purpose is communication within a social setting. Therefore EFL and ESL professionals should function well in an environment based on social constructivism.

However, ill-structured problems may be authentic, but it is possible that the actual learning situation is not authentic. “Practice fields” (e.g. simulations and role plays) can be both collaborative and based on authentic tasks (Squire & Johnson, 2000). In the late 1980s and early 1990s, situated learning, which is participating and learning in the actual situation where the learning tasks are performed, extended social constructivism in a practice-oriented direction. (Gieselman, Stark, & Farruggia, 2000; Harley 1993; Lave & Wenger, 1991). Situated learning theory was a reaction against cognitive theory. Cognitive theorists define the individual as a unit of analysis, whereas situated learning theorists define the group or a number of groups as the unit of analysis. (Cobb & Bowers, 1999; Petraglia, 1998).

Conventional education institutions are well suited for teaching cognitive and formal skills; however, they fail at teaching problem solving skills (Scardamalia & Bereiter, 1994). Theorists of situated learning asserted that traditional schooling abstracts concepts out of authentic situations (i.e., out of context), resulting in little to no transfer of learning to authentic situations (Brown, Collins, & Duguid, 1989; Brown. & Duguid, 1991; Lave & Wenger, 1991). Brown and Duguid (1996b) claimed that the workplace provides a richer environment for learning than a classroom situation.

Apprenticeship is a more natural way of learning because experts do not change their way of behavior in practice. Novices or apprentices learn in an environment, in which they become immersed in the culture and environment located where the actual context takes place.

Cognitive apprenticeship is a major aspect of situated learning. In contrast to cognitive theory, cognitive apprenticeship refers to non-physical tools used in situated learning — in other words, generalizations that emerge out of the situational context. Brown, Collins, and Duguid (1989) cite language learning as an example, in which combinations of words used in actual communication are far easier to remember than a vocabulary list. In a study of engineering interns, Winsor (2001) found that the interns valued hands-on learning and direct experimentation as key to learning and understanding.

Cognitive apprenticeship consists of four components that progress from one to the other: 1) a real world activity that is an ill-structured problem, 2) apprenticeship and coaching, 3) a collaboration and multiple practice stage, and 4) a reflection stage (Brown, Collins, & Duguid;1989). Rather than taking generalizations and abstractions and applying them to different situations, as in traditional education; generalizations emerge from context via collaboration and reflection. In addition to cognitive apprenticeship, situated learning includes stories, coaching or facilitation, technology, multiple means of authentic activity or practice, and articulation of learning skills (Gieselman, Stark, & Farruggia, 2000).

Through the work of Lave and Wenger (1991), the theory of communities of practice (CoPs) evolved from situated learning theory. Table 4 summarizes the theories

and concepts of the background theory of CoPs defined in this subsection. The next section discusses and defines CoPs themselves.

Table 4. Background Theories of Communities of Practice

Theory	Main Concepts
Cognitive theory	Learning from the perspective of an individual's thought processes.
Constructivism	Negotiated meaning, ill-structured problems of an authentic nature, facilitation, and shared goals between instructors and learners.
Social Constructivism	Concepts of constructivism in combination with social and group settings, promoting collaboration, articulation and reflection to reinforce the learning process.
Situated Learning	Concepts of social constructivism, in which the learning situation is completely authentic, that is, the learning takes place where it is actually applied.
Cognitive Apprenticeship	Aspect of situated learning that describes the generalizations (i.e., the cognitive tools) that emerge from situated learning conditions.

The Theory and Research Literature Specific to the Topic

What are communities of practice?

Communities of practice (CoPs) extend the concept of situated learning to groups that purposefully or coincidentally form for the objective of learning and advancement of knowledge in a particular area of concern to the members. CoPs are informal groups that manage intellectual capital (Lesser & Everest, 2001). They are emergent and social entities, whose reason for existence is learning to solve authentic problems (Wick, 2000; Wenger, 1998). Lave and Wenger (1991, p. 98) defined communities of practice as "a set of relations among persons, activity, and world over time and in relation to other

tangential and overlapping communities of practice". “Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis.” (Wenger, McDermott, & Snyder, 2002; p.4). They link people that have common interest and expertise in a certain area (Lipnack & Stamps, 2000). Wenger (1998) points out that CoPs have always existed whether they receive support or not.

Communities of practice are organic in nature, that is, they have lifetimes of birth, maturity, and death (Collier & Esteban,1999; Gongla & Rizzato, 2004; Wenger, 1998; Wenger, McDermott, & Snyder, 2002). Because of this organic nature, Wenger, McDermott, and Snyder (2002) described CoPs in very broad terms. For example, CoPs can be small to very large, ranging from a few members to hundreds of members. Table 5 displays the broad ranges of characteristics or attributes that apply to CoPs.

However, in order for a community or group to qualify as a CoP, three requirements must be met (Wenger, McDermott, & Snyder, 2002). First, the community must possess a domain of knowledge, which comprises key issues and problems that the community members experience themselves. Defining this domain (i.e., mapping this concept) is an art. Second, there must be a community of people, in which the community has an adequately informal environment for its members to have confidence to ask questions, share ideas, and show ignorance without fear. Third, the community must contain practice. Practice is defined as frameworks, ideas, tools, information, styles, language, and stories that are shared by the members (Wenger, McDermott, & Snyder, 2002). However, practice is the process and use of these concepts, involving dynamic learning within the context that takes place while members collaborate on authentic tasks (Brown & Duguid, 1996a). Practice in CoPs is specifically geared towards learning.

Table 5. Range of Attributes of Communities of Practice.

Attribute	Range	Supplementary Information
Size	A few members to hundreds of members.	Large CoPs are often subdivided.
Lifetime	Short-lived to long-lived. A few months to several years.	
Participants' Background	Homogeneous to heterogeneous.	With heterogeneous CoPs, strong bonding can occur with time.
Institutional	Insider to across institutional boundaries.	Includes cross-organizational and cross-company boundaries.
Planning	Spontaneous to intentional.	
Institutional Support	Unrecognized or institutionalized.	
Geographical Dispersement	Collected to distributed.	Importance of face-to-face contact is still an open question. No minimum time frequency between member meetings (e.g. can be once or twice a year). Distributed communities are on the rise.

(Wenger, McDermott, & Snyder, 2002)

Wenger, McDermott, and Snyder (2002) emphasized that a community without a knowledge domain is not a CoP, rather a group of friends or a social network. Brown and Duguid (2001) distinguished between CoPs and "networks of practice" (NoPs). Although CoPs are informal structures, NoPs are looser and more informal. Thus, Brown and Duguid placed CoPs between NoPs and traditional organizational entities, such as businesses or departments. Furthermore, Wenger, McDermott, and Snyder stressed that

CoPs are not teams. With teams, production is the main objective; whereas the main objective of CoPs is learning. However, it is true that teams may form within CoPs to accomplish certain tasks.

Communities of practice possess several characteristics that separate them from other types of communities and groups. The following subsections describe these aspects and characteristics.

Characteristics of CoPs: 1. Core Membership

Center, expert, or core membership of a given community of practice usually emerges with a maximum of about 20 members, given a community of practice with hundreds of members (Wenger & Snyder, 2000). Lipnack and Stamps (2000) described virtual teams as having a ring of membership with a core layer of approximately 20 members, a middle layer of approximately 50 members, and an outer layer of up to 200 members. Duarte and Snyder (2001) designated these layers as "core, extended, and ancillary" (p. 98). In a study of a CoP of online educators that communicate via a MOO (object-oriented multi-user domain), Schlager, Fusco, and Schank (2002) found that 15% of the total CoP membership logs in and out once per month, with as much as 40% of the total membership logging in once and never again. Thus, most members are not active.

Therefore, distributed CoPs and virtual communities have an active core membership of 15% to 20%. Although Schlager, Fusco, and Schank (2002) noted that active members drift in and out, this characteristic can be interpreted as rotating leadership and expertise (see subsection *Supporting Concepts of CoPs and VCs: 1. Roles and Rotating Leadership*) (Lipnack & Stamps, 2000; Preece, 2000; Wenger, McDermott, & Snyder, 2002).

One key aspect of expertise and core membership with respect to CoPs is the way experts solve problems compared to novices. Experts have a volume of theories that they can test mentally, beginning with the least complicated theories. Novices most often use step-by-step procedures to solve problems (McDermott, 1999). Preece (2000) added that experts solve problems differently from novices, relying heavily on implicit or tacit knowledge developed through experience (see *subsection Characteristics of CoPs: 4. Knowledge: Community, Explicit, and Implicit*). In an analysis of previous studies, Hill (1999) observed different behavior in the way that experts and novices conducted information search strategies. Novices used general searches, exploration, and browsing as strategies, whereas experts planned, evaluated, and refined strategies, as well as noticed subtle clues in successive search results. In a comparison study of three CoPs, Ardichvilli, Page, and Wentling (2002) attributed a wide variety of expertise and larger number of core members to the most successful of the three CoPs.

However, it must be emphasized that CoPs comprise a wide range or continuum of expertise, for they are not only experts grouped with novices. Thus, there is no clear dividing line between novices and experts because of the continuum or range of expertise. Furthermore, expertise rotates because of the wide range of knowledge; in other words, knowing which individual possesses expertise is perhaps more important than having the expertise itself (Behnke, 2001; Lave & Wenger, 1991; Lesser & Everest, 2001; Lesser & Prusak, 2002; Liedtka, Haskins, Rosenblum, & Weber, 1997; Rheingold, 2000). In other words, communities of practice have no clear periphery or center (Lave & Wenger, 1991).

Characteristics of CoPs: 2. Peripheral to Center Movement

Peripheral to center movement (i.e., novice to expert) is also called legitimate peripheral participation (LPP) (Gieselman, Stark, & Farruggia, 2000; Lave & Wenger, 1991; Wenger, 1998). Different areas of expertise coexist within a given CoP, which is a key difference from traditional learning environments. Traditional learning environments aim to establish and test the same level of expertise (Bielaczyc & Collins, 1999). Bloomer and Hodkinson (2000) noted that social and cognitive apprenticeship occur in many places outside of education, that is, novice learning is ubiquitous.

The term “legitimate” in LPP means that that novices have an integral reason for being in the CoP, and their participation is as important as expert participation. "Inexperience is an asset to be exploited" (Lave & Wenger, 1991; p. 117). According to Lave and Wenger, legitimate peripheral participation is akin to apprenticeship learning, in which novices perform legitimate work, often taking on the more general and less skilled work. By doing this, novices can obtain a general overview of the specific learning area, in which they are involved. Novices can participate directly in a gradually increasing manner, in which enculturation, negotiated meaning and artifacts (see subsection *Characteristics of CoPs: 5. Artifacts*), as well as implicit knowledge (see subsection *Characteristics of CoPs: 4. Knowledge: Community, Explicit, and Implicit*) are transferred (Brown, Collins, & Duguid, 1989). Legitimate peripheral participation is learning from an insider’s viewpoint, which includes learning to function socially and culturally (Brown & Duguid, 1991).

Lave and Wenger (1991) divide LPP into three interpretations that function simultaneously and are based on Vygotsky’s zone of proximal development (ZPD): 1) the "scaffolded interpretation", defined as the difference between what learners can learn on

their own and learning with experts, 2) the "cultural interpretation", which is the difference between traditional instruction and every day experience of the individual, and 3) the "collectivist/social interpretation", that is, the difference between individuals' every day activities alone and with groups. All of these interpretations interact in LPP.

Because of their lack of expertise, novices in a community force experts to explain their knowledge in understandable terms. This phenomenon adds reflection and clarity in the process of building community knowledge (Scardamalia & Bereiter, 1994; see subsection *Supporting Concepts of CoPs and VCs: 6. Reflection*). Scardamalia and Bereiter proposed restructuring schools to be based on assisting research communities and publishing in scientific journals, which would give students the roles of novices in the wider research community.

In a case study of learning impaired students, Englert, Berry, and Dunsmore (2001) found that novice-expert dyads produced better learning products than experts alone. Ludwig (1999) observed geography students consulting a listserv of experts, finding an enriching exchange resulting from students' specific questions. Zhao, Englert, Chen, Jones, and Ferdig (2000) cited the opportunities of apprenticeships between peers, instructors, and outside experts.

Finally, there is one key aspect, in which LPP extends the traditional interpretation of master-apprenticeship relationships. This relationship is "de-centered" because learning comes from other apprentices and not only masters; thus, creating a continuum of expertise, as well as branching expertise (Lave & Wenger, 1991). This concept of "continuum" not only manifests itself within CoPs, but between CoPs as well. The next subsection addresses this concept.

Characteristics of CoPs: 3. Boundary Practices

Communities of practice are permeable in the sense that a continuum extends from the center to the periphery and beyond. In other words, their boundaries are not clearly defined (Wenger, 1998). One reason for this permeability is that individuals often belong to more than one CoP, creating this boundary effect. For example, Riehl, Larson, Short, and Reitzug (2000) recommended blurring the boundaries between applied and theoretical research by establishing communication between researchers and practitioners.

Boundaries between CoPs are the "places" or "entry areas" for novices and new ideas in a CoP. They are the places, where new ideas and radical new theories emerge. However, Wenger (1998) noted that boundary practices are often unnoticed, unacknowledged, or not valued by core members. New theories and ideas cause debate and comparison to "accepted" community knowledge by its members, including core members. Even if a given new idea is not accepted by a CoP, the debate and reflection cause deeper understanding and newly generated knowledge of the old accepted ideas (McDermott, 1999). Brown and Duguid (1996a) emphasized that activity at the periphery of a CoP is as important as the work that goes on in the center.

Brown and Duguid (2001) classified organization knowledge as "sticky" or "leaky", in which non-marketable sticky knowledge stays within the organization and marketable leaky knowledge moves between organizations. They attributed this knowledge link to practitioners' belonging to the same CoPs, but to different organizations. They also noted that organizational attempts to prohibit this leaky outflow of knowledge are usually counterproductive because the corresponding inflow of leaky

knowledge for the organization also becomes inhibited. Thus, permeable boundaries of CoPs are bi-directional. The next subsection discusses knowledge in CoPs.

Characteristics of CoPs: 4. Knowledge: Community, Explicit, and Implicit

According to Wenger, McDermott, and Snyder (2002), communities of practice steward knowledge. Knowledge entails "thinking with information" (McDermott,1999, p. 112). However, knowledge is traditionally viewed as what is taught traditionally or what resides in knowledge databases. Databases contain only a small percentage of knowledge used in practice (McDermott, 1999; Saint-Onge & Wallace, 2003; Stapleton, Smith, & Murphy, 2005). In addition, most populated databases designed to be knowledge bases contain large volumes of information that are rarely used or accessed (Brown & Duguid, 2000; McDermott,1999).

This knowledge is “explicit”, that is, it exists in language and/or graphical form; moreover, it is labeled as knowledge. Traditional education espouses the transfer of explicit knowledge. Brown and Duguid (1996b) observed that current educational technology is occupied with the transfer of knowledge from teacher to learner. In other words, it is teacher centered and only explicit knowledge is measured.

CoPs are concerned with community knowledge, which Harley (1993) described as both agreed-upon and tacit intersections of individual perceptions. Implicit and explicit knowledge are two different types of knowledge, which work together (Cook & Brown, 1999). McDermott (1999) noted that most knowledge does not reside in databases, rather it is gained through practice because it is implicit. Roth (1998) added that much knowledge in the field of design is tacit or implicit. Cook and Brown (1999) classified knowledge into three forms: 1) individual vs. group, 2) explicit vs. implicit or tacit, 3)

what is known in the mind, and 4) knowledge in practice. Community knowledge, implicit knowledge, and knowledge gained from practice are important concepts with respect to CoPs.

Hindmarsh and Heath (2000) observed that individuals developed a common local understanding of an object via verbalizing their thought processes, although this understanding was not complete. This lack of complete understanding by any one individual gives rise to the concept of community knowledge, which surpasses individual knowledge (Bielaczyc & Collins,1999; Gherardi & Nicolini, 2000; Wolfson & Willinsky, 1998). Winsor (2001) terms this aspect "distributed cognition". Winsor noted that even experts work with incomplete knowledge in situations, in which knowledge is changing constantly.

Taylor (1999) confirmed that community knowledge exceeds individual knowledge. However, much of this knowledge is implicit and non-verbal because of the fast-paced nature of working in communities and organizations. In other words, communities and organizations possess much knowledge that the community or organization itself does not understand. McDermott and O'Dell (2001) noted that an organization's culture and core values are often implicit. Brown and Duguid (1991) compared explicit knowledge to a roadmap, which, by its nature, does not take into account road conditions, construction sites, and traffic (i.e., the implicit knowledge).

Implicit or tacit knowledge transfer is a major difference between CoPs and traditional forms of education and training. Implicit knowledge is transferred via direct practice (e.g., experts and novices working together), which Brown and Duguid (1996b) referred to as "stolen knowledge".

Another method of transferring implicit knowledge is by telling community stories (Brown & Duguid, 1996b; Brown & Duguid, 2000; Brown & Duguid, 2001). Saint-Onge and Wallace (2003) add that stories of experience contain implicit knowledge transfer. Community stories contain both explicit and implicit knowledge (Lave and Wenger, 1991). Brown and Duguid (2000) studied photocopier technicians. They observed that the technicians solved complex repair problems via improvisation and by exchanging stories in small local groups during breaks, rather than by consulting procedural repair manuals.

In addition to containing explicit, collective and tacit knowledge; these stories are dynamic and modified as new diagnoses and experiences are obtained by the collective group, or CoP. In contrast to stories, explicit and prescribed procedures of organizations lower the skills of workers (Brown & Duguid, 1991). Wenger, McDermott, and Snyder (2002) noted that good stories contain three elements: 1) an activity in skill-learning, problem-solving, or innovating, 2) a new method, relationship, or insight generated by this activity, and 3) how value was created from this resource.

A common view of implicit knowledge is that implicit knowledge has not been made explicit yet; however, that is not the case (Cook & Brown, 1999). Moreover, making implicit knowledge explicit does not guarantee its transfer, and it can have an opposite or a distorting effect (Brown & Duguid, 1991; Brown & Duguid, 1996b; Cook & Brown, 1999; Saint-Onge & Wallace, 2003). Knowledge is embedded in context and cannot be separated from the context (Gieselman, Stark & Farruggia, 2000). In addition to storytelling; CoPs combine explicit, implicit and community knowledge via conversation, facilitation (see subsection *Supporting Concepts of CoPs and VCs: 3.*

Facilitation), and legitimate peripheral participation (see subsection *Characteristics of CoPs: 2. Peripheral to Center Movement*) (Wenger, McDermott, & Snyder, 2002).

Wick (2000) added that it is not knowledge itself that is so valuable, rather it is the ability of an organization's members to generate knowledge and innovate using that knowledge; in other words, practice. Herman (2001) emphasized that knowledge is so dynamic that planning and work need to be reactive, rather than incremental — akin to riding successive waves.

Finally, the term "knowledge" itself implies possession. Based on an analysis of three case studies, Cook and Brown (1999) separated "knowing" from "knowledge", stating that knowledge is a tool of knowing. Knowing is a relation, which means to apply knowledge in a current activity or practice. Roth (1998), in referring to design, termed "knowing that" as corresponding to resources and "knowing how" as corresponding to practice. Knowing extends implicit and explicit knowledge into action, or doing. Brown, Collins, and Duguid (1989) added that natural learning occurs within activities, in which implicit knowledge, enculturation, and communication play most likely a more important role than explicit knowledge. Table 6 presents the three types of knowledge and modes of transfer. Artifacts, which are introduced in the next section, play a major role in knowledge transfer between members of CoPs.

Table 6. Types of Knowledge and Methods of Transfer.

Knowledge Type	Methods of Transfer
Explicit	Collaboration, stories, databases, documentation, and traditional instruction.
Community	Collaboration, negotiation, and stories.
Implicit or Tacit	Practice and stories.

Characteristics of CoPs: 5. Artifacts

A community of practice generates "artifacts", that is, any physical or non-physical representations or encoding of its learning (e.g., procedures, diagrams, technology, documents, etc.) (Roth, 1998; Wenger, 1998). Additional examples of artifacts include language, jargon, drawing and labeling conventions, asynchronous postings, chat logs, and e-mail records (Etzioni & Etzioni, 1999; Winsor, 2001).

Artifact production is shaped by social forces and by mutual understanding of artifacts' purposes (e.g., agency of artifacts, interaction networks, and constructed meaning of artifacts). CoP member interaction generates processes, and artifacts comprise the community product (Gherard & Nicolini, 2000; Lesser & Prusak, 2002; Lipnack & Stamps, 2000; Wenger, 1998; Wenger, McDermott, & Snyder, 2002).

There is a social and collaborative definition of a given artifact that is beyond the referent definition of any individual (Hindmarsh & Heath, 2000). In a case study of an eight-member inter-organizational team; Majchrzak, Rice, King, Malhotra, and Ba, (2000) postulated that it was the development of artifacts and shared language that caused a virtual team to move ambiguous problem solving, formerly implemented at face-to-face meetings, to the Internet.

Barnes (2000) supported this concept by pointing out that communities develop procedures and practices of usage with respect to communication; including responses, non-responses, patterns of response, and forms of response. For example, an e-mail, a written letter, or a personal phone call; all of which communicate the same explicit content; will each have a different implicit connotation attached to it. Cook and Brown (1999) identified meanings that groups apply to artifacts as genres.

Roth (1998) observed the cultural development of a glue gun in a community-oriented science course because it, as well as the skills necessary to use this tool, had become a scarce resource. The tool, or artifact, shaped the communication. He also defined "actor networks", which do not distinguish between people and artifacts of the community. This actor network viewpoint helps to understand the collectivity of a community.

According to Brown, Collins, and Duguid, (1989), meanings of tools and artifacts are negotiated (see subsection *Supporting Concepts of CoPs and VCs: 2. Negotiated Meaning*). Lave and Wenger (1991) noted transparency of artifacts emerges, and it attaches tacit or implicit knowledge transfer as participants become absorbed in a community's culture. Emergence is the next key characteristic of CoPs.

Characteristics of CoPs: 6. Emergence

A community of practice exhibits emergent behavior in a given environment, that is, behavior often different from the intended design of the community (Brown & Duguid, 1991; George, Iacono, & Kling, 1995; Wenger 1998; Wenger, McDermott, & Snyder, 2002). Emergence is the concept that embraces the organic nature of CoPs. Brown and Duguid (1991) warned that prescribed groups can upset the natural behavior

that is essential in learning among individuals. Herman (2001) noted the reactive quality of emergent and iterative behavior, which is necessary for the continuous learning required in today's working environment.

In a study of 115 graduate students, Nachmias, Mioduser, Oren, and Ram (2000) observed an increase in emergent collaboration in a Web-based course. George, Iacono, and Kling (1995) compared 38 cases of groups of clerical workers and groups of professional workers over a period of nine years. They found that groups that were managed in a top-down style did not have the emergent characteristic of CoPs, in contrast to other groups with "grass roots" organizational styles. Powell, Koput; and Doerr (1996) found a significant relationship between emerging ties among biotechnology companies, including competitors, and a given firm's growth rate.

Distributed Communities of Practice versus Virtual Communities and Virtual Teams

In the previous subsections of this literature review, CoPs were defined as learning entities without any references to their environment or the technology used to sustain communication. According to Wenger, McDermott, and Snyder (2002), CoPs can exist both physically and virtually. They refer to a community of practice that is geographically dispersed and communicates primarily via CMC as a distributed CoP. This subsection puts distributed CoPs in perspective with other entities that communicate primarily with CMC, namely virtual communities and virtual teams.

In the literature, the distinction between virtual communities and virtual teams is fuzzy. Both of these entities employ CMC as the primary source of interaction between their members. Eom and Lee (1999) studied a virtual team that consisted of 1000 members, and they note that a virtual team can have an infinite number of members. As

mentioned in a previous subsection of this literature review, Lipnack and Stamps (2000) presented virtual teams as layered entities with an outer ring of up to 200 members and a core of approximately 20 members (*see Characteristics of CoPs: 1. Core Membership*). Like CoPs, virtual teams cannot be classified according to size.

Duarte and Snyder (2001) classified virtual teams into several types, one of which is called a "networked team", whose members "collaborate to achieve a common goal or purpose" (p. 5). Networked teams are a pool of individuals that possess various expertise with fluid membership, that is, this type of virtual team is continuous and without a limited time span. Lipnack and Stamps (2000) cited the existence of "teamnets", which are networks of virtual teams. Both of these terms refer to the broader concept of virtual community.

Lipnack and Stamps (2000) pointed out that virtual teams form for a specific purpose and disband when that purpose is achieved. This temporary and task-oriented focus is the key difference between virtual teams and virtual communities. Eom and Lee (1999) added that task force teams deal with temporary problems, and they are disbanded when the task is completed.

Virtual communities exist for longer periods, and their goals are more general. Preece (2000) described distributed CoPs as a specific type of online community, that is, in which learning and informal membership are the main characteristics. Johnson (2001) regarded a virtual community as a designed entity using CMC, which can allow a CoP to emerge. This assumes the three requirements of CoPs are met (i.e., domain, community, and practice; see subsection *What are Communities of Practice?*). Communities of practice can potentially, but not necessarily, emerge in a virtual community. As with any

CoP, the learning domain and interest must be shared by the participants for a distributed community of practice to emerge (Wenger, 1998; Wenger, McDermott, & Snyder, 2002).

However, subgroup formation and reformation (i.e., virtual teams) is a sign of a healthy virtual community, especially large communities (Kim, 2000). Wenger, McDermott, and Snyder (2002) added that distributed CoPs benefit from "localness", which is an attempt to maximize informal chance meetings. Therefore, they recommended distributed CoPs form local chapters, in which representatives from each local chapter communicate on global issues. In a distributed CoP, this can allow for synchronous communication for CoPs that span time zones.

Furthermore, smaller groups are the best size for development of both innovative knowledge and deep personal relationships. Schlager, Fusco, and Schank (2002) noted that online learning and collaboration takes place most efficiently in groups of five or six. Thus, virtual private space is essential for subgroup development (Kim, 2000; Lipnack & Stamps, 2000).

A bottom-up view of virtual communities portrays a pool of membership, in which virtual teams can form. Kim (2000) observed that a bottom-up approach to setting up virtual subgroups or teams results in high community motivation. Lipnack and Stamps (2000) noted that virtual teams are subsets of a community of practice, that is, one phenomenon of a virtual community of practice is to form and reform virtual teams from its members.

Virtual communities and their virtual team subsets offer several advantages that are conducive to the formation of communities of practice. Currently, most virtual organizations are formed according to need like communities of practice (Squire & Johnson, 2000). Like communities of practice, online communities evolve or emerge

organically in virtual environments, as opposed to being purposefully structured (Lipnack & Stamps, 2000; Preece, 2000; Rheingold, 2000; Wiesenberg, 1999). They are democratic organizations that differentiate between chaos and disorder. This aspect contrasts with traditional organizational structures, which have low tolerance for change (Collier & Esteban, 1999).

The literature describes effective virtual communities as fluid, flat, loosely organized, or "federated" (Behnke, 2001; Boudreau, Loch, Robey, & Straub, 1998; Rheingold, 2000), in which this aspect is also inherent in CoPs (Lieberman, 2000; Squire & Johnson, 2000; Wenger, 1998). Boudreau, Loch, Robey, and Straub described virtual organizations as loose alliances and possibly inter-organizational — whether they are in the form of joint ventures, strategic alliances, outsourcing, consortia, or franchises.

Collier and Esteban (1999) termed this loose organizational structure as "participative". Although Ahula and Carley (1999) found that routine tasks are best completed via centralized and hierarchical organization (i.e., both online and in physical environments), they noted that non-routine and creative tasks work best in a more participative environment. The following subsections describe further supporting characteristics that CoPs and virtual communities (VCs) have in common.

Supporting Concepts of CoPs and VCs: 1. Roles and Rotating Leadership

Participative leadership, rotating leadership and defined roles are critical for success in virtual teams (Ardichvilli, Page, & Wentling, 2002; Cascio, 1999; Lipnack & Stamps, 2000; Nemiro, 2000). Jarvenpaa and Leidner (1999) cited shifting leadership as a success factor in a case study of 12 virtual teams. Kim (2000) extended the success

factors of roles and rotating leadership to virtual communities, and other authors tied them to CoPs (Liedka,1999; Wenger, McDermott, & Snyder, 2002).

Different participant roles in CoPs and VCs have the function of enabling access to different types of expertise and coping with geographic dispersement respectively. Kim (2000) cautioned that a tradeoff exists between control exerted by virtual community leaders and creativity of that community. With respect to CoPs, Lave and Wenger (1991) supported this tradeoff by stating that authoritarianism from experts can actually hinder learning. In other words; order, uniformity, and perceived efficiency can stifle both creativity and identification with a virtual community. Rotating leadership focuses on expertise for a given situation, rather than control over all situations.

Lesser and Everest (2001) listed the following roles in CoPs: 1) community leader or facilitator, 2) content manager, 3) education and skill developers, and 4) subject matter experts. Bradshaw, Powell, and Terrell (2004) emphasized the importance of summarizers and organizers of community knowledge. Preece (2000) outlined similar leadership roles for virtual communities: moderators, mediators, professional commentators (i.e., experts, often communicate in question and answer style chats), and provocateurs. Kim (2000) presented the following leadership functions in virtual communities: greeter, host, editor, cop, teacher or mentor, events coordinator, support, and manager. In addition, Preece (2000) cited the roles of general participants and lurkers, which can be categorized as novices in the case of distributed CoPs.

Finally, Kim (2000) noted the importance of bi-directional feedback between leaders and members of virtual communities. She also emphasized the leadership function of enthusiasts, or unofficial leaders, which help fill the gap between core

members and novices; thus paralleling the continuity between novices and core members necessary in CoPs.

Supporting Concepts of CoPs and VCs: 2. Negotiated Meaning

Negotiated meaning takes place among the members of CoPs, which facilitates peer interaction, as well as expert to novice interaction (Bielaczyc & Collins, 1999; Brown, Collins, & Duguid, 1989; Liedtka, 1999; Soden & Halliday, 2000; Wenger, 1998). Every aspect of CoPs is negotiable; therefore any rules that develop are both implicitly and explicitly agreed upon by its members (Gherardi & Nicolini, 2000), although virtual situations warrant explicit agreement (Duarte & Snyder, 2001; Lipnack & Stamps, 2000). This includes a CoP's artifacts, although this negotiation is often implicit (Roth, 1998; Wenger, 1998).

Lipnack and Stamps (2000) emphasized the importance of consensus in virtual teamwork as an investment in the team, especially during the formation stage. Kim (2000) supported negotiated meaning in the founding stages of virtual communities, emphasizing the importance of soliciting feedback and ideas from all members. She also stressed setting up methods (e.g. active discussion forums, synchronous communication, and Web pages) to show members that their ideas are being implemented.

Supporting Concepts of CoPs and VCs: 3. Facilitation

Drawing from social constructivism, facilitation is an important concept in both virtual communities and CoPs. Wenger, McDermott, and Snyder (2002) emphasized that a CoP's communities leaders are not bosses or managers — rather peers (see subsection *Supporting Concepts of CoPs and VCs: 1. Roles and Rotating Leadership*).

Palloff and Pratt (1999), as well as Bielaczyc and Collins (1999), noted that an expert's role in an online community is one of a facilitator or coach — in contrast to an authoritative role of a traditional instructor. Rogers (2000) concurred, adding that a facilitator should be, at most, a mentor. Squire and Johnson (2000) differentiated between facilitator and content provider, placing more value on the former. Borthick and Jones (2000) emphasized that an instructor becomes progressively a facilitator as learners become more comfortable with technology. Storck and Storck (2004) found that facilitators should deal with relationship development, administration tasks, and informational topics, and they should withhold posting their opinion until other community members have discussed a given issue for a time. Jonassen (1999) noted the importance of facilitating and coaching on participant motivation and performance.

Supporting Concepts of CoPs and VCs: 4. Social Scaffolding

Scaffolding is a very important feature in virtual learning communities. There are many types of scaffolding, which are briefly described here. CoPs engage in social scaffolding, whereas virtual communities can use both computer-based scaffolding and social scaffolding. A definition of scaffolding, computer-based scaffolding, and social scaffolding are subsequently explained.

First, scaffolding assumes a master-apprentice relationship, in which the master explains why something is being done (Guzdial, 1998). Scaffolding, which is a fuzzy concept, is described as any support for cognitive activity provided externally for a learner (Guzdial, 1998; Jonassen,1999; Land, 2000; Lin, Hmelo, Kinzer, & Secules, 1999; Squire & Johnson, 2000; Zhao, Englert, Chen, Jones, & Ferdig, 2000).

Lin, Hmelo, Kinzer, and Secules (1999) emphasized that simply providing solutions is not sufficient. The process itself has to be exemplified, and reflection (i.e., articulation and conscious awareness of thought processes throughout a problem solving activity) needs to be promoted. Furthermore, scaffolding should be provided at the point where it is needed (Guzdial, 1998; Herrington & Oliver, 2000). Scaffolding should take participants to the next level rather than provide total solutions (Dalgarno, 2001; Herrington & Oliver, 2000). Dalgarno added that scaffolding should provide only enough detail to achieve understanding and get the task finished. Wolfson and Willinsky (1998) noted that scaffolding is important for empowering participants to work independently, as opposed to giving them the right answers.

Guzdial (1998) noted that computer-based scaffolding, or embedded scaffolding, imitates human scaffolding. However, Dalgarno (2001) pointed out that hypertext environments cause disorientation. In contrast to positions in the previous paragraph, Dalgarno recommended guided tutorials with opportunities for exploration. Especially with respect to novices, Yang (2001) recommended limiting non-linearity.

Land (2000) analyzed a number of previous studies and concluded that learners often failed to use embedded scaffolding as aids to metacognition, especially in the case of novices. Oliver and Hannafin (2000) supported Land's position with a case study on middle school students. Procedural scaffolding was used by novices, whereas metacognitive scaffolding was not.

Rodrigues (2000) stressed that constructivist learning environments with metacognitive activities cannot be solely created through a hypertext environment. Moreover, metacognitive strategies and scaffolding are currently difficult to implement in software design. The reason for this is because constructivist problem solving is based on

language, which is difficult to reproduce in a fully computer-based environment. Thus, CMC needs to be employed as the basis for metacognitive learning. Land (2000) recommended metacognitive scaffolding in the forms of conversation, discussion, and collaboration; rather than embedded (i.e., computer-based training). Land's recommendation of social scaffolding for metacognition is also consistent with the theoretical foundations of communities of practice.

In fact, Harley (1993) described scaffolding in context with facilitation and does not differentiate between the two. Bliss, Askew, and MacRae (1996) defined scaffolding as a tutorial process between experts and non-experts. Lave and Wenger (1991) referred to the scaffolded interpretation of legitimate peripheral participation as the interaction between novices and experts (see subsection *Characteristics of CoPs: 2. Peripheral to Center Movement*). Roth (1998) supported Lave and Wenger, noting that scaffolding was a modeling activity, in which experts perform the harder tasks while novices carry out the easier tasks. Schlager, Fusco, and Schank (2002) cited the use of social scaffolding in the form of synchronous online help in assisting newcomers in a distributed CoP.

Supporting Concepts of CoPs and VCs: 5. Trust

In order for efficient exchange of information, stewardship of knowledge, and free expression of ideas to occur in CoPs, an environment of safety and trust must emerge (Callahan, 2004; Liedtka, Haskins, Rosenblum, & Weber, 1997; Saint-Onge & Wallace, 2003). Rovai (2002) defined "sense of community" as requiring safety and trust, as well as shared knowledge, values, and goals.

Virtual communities also necessitate trust to function adequately (Belanger & Collins, 1998; Grisham, Bergeron, & Brink, 1999; Palloff & Pratt, 2000; Rogers, 2000;

Saint-Onge & Wallace, 2003). Trust is also a key element of virtual teamwork (Cascio, 1999; Cascio, 2000; Duarte & Snyder, 2001; Eom & Lee, 1999; Kezsbom, 2000; Liedka,1999; Lipnack & Stamps, 2000; Mason, 2000; Preece, 2000). In analyzing the components of trust, Preece (2000) noted the importance of reciprocity, records of past behavior, ability to identify others, and anticipation of future contact — even in weak relational ties between individuals (i.e., that is relationships based mainly on information exchange with little personal exchange).

Herrington and Oliver (1999) found that social ease and experience in collaboration also made higher-order thinking more efficient among multimedia students. Edmondson (1999) observed that teams with a high degree of safety and trust were more innovative and productive than teams lacking these aspects. Jarvenpaa and Leidner (1999) analyzed 29 virtual teams and found that trust was based on consistent communication, as opposed to amount of communication. In addition, they rotated leadership, wrote fast and detailed responses, as well as used social and encouraging commentary with task-oriented communication. Malhotra, Majchrzak, Carman, and Lott (2001) provided an example of a virtual team, which developed a policy of summarizing and making public all private e-mail to keep all virtual team members in the information loop.

Lipnack and Stamps (2000), who are recognized experts in virtual teamwork, noted that traditional hierarchical organizations use force to maintain organization, whereas bureaucracies employ forms and procedures. They pointed out that networking is historically based on trust; and societies that employ trust, as opposed to other forms of organizational tactics, are the best off economically. Furthermore, hierarchical and bureaucratic measures do not work with virtual teams, due to virtual teams' distributed

nature. Ardichvilli, Page, and Wentling (2002) cited lack of trust in posted information, as well as fear of ridicule or non-acceptance by peers, as barriers to trust in CoPs. Virtual collaboration and work cannot exist without trust. Both Lipnack and Stamps (2000) and Duarte and Snyder (2001) devoted an entire chapter of their volumes on virtual teams to building trust.

Supporting Concepts of CoPs and VCs: 6. Reflection

In addition to transfer of implicit knowledge through practice and stories, another reason why CoPs are conducive to learning is because the social and collaborative environment causes members to verbalize frequently their thoughts (Herrington & Oliver, 2000). This verbalization, which is a concept of social constructivism, is known as "reflection" (Herrington & Oliver, 1999; Wolfson & Willinsky, 1998).

Reflection is articulation of learning, which is important for building conceptual understanding (Eick & Dias, 2005; Gieselman, Stark, & Farruggia, 2000). Wolfson and Willinsky (1998) pointed out that reflection externalizes processes that are normally internal; thus, aiding in both individual and collaborative learning. Learners can solve a problem implicitly on an individual basis; however this can very well prohibit any transfer of knowledge beyond the specific problem at hand. Thus, verbalizing thought processes (i.e., "adaptive expertise" versus "routine expertise") aid in transfer of thought processes (Lin, Hmelo, Kinzer, & Secules, 1999; Taylor, 1999).

Englert, Berry, and Dunsmore (2001) attributed the higher learning levels of disabled children in novice-expert pairings to reflection. In fact, Englert, Berry, and Dunsmore noted that the individuals of novice-expert dyads who were not engaged in the

mechanics of typing on the computer keyboard achieved higher metacognitive ability than the other members of the dyad— irrespective of being a novice or expert.

Finally, it seems that concepts such as reflection, social scaffolding, and negotiated meaning conflict with the CoP characteristic of implicit knowledge transfer (see subsections *Characteristics of CoPs: 4. Knowledge: Community, Explicit, and Implicit* and *Supporting Concepts of CoPs and VCs: 2. Negotiated Meaning*). In other words, reflection and negotiated add explicitness and clarity to learning via group interaction.

However, there is also an implicit aspect to language as well, which was termed "indexical" by Brown, Collins, and Duguid (1989). Indexical terms are linguistic pointers and abbreviations that arise in situational context and practice (e.g., jargon and agreed terminology) that are often only understood by the individuals engaged in communication during practice.

Current Issues in CoP and DCoP/VCoP Research

The terms "distributed communities of practice" (DCoPs) and "virtual communities of practice" (VCoPs) are used interchangeably by current researchers, which signify the same thing. Since 2002, research has highlighted five main areas with respect to CoPs, with special focus on DCoPs/VCoPs. These areas are listed as follows:

- technology in relation to DCoPs/VCoPs.
- degree of face-to-face (F2F) versus online or virtual contact.
- different terminology for online communities and DCoPs/VCoPs based on different concepts, background knowledge, and theory interpretations.

- degree of organizational control with respect to CoPs.
- identifying factors of DCoPs/VCoPs.

The following subsections address each of these factors in succession.

Degree of Organizational Control

In their volume describing an organizationally initiated CoP, Saint-Onge and Wallace (2003) described a prescribed set up and launch of a VCoP in a Canadian insurance company. Gongla and Rizzato (2004) noted the formalization of a CoP in becoming a unit or department of a given organization.

However, CoPs cannot be mandated because it jeopardizes trust within the CoP (Snyder, Wenger, & De Sousa Briggs, 2003; Wenger, 1998; Vaast, 2004). Snyder, Wenger, and De Sousa Briggs (2003) stress that CoPs membership must be voluntary. Dubé, Bourhis, and Jacob (2005) found that the relevance of VCoPs is questionable when they are formed via top-down policy or initiated by management. Ardichvilli, Page, and Wentling (2002) emphasized that management control will strangle CoPs. CoPs can also "go underground" if management does not recognize a CoP or, in contrast to lack of support, gives it too much recognition (Gongla & Rizzato, 2004).

Vaast (2004) added that management needs to take a sponsoring role of CoPs, as opposed to a reporting role. This creates a conflict between voluntary CoP membership and the realities of organizations (Bradshaw, Powell, & Terrell, 2004). Better understanding of how a CoP functions and what constitutes its essence could help gain insight on this debate.

Technology in Relation to DCoPs/VCoPs

The debate on whether online environments support implicit knowledge transfer is still prevalent in current research. Hara and Kling (2002) highlighted the limitations of text-based IT for transfer of tacit knowledge. Participants often find working with CMC laborious (Stacey, Smith, & Barty, 2004). Systems can possibly impede knowledge sharing, rather than enhance it (Davenport & Hall, 2002). Schenkel (2004) found that media richness increases implicit knowledge transfer (i.e., text-based media having low media richness, high-end multimedia having higher media richness, and face-to-face communication possessing the highest).

Participants' unfamiliarity with using online technology hampers CoP development (Davenport, 2004). Davenport observed that, although users understood the principles of using e-mail, they had difficulties in understanding the usage of discussion forums and group online tools. In addition, she noted that designers and developers of online technology have been accustomed to designing software for single users, as opposed to groups working together.

Bradshaw, Powell, and Terrell (2004) warn that changes in software and CMC environments should be slow and gradual; otherwise, participants will lose their orientation. Furthermore, technology needs to support conversational communication because people are generally better speakers than writers (Davenport & Hall, 2002). Also, a mix of technologies is needed, and no technology is comprehensive for all situations. Moreover, the system architecture must reflect the need to use multiple channels (Lee & Neff, 2004; Saint-Onge & Wallace, 2003).

Davenport (2004) concluded that the details of the technology infrastructure need to be made available to communities' participants in order for them to understand it.

Sherer, Shea, and Kristensen (2003) proposed a prototype development style with users, in which functionality is made available piece by piece. This enhances community involvement with the users and makes the technology learning curve more gradual.

However, Saint-Onge and Wallace (2003) emphasized there is always a learning curve for technology no matter how functional and easy to use it is. This is because of both the social aspect of virtual communities and becoming used to virtual communication. The social aspects are more important than the technology (Lee & Neff, 2004; Saint-Onge & Wallace, 2003). Facilitation, norms, trust, and agreements are as important as the technology and software chosen (White, 2004).

Thus, the use of technology for online community development, in particular CoPs, is still being researched. The question of face-to-face contact with respect to virtual communities is discussed in the next subsection.

Degree of Face-to-Face (F2F) Versus Online or Virtual Contact

Current research supports generally the conclusion that at least some face-to-face (F2F) contact should transpire between participants whenever it is possible, and F2F contact is important to a community's success (Ardichvilli, Page, & Wentling, 2002; Dubé, Bourhis, & Jacob, 2005; Lee & Neff, 2004). Physical isolation of participants can cause "goal slippage", that is, losing focus on community objectives (Bradshaw, Powell, & Terrell, 2004, p. 198). In a study of three groups that posted reflective messages online, Hough (2004) determined that the most reflective messages were posted by the one group that had met face-to-face.

Ardichvilli, Page, and Wentling (2002) found that newly founded DCoPs could not override existing, tight-knit, F2F CoPs. Instead, they recommended nurturing existing F2F CoPs and adding gradually technology to enhance the F2F CoPs in a virtual way.

Hung and Nichani (2002) claimed online communities of practice cannot exist in the true sense, rather they are quasi-CoPs. Hung and Nichani contended that face-to-face contact is essential for implicit knowledge transfer, whose nuances cannot be duplicated in an online environment. They asserted that participating in online communities is usually for a quick benefit, and it does not sustain long term relationships necessary for CoPs.

Conversely, other researchers maintain that weak ties may be more conducive to knowledge sharing than strong ties. Strong ties imply frequent and multi-faceted interaction between individuals, whereas weak ties are less frequent (e.g., infrequent exchange of information, casual acquaintance) (Davenport & Hall, 2002; Haythornthwaite, 2000; Haythornthwaite, 2002; Lesser & Prusak, 2002; Preece, 2000; Rheingold, 2000). The ties in virtual communities are generally weaker than in F2F situations. In describing electronic networks of practice (ENoPs), Teigland and Wasko (2004) noted the virtual environment in ENoPs contained weaker ties than in traditional CoPs, and they predicted that ENoPs would make traditional CoPs redundant.

Different Terminology for Virtual Communities and DCoPs/VCoPs

The debate of CoPs, whose theory was originally developed in face-to-face environment (Lave & Wenger, 1991), has not been settled. The concepts of virtual community, DCoPs, and other forms of online community differ between researchers and their background viewpoints.

As briefly mentioned in the last subsection, Teigland and Wasko (2004) considered online or virtual CoPs as electronic networks of practice (ENoPs). They contrast the differences between ENoPs and traditional CoPs in the following ways:

- weak social links (ENoPs) versus strong social links (CoPs).
- absence of visual clues and leaner communication (ENoPs) versus stronger and more channeled transfer of tacit knowledge (CoPs).
- support of a larger number of participants (ENoPs) versus number of participants limited by physical space and proximity (CoPs).
- more fluid boundaries (ENoPs) versus physically constrained boundaries (CoPs).
- permanent records of discussion available (ENoPs) to everyone versus no records because of personal conversations (CoPs).

This distinction draws upon Brown and Duguid's (2001) concept of networks of practice (NoPs), which are looser structures that rely on verbal communication. Vaast (2004) postulated NoPs develop when people share common work and practice, but are geographically dispersed — noting that story telling and discussion play a more central role than engaging in practice. Vaast (2004) theorized that, with intranet technology, local CoPs will combine to form NoPs. White (2004) recommended CoPs be situated within larger networks in order to enhance the inflow and outflow of information. However, she did not specify what these larger networks were called.

From a knowledge management view, Rubenstein Montano (2004) listed the following attributes of virtual communities: 1) emergence, 2) social ties, 3) self-motivation, and 4) communication having greater importance than profit. Although these attributes can also apply to CoPs or DCoPs, Rubenstein Montano did not distinguish

between VCs and CoPs. Davenport (2004) maintained that "not all online communities are CoPs." (p. 258).

In addition to the previously mentioned differences in terminology with respect to CoPs and virtual communities, some researchers classified different types of CoPs and DCoPs. Stacey, Smith, and Barty (2004) analyzed two types of CoPs: communities of learning and workplace CoPs. Lee and Neff (2004) described CoPs as spanning a range from "communities of interest" to those communities that deliver business results. Saint-Onge and Wallace (2003) categorized types of CoPs under the following classifications:

- with respect to organization: informal, formal, and structural CoPs.
- with respect to focus: communities of interest, communities of purpose, communities of expertise, professional communities, learning communities.
- CoP as methodology/approach versus CoP as result/outcome.

In summary, this subsection noted the differences and terminology with respect to virtual communities and CoPs. Some of the differences are based on theory, especially the contention that implicit knowledge transfer is subdued in virtual environments. This reduces the "practice" element of CoPs, necessitating a greater reliance on story telling in a virtual environment. Other differences cite an organizational viewpoint with respect to the community's purpose. These differences pose the question of whether researchers are discussing the same type of virtual community and/or how these communities function.

Summary of What Is Known and Unknown About the Topic

Current literature stresses the organic nature of CoPs, and how their continuity exists by remaining within ranges and not drifting too much into the extreme areas of

these ranges. Although CoPs exist and form virtually as distributed CoPs, more research is needed to determine how CMC technology affects CoPs. Alani, Dasmahapatra, O'Hara, and Shadbolt (2003) emphasized that current management lacks methodologies for identifying CoPs. Gongla and Rizzato (2004) recommended a periodic health check of the community, but there are currently no benchmarking systems for that purpose.

It is a fact that approximately 80% of a given virtual community's members, including distributed CoPs, do not participate; thus, they are classified as lurkers (Hammond, 1999; Preece, 2000; Rheingold, 2000; Schlager, Fusco, & Schank, 2002). Lurkers are at the boundaries of a distributed CoP, and it is assumed they use the knowledge gained in a given CoP in other CoPs. Proportionally, the passive participation of lurkers is much greater than in a physical CoP, and how this affects the learning and knowledge aspects of distributed CoPs is unknown.

Perhaps the most important unknown is the current text-based state of CMC with respect to the transfer of implicit knowledge, which is vital to CoPs. It is not known how this environment affects this transfer (Brown & Duguid, 1991; Brown & Duguid, 1996b; Cook & Brown, 1999). A further question is how stories, which contain both explicit and implicit knowledge, can be effectively transmitted using CMC (Lyons, 2000).

In addition, CoP theory is an interest of the members of WIA; thus, it is discussed openly among its members. Because CoPs have always existed (i.e., they are not new, but often unrecognized); much of the formation, negotiation, and operation of a CoP is also implicit. In other words, many CoPs do not label and consider themselves CoPs. It is unknown how making this aspect explicitly aware to its members will affect a CoP (Brown & Duguid, 1991; Brown & Duguid, 1996b; Cook & Brown, 1999).

White (2004) observed that, in the 1990s, the online community was the focus of research; however, current research is delving into type and purpose of a given online community. She outlines the following critical questions, which are relevant to the essence of DCoPs:

- the key attributes and relationships between networks,
- the people and methods used to keep CoPs going in online environments,
- the practices, and
- the factors that allow emergence and growth.

"While traditional face-to-face CoPs within organizations have received increasing attention, we know much less about the dynamics underlying ENoPs and the electronic knowledge exchange supported by these computer networks" (Teigland & Wasko, 2004, p. 231). "As educational researchers, we still are trying to understand what constitutes a community of practice and the implications of this model for generating new knowledge…" (Buysse, Sparkman, & Wesley, 2003, p. 265).

The Contribution This Study Made to the Field

Preece (2000) noted most virtual community research is interdisciplinary and calls for more research specific to this field. She pointed out that CoPs and other types of online communities have specialist needs. Further research needs to be done to clarify what these specialist needs are.

Roth (1998) emphasized that CoP studies are hard to replicate because no two communities will use the same artifacts (i.e., tools, language, technology, documentation,

etc.) and emerge in the same way. Establishing base criteria based on the more abstract concepts of CoP theory can allow for some basis of comparison between CoPs.

This study contributed to the distributed CoP field by addressing criteria unique to distributed CoPs; thus providing a starting point in comparing different distributed CoPs. The results of this study provided further advancement in this field in several ways. First, it opened the debate of what criteria constitute a CoP, perhaps generating further criteria or modifications of the criteria presented in this study. Second, it spawned comparison of criteria within a single case (i.e., how these criteria interact with and are dependent on each other), as well as proposed cross comparison of criteria in multiple cases. Third, criteria were quantified as metrics (e.g., percentage of types of communication within a CoP or quantities of produced artifacts) (Preece, 2000). All of the previously mentioned contributions helped to develop and refine theoretical and applied models of distributed CoPs in the future.

Furthermore, few longitudinal studies are available in the area of teachers engaging in a community of practice environment. Rather most studies examined formal teaching environments (Little, 2003).

Finally, this view of specific criteria for distributed CoPs brought directly the question of practice and implicit knowledge transfer into the research. Brown and Duguid (2001) argued that too much emphasis is placed on communities over practice in current CoP research.

Chapter 3

Methodology

Introduction

Overview

Chapter 1 described the unique identifiers of CoPs investigated in this dissertation (see the section **Theoretical Proposition and Research Questions to Be Investigated**). This chapter describes and delineates the methodology that was employed in analyzing the Webheads in Action virtual community with respect to CoP theory.

This methodology chapter is divided into three main sections:

- This introductory section, which gives background information on why the case study method was chosen, as well as the iterative nature of qualitative research.
- The **Research Methods Employed** section, which presents the main phases and milestones of the case study. Although the author, hereafter referred to as the researcher, carried out this study in an iterative manner; the milestones discussed in the section represented the main synthesis and decision points of the study.

- The **Special Procedures Employed** section, which outlines detailed explanations of the analysis techniques used in the study.

The remaining sections describe data presentation formats, reliability and validity, as well as resources used in the study.

Evolving and Iterative Nature of Qualitative Methodology and Case Studies

The theoretical proposition and research questions of this study were a focusing process (Miles & Huberman, 1994; Yin, 1993; Yin, 1994). This study comprised an iterative and continuous process, in which the researcher examined data, formed observations and theories, and reexamined the data. The study's objective was to formulate new research questions and theory, rather than establish any sort of cause and effect.

"Qualitative research is concerned with process, and understanding the process is more important than looking for an outcome" (Merriam, Courtenay, & Baumgartner, 2003, p. 174). This study was concerned with understanding the processes and characteristics of distributed CoPs.

A qualitative approach does not require objectivity or non-bias with respect to the data (Gray, 2004). Although the researcher tried to be objective, full objectivity was impossible. He took interpretive steps and made decisions throughout the methodology and data analysis. However, it was important to show that the decisions, questions, and theory were derived via analysis and interpretation of the data.

This was shown by looking for negative and tangential evidence of the theory, as well as establishing an audit trail of the analysis and methodology (Miles &

Huberman, 1994; Yin, 1993; Yin, 1994). Yin (1994) referred to this audit trail as a case study database. Its goal was not to enable replication of the study per se, but to allow interested researchers to follow the logic through the qualitative study design (see Appendices B & C).

A case study differs from other types of qualitative designs because it is focused. Grounded theory, as described by Strauss and Corbin (1998), describes thick observation and acquiring as much data as possible, formulating new theory from the data subsequently and emergently. Case studies differ because they consist of focused observation based on theory, comparing the data to the theory. Yin (1993) noted case study methodology is selective and not all inclusive like ethnographic studies. In other words, the theoretical proposition and research questions acted as filters for goal-oriented analysis (Yin, 1993; 1994).

Davenport and Hall (2002) pointed out that no studies exist for CoPs beyond the case study level. Subsequent research by the researcher to the year 2005 confirmed Davenport and Hall's (2002) assertion. The practice and implicit knowledge aspects of CoP theory are indistinguishably situational and in context; therefore, the literature dictated a case study approach (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; Roth, 1998; Yin, 1993).

This study was conducted as an interpretive case study, which developed "conceptual categories that develop, support, or challenge theoretical assumptions prior to data gathering" (Merriam, 1998; p. 38). In addition, this case study was exploratory, given the nature of untested criteria that previous studies have not presented (Miles & Huberman, 1994). Finally, this case study was longitudinal because the data analysis period was greater than 12 months. The researcher found only four longitudinal studies

of distributed CoPs in the literature since 2002 (Dubé, Bourhis, & Jacob, 2005; Hough, 2004; Lundkvist, 2004; Storck & Storck, 2004). The theoretical assumptions of this case study were the nine criteria unique to distributed communities of practice, as opposed to other aspects that distributed CoPs have in common with other types of virtual community (see Table 3, p. 14).

Because this study compared WIA (Webheads in Action) to these identified characteristics of CoP theory, it qualified as a single case (Yin, 1993; Yin, 1994). According to Yin, case study researchers use single cases in the following situations: 1) a "critical test of existing theory" (Yin, 1994; p.44), that is, developing unique criteria to identify and compare distributed CoPs; 2) for first studies of a particular type as a prelude to further studies; and 3) based on longitudinal data, or data gathered for over one year (Dubé, Bourhis, & Jacob, 2005; Hough, 2004; Lundkvist, 2004; Storck & Storck, 2004). This case study analyzed data gathered since the inception of WIA, which was a period of 13 months (i.e., January 1, 2002 to January 31, 2003).

Fisher and Bennion (2005) recommended the following analysis methods for analyzing the effectiveness of CoPs:

- Reviews and interviews (Ardichvilli, Page, & Wentling, 2002; Dubé, Bourhis, & Jacob, 2005; Gray, 2004; Hara & Kling, 2002; Little, 2003; Merriam, Courtenay, & Baumgartner, 2003; Schenkel, 2004; Stacey, Smith, & Barty, 2004; Vaast, 2004).
- Usefulness evaluation via formal review, as well as individual perception. St. Onge and Wallace (2003) employed this process via a personal review completed by the facilitator for the CoP they studied.

- Informal interviews and discussions with managers, stakeholders, individuals, and groups (Saint-Onge & Wallace, 2003).
- Surveys (Gray, 2004; Little, 2003; Saint-Onge & Wallace, 2003; Teigland & Wasko, 2004)
- E-collaboration: formative and summative analysis and reviews of forums, team rooms, and databases (i.e., where knowledge is generated and stored) (Eick & Dias, 2005; Gray, 2004; Hough, 2004; Saint-Onge & Wallace, 2003). These types of reviews included analysis of electronic message content.

This case study employed analysis of asynchronous and synchronous message content, Web sites, as well as an online survey of the WIA virtual community members. The researcher also implemented an online survey of selected participants as supporting analysis. However, the researcher relied most heavily on analysis of electronic communication data because it was a primary data source, whereas the other previously mentioned analysis methods focus on secondary data.

Decisions in the Iterative Process of Examining the Data

The iterative nature of the methodology of this study cannot be emphasized enough. The researcher posed, visited, and revisited the questions, concepts, and policies of both the data and the methodology. This included reexamining and recategorizing previously categorized data when there had been a change in interpretation or policy of the analysis (Miles & Huberman, 1994).

The researcher derived the theoretical proposition, the research questions, and the initial categorization scheme as tools for focusing the data analysis at the beginning of the study. However, this focusing process continued through the end of the data analysis (Miles & Huberman, 1994; Yin, 1993; Yin; 1994). Appendix C presents a chronological listing of memos, all of which link to corresponding data units (i.e., communication acts) that were categorized. Thus, Appendix C provides both an audit trail of the data analysis, as well as chronological documentation of the detailed decisions involved in this iterative process (see also **Specific Procedures Employed**, *Memos with Respect to Communication and Artifact Logs*).

However, the decisions documented in the memos were divided into the following main areas:

- with respect to the delineation of communication acts (Henri, 1992; Jonassen & Kwon, 2001). Miles and Huberman (1994) refer to communication acts as chunks of sentences or paragraphs that are monothematic (see **Specific Procedures Employed**, *Conversation Analysis*).
- type of communication that evidenced collaboration. These decisions had implications on both the categorization scheme as well as relevance of an entire data area (see **Research Methods Employed**, *The Interim Case Study Report: Artifacts vs. Documentation*).
- type of communication that constituted both negative and tangential instances of a given category, as well as which instances confirmed the category.

Research Methods Employed

Introduction

The researcher conducted the following steps to complete this case study, which consisted of data categorization and re-categorization throughout. Referring to the iterative nature addressed in the previous section, these steps represent milestones within the study:

- Initial definitions of the unit of analysis, independent variables, and embedded subunits, plus consolidation of the data.
- The pilot case study.
- The interim case study report.
- Final analysis of communication data and survey data.
- Formation of new theoretical propositions in the form of research questions (see Chapter 5).

Initial Definitions

After the literature review and the decision to conduct a single case study — which was exploratory, interpretive, and longitudinal — the researcher implemented the following preliminary actions:

- designation of a unit of analysis,
- designation of the independent variables,
- arrangement of the variables into embedded subunits
- consolidation of the data.

The researcher defined the WIA community as the unit of analysis (Cobb & Powers, 1999; Hoadley & Pea, 2002; Yin, 1993). The unit of analysis coincided with the theoretical proposition and the research questions of this study, as described in Chapter 1 (see also **Specific Procedures Employed**, *Unit of Analysis and Embedded Subunits*).

Raw data were extracted from Web sites, chat logs, and asynchronous forum logs. Raw data were collected from the following sources:

- logs of asynchronous communication in the form of Yahoo Group postings and synchronous communication from the logs of the Tapped-In MOO (Object Oriented Multi-user Domain) (Ardichvilli, Page, & Wentling, 2002; Dubé, Bourhis, & Jacob, 2005; Saint-Onge & Wallace, 2003; Storck & Storck, 2004).
- artifacts in the form of Web publishing by WIA's members (i.e., Web sites, articles, and summarized online meetings), and
- online survey data from representative samples of participants (Gray, 2004; Hawkes, 2001; Little, 2003; Merriam, 1998; Miles & Huberman, 1994; Squire & Johnson, 2000; Preece, 2001; Saint-Onge & Wallace, 2003; Teigland & Wasko, 2004).

Survey data served as support for the other two sources, which were the main sources of data (Merriam, 1998; Yin, 1993). Given the exploratory nature of this case study, the researcher did not use prior instrumentation (Miles & Huberman, 1994; Rourke & Anderson, 2004). At this stage, the researcher had not developed the survey (see **Specific Procedures Employed**, *The Survey*).

The researcher did not employ direct observation because of the availability of logged sessions, as well as the unreliability of direct observation in online environments (Preece, 2000). Although Wenger (1998) based his theories on direct observation, he was physically present during those observations. Preece (2000) noted that direct observation online comprises direct monitoring of one or possibly more synchronous programs simultaneously, in which the observer relies upon the feedback presented by the CMC programs as output on a computer screen (see the **Assumptions, Limitations, and Delimitations** section of Chapter 1).

The Pilot Study

The goal of the pilot case study was to test and validate the categorization and embedded subunits, as defined in the previous subsection (Yin, 1993; Yin 1994). Miles and Huberman (1994) advised initial coding of data into the designated categories (i.e., the independent variables) in order to focus the data collection process. However, Miles and Huberman (1994) warned that the researcher must avoid hammering the data to make it fit into this categorization scheme. In other words, the purpose of initial coding was to provide direction in the data analysis. Miles and Huberman (1994) also noted that a researcher must be flexible and alert, in the event that the data needed to be rearranged from this initial categorization scheme — resulting from more detailed analysis. The researcher accomplished this validation by employing the following steps.

First, the researcher introduced his categorization scheme to three other participant coders, who belonged to the WIA community and had research interests in CoPs. He used synchronous discussion and a Web site to introduce the independent

variables. During the discussion, the other coders asked questions and provided opinions on the arrangement of independent variables into their embedded subunits. They also had the opportunity to propose another arrangement of the variable scheme, although none of them exercised this option during the discussions.

Subsequently, the researcher sampled the body of data (i.e., from communication logs and documentation) during different time periods during the data analysis period: January 2002, April 2002, June 2002, October 2002, and January 2003. Compared to the volume of total data categorized, the amount categorized and analyzed was miniscule (i.e., less than 1%). This totaled to 20 asynchronous sample communication acts and 35 synchronous sample communication acts.

He then categorized the data according to the initial categorization scheme via conversation analysis (Preece, 2000; Schlager, Fusco, & Schank, 2002) (see **Specific Procedures Employed**, *Conversation Analysis*). The three other coders independently categorized the same data. Differences with respect to categorization between the three other coders and the main researcher were discussed and agreed upon, resulting in modification of the classification scheme (Miles & Huberman, 1994).

The analysis, as well as live feedback from the other researchers, resulted in the following measures:

- Decision to forgo the metric of interrater percentage as an indicator of reliability as outlined by Miles and Huberman (1994). (see **Reliability and Validity**, *Conversation Analysis, Communication Acts, Thematic Units, and Interpretive Burden*). Nevertheless, the other researchers offered suggestions used by the main researcher. This exchange also required the

researcher to articulate and systematize the categorization process (see Appendix F). However, the other researchers did not possess the theoretical background necessary to classify the communication acts on their own (Rourke & Anderson, 2004).

- Data extraction in smaller chunks. Longer communication acts tended to confuse the other researchers; therefore, the main researcher endeavored to make the units as small as possible (see **Specific Procedures Employed**, *Conversation Analysis*). Shorter communication acts increased the mutual exclusivity of categorization, although splitting longer messages never achieved this goal perfectly (see **Reliability and Validity**, *Conversation Analysis, Communication Acts, Thematic Units, and Interpretive Burden* & Chapter 5, **Implications**, *Implications of Methodology*).
- Classifications were strictly based on the content of the communication and not based on references or background knowledge within the communication. The researcher developed a detailed procedure for classification of messages (see Appendix F), which also served as a training procedure for the other researchers (Rourke & Anderson, 2004). The researcher noted that this policy was consistent with the concept of the community as the analysis unit (see **Specific Procedures Employed**, *Unit of Analysis and Embedded Subunits*).
- Further spot checks by the three other researchers, as well as online meetings between the main researcher and the other researchers, as the data analysis continued. That is, they categorized five communication acts from

each of the asynchronous and synchronous communication categories per spot check. There were three such spot checks performed by the other researchers during the pre-interim data analysis, which helped further develop the previously discussed issues in points #1, #2, and #3 of this list.

- The other researchers also provided feedback on the questionnaire for the online survey. This feedback helped in the final validation of the survey questionnaire. Appendix D contains the final questionnaire (see also **Specific Procedures Employed**, *The Survey*).
- Modification of the variable scheme with respect to classification of the communication data. The hierarchy of the independent variables remained the same; however, the researcher added a second embedded subunit (i.e., Sublevel 2). All of the previous communication data were reclassified according to this more detailed scheme (see **Specific Procedures Employed**, *Conversation Analysis*), and this modified hierarchy (i.e., with the added Sublevel 2) was employed until the end of the study.

Yin (1994) noted that a pilot case study's purpose is to refine, narrow, and focus data gathering methods and provide "lessons learned" in both research design and data gathering procedures. Moreover, the pilot case study functioned as a prototype for the final case study; thus saving time before committing substantial resources to the final case study. The pilot study was the first major refinement of the data gathering methods (i.e., to circumvent fuzzy categorization). In addition, the pilot study was the first milestone in the iterative and ongoing nature of the categorization process (Merriam, 1998).

The Interim Case Study Report

The interim report stage culminated the first third of the data analysis, that is, after one-third of the communication data had been categorized. The objective of the interim report was to provide a preliminary data analysis and summarization to determine if there were rival explanations unforeseen by the researcher. It consisted of a trial run of the summarization methods, development of summarization diagrams and displays, as well as a check on the study's progress (Miles & Huberman, 1994). At this point in the study, the researcher wrote a 50-page report, which functioned as a self-check and self-evaluation for the data summarization and the direction of the study.

The researcher also reviewed the data classifications and the memos to February 2004 — when the interim report was compiled. The researcher used a memo journalizing technique that linked to the original raw data (i.e., using the same coding technique as was applied to the raw data). This reference linked to the categorized communication act from where the memo idea and insights originated (see **Specific Procedures Employed**, *Memos with Respect to Communication and Artifact Logs*).

This review of the memos, as well as the review of the interim report itself, was self-conducted by the researcher. Also, during this time, the researcher carried out the online survey and categorized the survey data. The analysis leading up to the interim report included the following.

First, using conversation analysis (see section **Specific Procedures Employed,** *Conversation Analysis*), all of the data were analyzed and categorized according to the previously described categorization scheme (see Table 8, p. 86), allowing for revisions in categorization as prescribed by the pilot case study and more detailed data analysis.

During conversation analysis, the researcher looked for and found examples that conflicted with and provided alternate explanations to the categorization scheme (Miles & Huberman, 1994; Yin, 1994).

The researcher analyzed and summarized the data, according to the following methods as described by Miles and Huberman (1994). In addition to the development of visual displays and summaries, this analysis included initial calculation of metrics (see **Formats for Presenting Results**). The results of the interim report stage follow:

- Further refinements to the classification procedure. Although the classification scheme retained the same hierarchy to the end of the study, further refinements were made to the classification procedure (see Appendix F), which is summarized in Figure 3 (p. 92).
- Establishment of data views, which connected the theoretical proposition and research question to the classified data. (see **Specific Procedures Employed**, *Data Views and Artifact Designation of CMC Data Types*).
- With respect to time series analysis, events overlapping within the same time frame were considered as one event. This was because the method of analysis and the community as unit of analysis did not warrant a finer breakdown.
- Clarification of the distinction between artifacts and documentation (see Chapter 1, **Definition of Terms**). A Web site that was created for the community required evidence of two or more community members accessing and using it in a collaborative way; thus showing evidence of negotiated meaning (Bielaczyc & Collins, 1999; Lipnack & Stamps, 2000;

Wenger, 1998). The asynchronous and/or synchronous communication logs provided this evidence (see **Specific Procedures Employed**, *Data Views and Artifact Designation of CMC Data Types*

The Interim Case Study Report: Artifacts vs. Documentation

The differentiation of what evidenced a document or an artifact constituted a key decision of this study. The researcher reached this decision during the interim report stage, and it had major implications on the rest of the study. While examining the original data (i.e., Web sites, articles, and summaries of online meetings), the researcher referred to these items as artifacts because they were produced by the WIA community members (Wenger, 1998) (see the subsection *Initial Definitions*). However, Wenger, McDermott, and Snyder (2002) also refer to documentation, which they describe as possibly detrimental to a CoP's early development (see Chapter 1, **Definition of Terms**).

In the *Initial Definitions* stage of this study, the researcher did not delineate how an artifact differentiated from documentation (Wenger, McDermott, & Snyder, 2002). Furthermore, he did not provide a clear differentiation between types of possible artifacts (i.e., static Web pages and CMC tools). Therefore, the research questions were ambiguous in this respect.

By the interim report stage of this study, the researcher had noted several factors. First, a clear and strict definition needed to be established of what constituted an artifact. For example, the mere existence a Web page that was set up by a member for community purposes did not establish a given Web page as being an artifact.

The researcher determined that collaborative use by two or more community members needed to be shown. This evidence of collaborative use would exist in the communication data, that is, two or more members would have discussed a particular Web site or online document. Otherwise, a given Web page may have existed as documentation, that is, a record of activity that was *not* used in collaboration or practice by its members. For the analysis of both the first third of the data body to the Interim Report, as well as the final two-thirds of the data body to the final data analysis; the communication data showed extremely minimal use of Web pages as community tools (i.e., a total of four instances).

A second form of artifact was the CMC tools themselves (i.e., the Tapped-In MOO environment, Yahoo Messenger, & the Yahoo Group). These tools were transparent to the community members during use; however, they were integral for community collaboration and communication. In order to determine the degree, in which independent variables were used with each type of tool; the researcher divided the communication into asynchronous and synchronous modes, according to the available records. This yielded insight into this area of artifacts.

The researcher went on the premise that this separation provided a meta-analysis of communication. Thus, the researcher considered this separation as a third source of data for triangulation (see Chapter 5, **Conclusions**, *Weaknesses*). Finally, this comparison of asynchronous to synchronous addressed Research Question No. 3 (see **Theoretical Proposition and Research Questions** in Chapter 1).

Miles and Huberman (1994) recommended an interim report as a way of gaining insights and summarizing to help form conclusions during data analysis.

However they warned of the danger of forming conclusions too early in the analysis. The interim case study report served as a second verification phase for the study.

Final analysis of communication data and survey data.

In the final analysis stage, the researcher analyzed all of the available communication and survey data during the 13-month analysis period, using the methods presented in the **Special Procedures Employed** section of this chapter. These results are presented in Chapter 4, and discussion of these results and introduction of new research questions are in Chapter 5. Based on this final data analysis, the researcher formed new theoretical propositions and refined theory with respect to distributed CoPs. These conclusions resulted from time-series analysis, as described by Yin (1994) and explained in **Special Procedures Employed,** Time Series analysis.

The time series design of this case study tracked and plotted the independent variables over the 13 month period of the case study (see Table 8, p. 86 for a list of independent variables). Yin (1994) described time-series analysis as similar in nature to time-series analysis used in experimental and quasi-experimental designs. In addition, time-series analysis is one of the major modes of analysis in case study design. In this study, time-series analysis was employed in conjunction with a lesser analysis mode, which is embedded units (see **Specific Procedures Employed**, *Unit of Analysis and Embedded Subunits*).

Specific Procedures Employed

Introduction

The previous section outlined the major steps and milestones for the case study. This section outlines the following analysis techniques, which took place between the raw data and the unit of analysis (i.e., the WIA community). Figure 2 (p. 79) presents an overview of the techniques described in this section, as well as shows how they are connected in forming both the results and conclusions of this study — as described in Chapters 4 and 5. The individual subsections in this section of Chapter 3 describe the analysis methods in Figure 2 in more detail.

The following analysis procedures comprised the study in the order from general to specific:

- Designation of the WIA community as the unit of analysis.
- Assignment of the unique identifiers of distributed CoPs drawn from the literature as independent variables in the study. These independent variables were arranged in a hierarchy as embedded subunits. Communication acts extracted from the raw data were coded — according to this hierarchical arrangement. (see Table 8, p. 86).
- Establishment of data views from nominal and summarized frequency counts of various criteria. This procedure tied the theoretical proposition and research questions to the data.
- Implementation of time series analysis of the data views, which tracked behavior and trends during the longitudinal study period of 13 months.

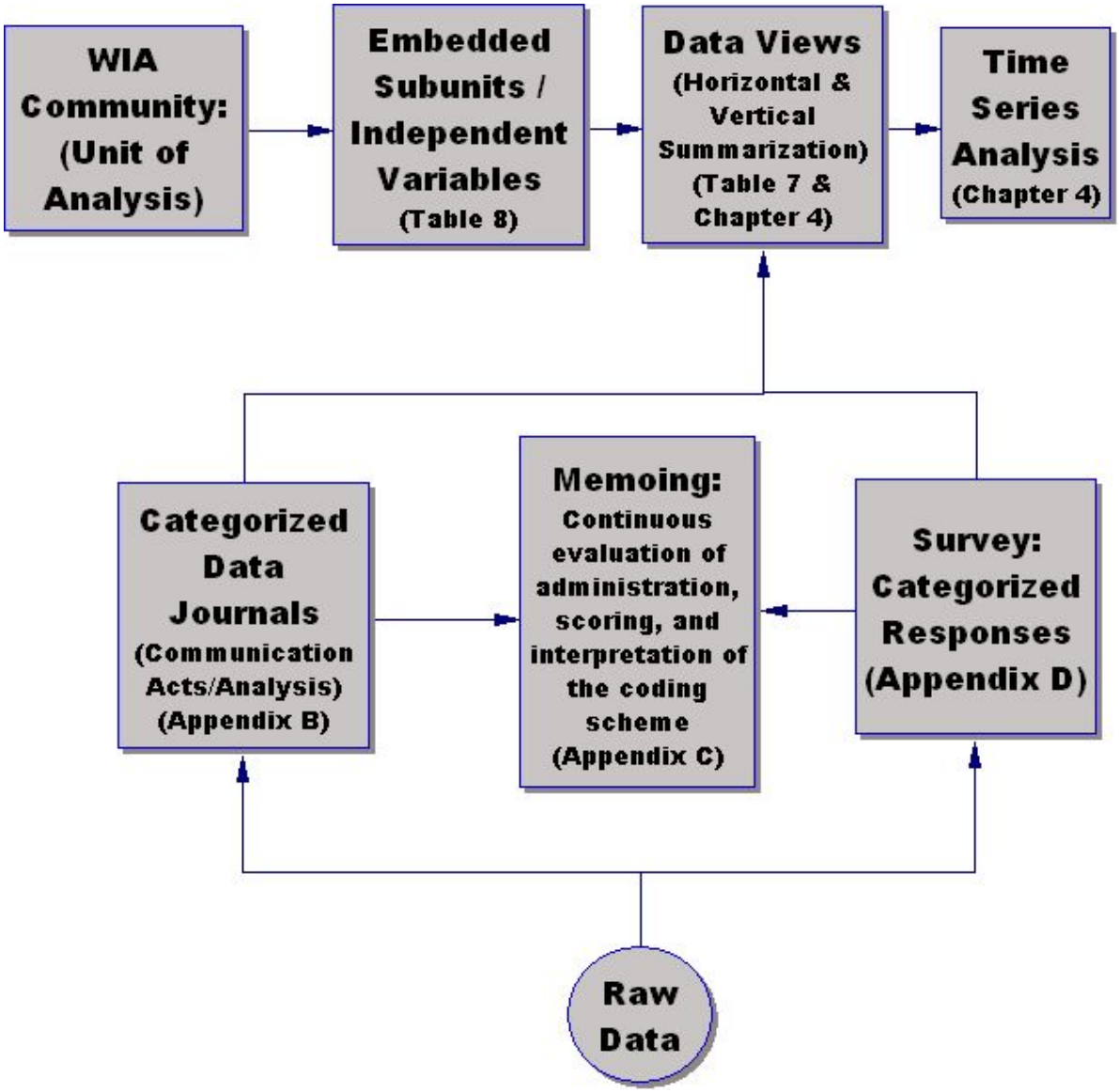

Figure 2. Overview of WIA Case Study Analysis Methods.

Unit of Analysis and Embedded Subunits

The researcher defined the WIA community as the unit of analysis, for the unique characteristics based on the theory pertained to the community itself (see Table 3, p. 14). Because the unit of analysis was at the community level, this study did not

track communication of individuals, rather it examined the variables from the view of the community as a whole (Alani, Dasmahapatra, O'Hara, & Shadbolt, 2003; Cobb & Powers, 1999; Hoadley & Pea, 2002; Yin, 1993).

The nine criteria were designated as embedded subunits of the community in a hierarchical arrangement. Based on the criteria in Table 3 (p. 14), the researcher initially defined and categorized these criteria as independent variables to be employed in the case study (Dubé, Bourhis, & Jacob, 2005; Sudweeks & Simoff, 1999; Yin, 1993; Yin, 1994). The Main Level and Sublevel 1 columns of Table 7 (p. 82) depict the initial independent variables and their embedded subunits.

These independent variables formed a coding scheme, which the researcher applied to communication acts extracted from the raw data (Henri, 1992; Jonassen & Kwon, 2001). In current studies of CMC communication, coding schemes are often extracted and interpreted from theory in the literature. (Jonassen & Kwon, 2001; Rourke & Anderson, 2004).The analysis of these independent variables via triangulation and multiple sources of evidence indicated whether WIA exhibited behavior of a distributed CoP, according to CoP theory (Merriam, 1998; Yin, 1993; Yin, 1994).

Table 7 (p. 82) depicts the hierarchical arrangement of the variables. Sublevel 2 was added to the hierarchy after completion of the pilot study. Sublevel 2 variables were more detailed concepts that supported the corresponding Sublevel 1 variable; moreover, they exemplified a particular type of communication that described the corresponding Sublevel 1 variable.

Based on the literature review and his resulting interpretation of CoP theory, the researcher assumed the main independent variables to be broader concepts than the

embedded Sublevel 1 variables, in which the embedded units described the broader concepts in more detail. Furthermore, the main level independent variables were themselves embedded subunits of the main unit of analysis, which is the WIA community itself (Dubé, Bourhis, & Jacob, 2005). Appendix F portrays detailed descriptions of each independent variable.

The survey data did not apply to Sublevel 2 because this second sublevel identified specific *communication* instances that applied to the corresponding variables in Sublevel 1 (see Table 7). In other words, the Sublevel 2 category sought to exemplify types of communication that corresponded to the Sublevel 1 category within embedded subunit hierarchy. The survey data differed because a given answer to a question was coded accordingly at Sublevel 1.

Yin (1993; 1994) recommended defining embedded subunits, which fall under the main unit of analysis as a way to hinder "slippage" of the case study. Slippage is defined as an unexpected change in the study's direction. Yin emphasized that case study methods define independent variables in much broader terms than experimental research designs.

Table 7. Finalized Independent Variable Hierarchy for Communication Data

Classification and Description of Independent Variables		
Main level	**Sublevel 1**	**Sublevel 2**
	Core Membership (CORE)	Rotating Expertise (ROT) Distributed Expertise (DIS).
Emergence (EMG)	Peripheral to Center Movement (P2C)	Receiving Instructions (REC) Asking Questions (QUE) Question and Answer Exchange (EX) Acknowledgement of Gained Expertise (ACKN)
	Boundary Practices (BP)	Background Questions (BG) Eliciting Background Knowledge (EBK) Use of Community Knowledge (COM)
Transfer of Implicit Knowledge (TIK)	Practice (P)	Proposed Collaboration (PROP). **Note: this is an opening code.** Reported Collaboration (REP) Actual Collaboration (ACT)
	Exchange of Stories (S)	Complete Stories (COMP) Partial Stories (PART) **Note: this is an opening code**
Learning as Principal Goal (LPG)	Negotiation/ Definition of Knowledge Domain (KD)	Opening Statements (OPEN) **Note: this is an opening code.** Declaration of Overall Community Goals (GOAL) Active negotiation and definition of Community Goals (NEG)

Data Views and Artifact Designation of CMC Data Types

Data views represented summarized communication acts that addressed the theoretical proposition and research questions; thus providing a connection to the raw data. Table 8 (p. 86) presents an overview of this analysis approach.

Most studies of CMC communication use nominal measuring scales, such as frequency counts, in which summaries of the coded data are presented (Rourke & Anderson, 2004). Nominal summarized data and comparison via relative percentages between the categories formed the main analysis basis of the data views.

Relative percentages allowed comparison between variables, in which total instances fluctuated over the longitudinal analysis period of 13 months. These total fluctuations were due to participation levels increasing and decreasing, for which the reasons were beyond the scope of this study.

- Theoretical proposition: The virtual community Webheads in Action exhibits behavior of a distributed community of practice if it possesses all nine characteristics unique to distributed CoPs. Instances of negative or tangential behavior with respect to the nine characteristics weaken, or possibly negate, the theoretical proposition that distributed CoP behavior is exhibited by this online community.

As mentioned in Chapter 1 (see **Theoretical Proposition and Research Questions to Be Investigated**, *Theoretical Proposition*), negative and tangential evidence counters the theoretical proposition. If there were a higher percentage of negative and tangential instances of communication acts than normal data (i.e., data that was consistent with the CoP theory represented by a given independent variable),

then the theoretical proposition would be weakened. Such evidence would lead the researcher to conclude that WIA is possibly another type of virtual community, as opposed to a distributed CoP. This type of rejection would depend on several factors, for example, the number of variables rejected and/or when in the time series the rejection occurred (s*ee Time Series Analysis*).

- Research Question #1: In what ways does the observed virtual community correspond to theoretical aspects of communities of practice? How are these theoretical aspects represented or not represented in the virtual community of WIA? How do they deviate? To what degree are each of these characteristics represented in WIA?

Research Question #1 tracked the normal variables over time, examining patterns of fluctuation over time (see Table 8, p. 86). This research question focused on normal instances of the main level and Sublevel 1 variables. Increases of the variables' instances would indicate increase in distributed CoP behavior. The relative percentage of a given variable at a particular time point addressed the presence of the variable with relation to total instances and in relation to the other variables – in other words, how strongly the theoretical characteristic described by the variable was represented. Data from the online survey was also examined at this level.

The researcher chose a benchmark of 10%, below which he considered a variable to be underrepresented. Because the literature, which consisted of different case studies, did not address benchmarking of distributed CoPs by their attributes; the selection of this 10% benchmark was somewhat arbitrary. Moreover, no study of distributed CoPs reported criteria selection to this level of detail. Ideal representation of

the variables would be equal percentages, that is, one-sixth for each of the Main Level and Sublevel 1 hierarchical variable combination (e.g., EMG-CORE, representing core membership, see Table 7, p. 82). Thus, the researcher considered independent variables above 10% as well-represented and variables below this percentages as underrepresented.

- Research Question #2: In what ways can a community of practice, whose interactions are mainly carried out online, evolve with the founding of a virtual community designed specifically to enhance the emergent aspects of a community of practice (Wenger, 1998)?

The researcher used the Sublevel 2 embedded subunits to examine Research Question #2, comparing the number of instances and relative percentages of normal instances this level. In general, Sublevel 2 variables showed evolutionary and relative aspects of the corresponding Sublevel 1 variable. Another aspect of the analysis of Research Question 2 was "opening codes".

Opening codes comprised three of the Sublevel 2 codes that aided the researcher in finding more concrete examples of communication data. The three opening codes are described as follows and listed in Table 7 (p.82):

1. TIK-P-PROP (transfer of implicit knowledge via proposed collaboration),
2. TIK-S-PART (transfer of implicit knowledge via partial stories), and
3. LPG-KD-OPEN (learning as principal goal with respect to knowledge domain with respect to opening statements and opinions).

Opening codes represented introductory or chronological starting points that could possibly progress to other variables within their respective embedded subunits.

They coincided with *potential* distributed CoP behavior; therefore, their percentages relative to the other variables within their Sublevel 1 parent variable also yielded insight on how distributed CoP behavior evolved.

Table 8. Analysis Approach of Communication Data with Respect to Data View and Theoretical Proposition / Research Questions.

Theoretical proposition/Research Question	Data View	Explanation
Theoretical proposition	Normal Data vs. Exception Data (Negative and Tangential Instances). Sublevel 1	Higher percentage of normal data supported the theoretical proposition, vice-versa rejected the theoretical proposition.
Research Question #1	Normal instances of Main level, Sublevel 1	Relative percentages, trends and total instance counts of different time periods addressed this research question.
Research Question #2	Opening codes and percentages of Sublevel 2	Opening codes, which were at Sublevel 2, showed introductory phases of a given Sublevel 1 variable. Also, additional Sublevel 2 comparisons established other relationships.
Research Question #3	Artifact analysis at Sublevel 1 & Sublevel 2. Asynchronous vs. Synchronous.	Different distributions of variables revealed different community use of tools.

- Research Question #3: In what ways do the interaction and community understanding of the community members with its artifacts, specifically CMC and Web technology, aid the community in reaching its learning goals? In which ways do these tools help or hinder this interaction?

All of the previously discussed data views cut into the total communication data (i.e., the total number of communication acts) horizontally. That is, all of the variables had coded exceptions (viz., negative and tangential instances of communication acts), Sublevel 1, and Sublevel 2 classifications. However, in order to address Research Question #3, the communication data had to be split vertically according to CMC type (i.e., asynchronous and synchronous categories). Thus, a communication act was asynchronous or synchronous, but not both. Furthermore, with this CMC data type division, the researcher examined Research Question #3 by comparing the CMC data types with the theoretical proposition and other research questions. By doing so, he considered this division as a meta-analysis of a third data type (see **Research Methods Employed**, *The Interim Case Study Report: Artifacts vs. Documentation*).

Time-Series Analysis

The main goal of time-series analysis was to observe changes and patterns in the independent variables with respect to time and each other (Yin, 1994). Basically, this method took the summarized data explained in the previous subsection (i.e., *Data Views and Artifact Designation of CMC Data Types*), and divided it into time periods to see the movement of the variables over time.

Miles and Huberman (1994) suggested approaching this observation from two different angles. The researcher employed both of these methods in this case study; however, only one of these methods yielded any interpretable results.

One method was dividing time into periods and observing the changes of the summarized period within these periods. This view revealed gradual development with respect to the independent variables. The researcher displayed these trends as bar

charts, in which the summarized data represented the total number of instances for a given period.

The other method was to observe the patterns of movement of the independent variables with respect to critical events that took place during the data gathering period. The purpose of this method was for the researcher to gain insight into possible reasons for fluctuations of movement of the independent variables.

With respect to his interpretation of distributed CoP theory, as discussed in Chapter 2; the researcher postulated the following with respect to the movement of the independent variables:

- A steady increase in the number of instances of a given independent variable would be a strong indicator of the identifying characteristic that the independent variable represents.
- A steady decrease in the number of instances of a given independent variable would be a strong indicator of the identifying characteristic, which the independent variable represents, is not supported.
- Fluctuations in the number of instances weaken the previous two postulations; thus, the researcher would have to rely on a net increase or decrease to draw any conclusions with respect to his interpretation of distributed CoP theory.
- In addition to the previous description regarding fluctuation of variables, the researcher also compared the beginning and ending number of instances for a given variable.

Yin (1994) noted that case study data are not of a specific type, and case studies can consider both quantitative and qualitative data. This combination of quantitative and qualitative data was confirmed by Sudweeks and Simoff (1999) in carrying out Internet research because of its non-linear nature. Preece (2000) cited the common use of metrics in communication analysis of online communities.

Conversation Analysis

This subsection discussed the details on how individual data items (i.e., communication acts) were classified. This study relied on conversation analysis to examine the communication data of the WIA community for the purposes of categorizing the communication relevant to the independent variables. Conversation analysis is currently the primary technique used to analyze asynchronous and synchronous text logs (Jonassen & Kwon, 2001;Eick & Dias, 2005; Gray, 2004; Hough, 2004).

Davenport and Hall (2002) emphasized conversation as the medium of organizational knowledge; therefore, conversation analysis is often used as a methodology for analyzing CoPs. Luppicini (2002) differentiated between conversation analysis and discourse analysis. Luppicini described conversation analysis as analysis of second order communication, which addresses social, political, and cultural forms of communication. In other words, conversation analysis focuses on the broader intent of the speakers, as opposed to the more detailed and utterance level intent of discourse analysis (Luppicini, 2002).

Rourke and Anderson (2004) recommend five steps in coding and analyzing CMC data:

1. Identifying the purpose of the data to be coded. In this study, this was accomplished via the definition of the community as the unit of analysis.
2. Identifying the behaviors that represent this coding scheme. The researcher established the identifying factors (i.e., the independent variables) and embedded subunit hierarchy from the literature review of Chapter 2 (Jonassen & Kwon, 2001). This embedded subunit hierarchy formed the categorization scheme, whose behaviors were identified via the researcher's interpretation of distributed CoP theory.
3. Reviewing the categories. This was accomplished during the pilot study with other researchers, as well as continuously throughout the coding and analysis periods via memos (see Appendix C).
4. Preliminary testing of the categorization scheme. During the pilot study, the researcher had three other researchers in coding and providing feedback on the categorization scheme.
5. Developing guidelines: administration, scoring, and interpretation of the coding scheme. This was continuously and iteratively carried out throughout the coding and analysis periods via memos (see Appendix C). Figure 3 (p. 92) shows the finalized guidelines and procedures based on Rourke and Anderson's (2004) recommendations. Appendix F details the communication aspects of the coding process..

A unit of categorized CMC is known as a communication act. (Henri, 1992; Jonassen & Kwon, 2001; Miles & Huberman 1994). Communication acts were comments and textual units that fit the categorized independent variables (Miles & Huberman, 1994; Schlager, Fusco, & Schank, 2002).

The researcher extracted these communication acts from the available CMC records between January 2002 and January 2003, according to the procedure shown in Figure 3 (Jonassen & Kwon, 2001). The **Reliability and Validity** section of this chapter discusses issues pertaining to communication acts (see *Communication Acts, Thematic Units, and Interpretive Burden*).

In addition to the procedure depicted in Figure 3, the content of a given communication act was analyzed without regard to any background knowledge, for example, the identity of individual participants. Rather, the content of the relationship between the speakers or writers within the given communication act was considered. For example, an individual's message expressing a lot of knowledge about a given area would not be categorized as a core message (EMG-CORE). Instead, a message that showed knowledge of others' expertise (i.e., a reference to a knowledge network of individuals) would fall under this category. The former would be an example of a negative posting. Appendix F describes the complete categorization criteria.

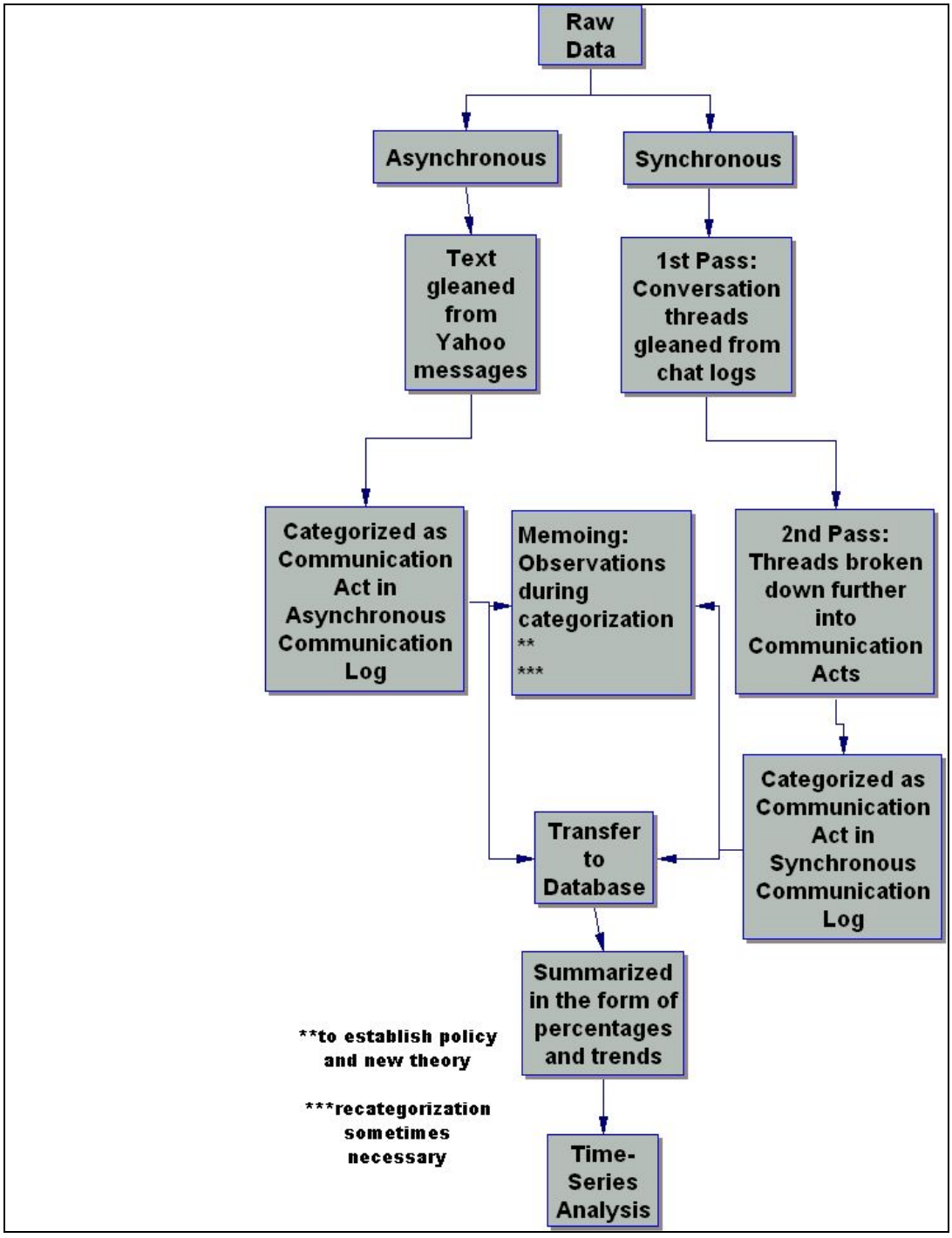

Figure 3. Procedure for extraction and classification of asynchronous and synchronous communication acts.

Memos with Respect to Communication and Artifact Logs

The analysis performed in this study included comprehensive data logging and journalizing techniques to establish a chain of evidence from the raw data to the matrices and diagrams that summarized the data analysis (Miles & Huberman,1994). In addition, the researcher used memos for documenting ideas and insight gained during data analysis.

The memoing technique served three purposes. First, it aided the researcher in developing conclusions and theoretical propositions. Second, it allowed an element of transparency for other researchers to see the pattern of conclusion and theoretical proposition development. Third, it helped to minimize researcher fatigue during data classification; thus, making the analysis more accurate (Miles & Huberman, 1994; Nemiro, 2000).

Nemiro (2000) also cited the use of a chronological journal, which showed the dates and times of the data logging, categorization, and memoing procedures. This journal established transparency of the timing and sequence of the data analysis.

The memoing procedure consisted of the following. First, the researcher logged ideas and insights during coding into memos (Miles & Huberman, 1994). Each memo included a memo data, subject, as well as a reference to the communication act or acts that spawned the idea. The researcher assigned a unique number to each communication act in one of two logs: asynchronous and synchronous. Recurring themes eventually became policies or theoretical propositions, regarding the data. This process also helped to reduce fatigue caused by continuous coding (Miles & Huberman, 1994).

The Survey

The survey was developed during the pilot study and conducted during the interim report stage. It served as supporting analysis and a secondary data source, as opposed to the primary analysis and primary data source of the online communication logs (Preece, 2000).

The survey asked participants to reflect on their experiences within WIA since its inception or since they joined WIA. Data classification with the variable codes was based on the different responses. This method differed from classifying the communication itself, for it was one step removed from the actual activities of the community. Therefore, it took a secondary and supporting role.

Appendix D shows the survey form with the corresponding independent variable codes for each question. The survey was placed on a Web page as an HTML form, and the data were gathered using an online survey tool (www.surveymonkey.com). The researcher sent notification and two reminders to the community, both by private e-mail and as a message to the community's asynchronous discussion forum. The participants were given one of two Web addresses, depending on the sample, for which they were selected.

The survey questions were reviewed and tested by the researcher and three other researchers. Merriam (1998) stressed that multiple questions, leading questions, and yes/no questions should be avoided. With the feedback supplied by the other researchers, the main researcher revised and refined the questions further. These procedures established the reliability and validity of the online survey instrument.

Survey Samples: Purposive and Random

Survey data was compiled from two samples: purposive and random. It consisted of 10% samples of each sample type (i.e., each sample consisted of 10 members out of a possible 93). The random sample functioned as a check against the purposive sample, whereas the purposive sample was designed to represent the group based on participation level. The goal of the purposive sample was to find a representative opinion of WIA's core members, boundary members, as well as members in transition between boundary and core. The random sample was used to provide cross analysis with the purposive sample (Miles & Huberman, 1994). Table 9 depicts the timeline of the survey development, pretest, and implementation.

Table 9. Timeline of Webheads in Action Case Study Survey.

Time period	Stage	Activities	Comments
April 15, 2003 to May 1, 2003	Pilot Study	Survey questionnaire development. Online pretest	Online pretest verified by three other researchers
May 1, 2003 – June 30, 2003	Interim Report	Survey period.	Introductory e-mail and two reminders were sent to random and purposive sample groups.

The researcher used the following method for taking the purposive and random samples. First, a list of all members of the asynchronous forum (i.e., the Yahoo Group) was compiled. One of the WIA members generated this list by using a Unix-based tracking program for each member, as well as their total postings to the discussion

forum. The WIA member provided this data as of the date of 3800 total postings in the Yahoo forum when the community had 93 active members, each of whom had posted at least one message. This was in March 2003. The official members of the WIA community were listed on this group; whereas the sessions of the synchronous forum also included outside members; thus, these outside members were not on the list of possible survey participants (Wenger 1998).

Although outsiders could browse the asynchronous forum, only members were able to post. The purposive sample was taken by using a random selection of each category. The researcher divided each category by the percentage of asynchronous postings per category group (see Table 10).

Table 10. Purposive Sample Categories.

Cumulative Percentage of Asynchronous Postings	Percentage of Asynchronous Postings	Number of WIA Members in Percentage Group	Number of Randomly Selected Members from Each Group
60%	60.26%	7	2
80%	20.63%	10	2
92%	11.42%	13	2
95%	31.03%	6	2
100%	5.68%	57	2
Totals	**100%**	**93**	**10**

In examining Table 10, one notes that 7 members posted 60% of the asynchronous postings. For this reason, the purposive sample selected randomly two

members from each of these percentage groups in order to provide a more representative sample of the WIA community as a whole.

A second, completely random, sample of 10 of the 93 members was also taken. In both sample types, the researcher used a random number generator to accomplish this selection. The researcher then categorized the responses under the coding scheme, according to the scheme shown in Appendix D. Categorized survey data reached the level of Sublevel 1 (see Table 7, p. 82). The researcher designed Sublevel 2 to help delineate communication instances that exemplified Sublevel 1 occurrences. Therefore survey data did not apply to Sublevel 2.

Formats for Presenting Results

As described in the previous sections, the time-series analysis of WIA's communication and artifacts, along with the survey as support, were journalized and presented. Appendix B depicts sample pages from the categorization logs, and Appendix C displays the chronological journal for the memos.

The data summarization displays in Chapter 4 were based on the techniques recommended by Miles and Huberman (1994). This study presented analysis results in the form of tables, networked diagrams, pie charts, and bar charts. Tables, bar charts and pie charts were employed to display comparative metrics of the independent variables. Network diagrams and tables outlined concepts and relationships between the independent variables. The researcher developed and refined these displays in iterative phases during the data analysis, in which a major milestone was the case study interim report and resulting analysis (Yin, 1993).

Resources Used

The following CMC and Web tools were accessed and catalogued for analysis:

- Synchronous discussion at Tapped In (www.tappedin.org), a MOO (object-oriented multi-user domain), which generated chat logs. These chat logs were posted on HTML (Hypertext Markup Language) pages for review by WIA's participants.
- Files generated by Yahoo Instant Messenger (www.yahoo.com), which contained individual and small group discussions.
- Asynchronous discussion logs generated by Yahoo Groups (www.yahoo.com), as well as file repositories on the Yahoo groups site.
- Documents in the form of HTML (Hypertext Markup Language) and ASP (Active Server Protocol) pages.

The following software tools served for the functions of data analysis and summarization:

- Microsoft Excel provided tabular, list sorting, calculation, and diagram design support.
- Microsoft Access aided in data categorization, querying, and summarization.
- Inspiration by Inspiration Software supplied tools for visual conception of the data analysis.
- Survey Monkey (www.surveymonkey.com) provided the online environment and data gathering tool for the online survey.

Reliability and Validity

This study concerned reliability and validity issues common to single case studies. The following measures and considerations were taken to maximize reliability and validity.

Triangulation of Data

First, triangulation of multiple sources of evidence was applied to increase construct validity in this study (Englert; Berry, & Dunsmore, 2001; Merriam, 1998; Nemiro, 2000; Yin, 1993; Yin, 1994). This study drew on communication logs, WIA community artifacts (i.e., use of two asynchronous and synchronous CMC tools), plus online survey data as triangulation. According to Yin (1993; 1994) and Merriam (1998), the multiple sources of evidence did not need to be weighted equally; therefore, online survey data served a supporting role and was weighted less heavily than the other two sources. Because some of the survey data drew on participants' memories, communication data provided a primary source for analysis; thus, the supporting function of survey data.

Generalization of Results to Theory

Yin (1994) stressed that case studies do not generalize observed results to larger populations, rather they generalize to theory. Miles and Huberman (1994) also recommended grounding concepts in theory. Generalization to theory reinforces external validity. The embedded units of analysis developed for this study (i.e., the categorization scheme of independent variables) were all derived from CoP theory.

Specification of Unit of Analysis

The specification of a unit of analysis, which was the virtual community of WIA itself, aided in establishing internal validity for this study (Yin, 1994). Furthermore, finding negative and tangential cases (i.e., instances in the data that challenge, contradict or provide alternate explanations to the categorization scheme), reinforced internal validity (Nemiro, 2000).

Negative and Tangential Cases

Nemiro (2000) confirmed Miles and Huberman (1994) by emphasizing that negative evidence, extreme cases, and surprises in the data can force re-categorization. This included purposively selecting boundary members for survey data (i.e., those members who never or rarely participate in asynchronous or synchronous discussions). Furthermore, the researcher compared the purposeful sample with a randomly sampled interview group from the WIA community members to yield insight on under-weighting or over-weighting findings. Yin (1994) added that rival theoretical propositions (i.e., the possibility of the negation of the theoretical proposition) and searching for opposite cases strengthens internal validity — hence, the theoretical proposition for this study.

Chain of Evidence

The reliability of this case study was established by maintaining a chain of evidence, which is also called a case study database (Miles & Huberman, 1994; Nemiro, 2000; Yin, 1993; Yin 1994). Appendices B and C include samples of the large volume of the categorization logs, references to memos and personal observations, as

well as data analysis summaries. This case study database differentiated the evidence, or data, from the report; thus, giving other researchers the opportunity to trace the development of the analysis and conclusions upon request.

Piloting and Pre-testing Surveys

In addition, piloting and pre-testing surveys in the pilot study increased reliability (Nemiro, 2000). This piloting and pre-testing was aided by three other researchers. The primary researcher incorporated the other researchers' feedback and suggestions into the final survey design (see Appendix D).

Conversation Analysis, Communication Acts, Thematic Units, and Interpretive Burden

Preece (2000) noted that discourse analysis is very flexible in design; therefore, it affects reliability and necessitates the use of multiple researchers. However, conversation analysis, or second order discourse analysis (Luppicini, 2002), is a methodology that is in its preliminary stages, which is not well developed and tested. Moreover, conversation analysis lacks developed and tested instruments (Rourke & Anderson, 2004). Rourke and Anderson note that content analysis and conversation analysis are used rather loosely in data analysis of CMC.

Interrater debate and comparison with three other researchers, as well as agreement of categorization and data analysis, helped to establish reliability (Nemiro, 2000; Miles & Huberman, 1994). Originally, the researcher based the use of other coders for improving reliability in the coding process on the recommendation of Miles and Huberman (1994). Miles and Huberman cited using percentage agreement as an indicator of coding consistency.

However, percentage agreement does not account for the fact that some interrater agreement may be due to pure chance (Banerjee, Capozzoli, McSweeney, & Debajyoti, 1999). During the first third of the coding process and on the recommendation of his dissertation chair, the researcher performed additional research in the area of interrater reliability, for Miles and Huberman's (1994) description was quite brief.

Miles and Huberman (1994) recommended only one type of interrater agreement: categorizing reliability (Hagelin, 1999). Another type of interrater agreement is unitizing reliability, which Hagelin defined as the consistency of identifying and delimiting the units to be coded. A factor in this delimitation is termed "interpretive burden (IB)" (Hagelin, 1999; p. 315), which is the degree that a rater needs to infer to determine coding.

The researcher extracted the communication data into communication acts, which Henri (1992) refers to as a "thematic unit". A thematic unit or communication act delineates units of variable length, in which communication fits a category. Jonassen and Kwon (2001) also employed this method, although their communication acts were contained within a sentence, that is, they delineated their communication acts into phrases and word clusters.

Déziel-Evans (2000) concluded that delineation of CMC (computer-mediated communication) messages into thematic units lowers unitizing reliability. She cited Henri (1992) as an example of this low unitizing reliability. Hagelin (1999) supported this conclusion because the interpretive burden of open text is more difficult for different raters than fixed format responses (e.g., a numeric rating scale).

For this reason, Déziel-Evans (2000) used the whole asynchronous message to lower interpretive burden and to raise unitizing reliability. However, Déziel-Evans noted that possible multiple categorizations within a single message was a limit of categorizing reliability — in other words, her categories were non-exclusive. Miles and Huberman (1994) stressed the importance of exclusive categories for establishing numeric comparison between them. Therefore, in coding CMC messages, there was a tradeoff between delineation of categorization units and exclusivity of categories.

The initial data extraction was performed by the researcher himself. He made this decision on the basis of the high volume of data, the high interpretive burden involved in gleaning the communication acts, as well as the necessary background of CoP theory needed to interpret suitable content to be classified into the categorization scheme (Rourke & Anderson, 2004). These factors need to be considered as a possible threat to reliability of this study. The following paragraph describes in more detail how the researcher extracted the data for this study.

For the first third of the study, the researcher used communication acts, that is, he divided the messages into units that matched the categorization codes (Henri, 1992; Jonassen and Kwon, 2001). For asynchronous messages, longer messages were divided into communication acts or thematic units. He divided synchronous messages into cohesive conversations in a first pass (i.e., synchronous communication in larger groups consists of several conversations intertwined). Subsequently, the researcher gleaned the communication acts from these conversations in a second pass. In both the asynchronous and synchronous message types, the researcher made a final pass in categorizing the messages, hence the high interpretive burden. Figure 3 (p. 92) illustrates this process.

Given the volume of messages over 13 months of asynchronous and synchronous communication, it was not feasible to include other researchers in the entire coding process. The number of messages coded by other researchers represented less than 1% of the total messages analyzed at the interim report stage. For this reason, it was not meaningful to include the percentage of interrater agreement as an indicator of reliability of the categorization process.

In summary, the absence of other researchers' involvement, in neither the delineation of communication acts nor the selection of test messages to be categorized, lowered unitary reliability of the study. Furthermore, the small percentage of sample messages coded challenged the meaningfulness of the interrater agreement percentage. Moreover, three more passes at coding selected data did not raise the interrater agreement percentages, even with training and additional clarification of the coding process. He concluded that interpretation of the variable scheme required the in-depth knowledge and background in CoP theory that was required to derive the variable scheme in the first place. Rourke & Anderson (2004) confirmed this conclusion.

Even though the researcher determined that the interrater percentage was not a good indicator of reliability, he noted the importance of the interrater feedback in helping to further define the variables. Therefore, the feedback of the other researchers was included as a necessary factor in this study.

Researcher's Role as Participant Observer

The researcher's role as a participant in the virtual community was recognized as a possible threat to validity (Yin, 1994). However, his role was very much in the background for the period, in which the data were analyzed. The researcher's

dissertation goals were known to the members of the virtual community. His participation during the data collection period was limited to answering occasional questions about his research and CoP theory. However, CoP theory was known to the WIA community before the researcher joined it because it had been introduced by another member. Membership in WIA was vital for gaining support from the community members to carry out this study. Nevertheless, the researcher examined critically any of this limited involvement as a factor in the analysis (Miles & Huberman, 1994). This involved excluding data categorizations from the study's results, in which he was involved. Nonetheless, these effects of participant researchers remain as a possible threat to validity.

The researcher shared openly and transparently his research and intentions with the members of the community. He cited the importance of establishing trust within the community, of which openness is a vital factor. Hence, all aspects of the study, including proposals were made available to the participants, so they could see the researcher's purpose in conducting it. This availability fell outside of the data collection and analysis period, so it should not have affected the results of the analysis. Furthermore, he functioned as a participant researcher to eliminate any possible mistrust because of "lurking". Riehl, Larson, Short, and Reitzug (2000) recommended action and participant research among practitioner situations, such as, this dissertation. This decision was accounted for with respect to the reliability of this study.

Finally, the use of three other researchers in the categorization and survey instrument validation procedures helped control for the effects of participant researchers (Hoadley & Pea, 2002; Riehl, Larson, Short, & Reitzug, 2000). Lipnack and Stamps (2000) emphasized that any observer in a complex social situation, such as

a virtual community or virtual team, influences the outcome — whether the observer is a participant or not. During a study of student teachers, Mason (2000) changed from a passive observer to a participant observer because the participants did not want any lurkers. Rodrigues (2000) did the same while designing a multimedia educational program.

Summary

This interpretive, longitudinal, and exploratory case study compared independent variables arranged in a hierarchy of embedded subunits, which were criteria derived from CoP theory and distinguished from other types of virtual community. Further criteria, as a second sublevel of independent variables, were added that described the types of communication corresponding to the original nine independent variables. The goal of this study was to examine and refine CoP theory with respect to distributed environments. The case study employed data views and time-series analysis as the main modes of analysis, with embedded subunits as the secondary and minor mode of analysis (Yin, 1994).

The study drew upon data generated by the WIA community for a period of 13 months: communication logs, artifacts generated by the community members in the form of Web-based documentation and CMC tools, as well as online survey data with selected participants. Survey data supported the other two data types in the analysis. Chapter 4 presents the results of this analysis.

Chapter 4

Results

Introduction

This chapter describes the data analysis results, as described in Chapter 3. It focuses on the data views and time series analysis, as described in the **Special Methods Employed** section of Chapter 3. As described in this section, the data views tied the communication data to the research questions. This chapter presents the results in the following sequence:

1. Description of aggregate communication data as a background for the main analysis. The total communication instances varied over the 13 month analysis period; thus, having implications in the analysis.
2. Data views pertaining to the theoretical proposition. In this section, both communication data and survey data address the theoretical proposition.
3. Data views with respect to Research Question #1.
4. Data views relating to Research Question #2.

Because Research Question #3 divides the data vertically by splitting the data into asynchronous and synchronous data views, it is addressed in each of the above sections. Data views with respect to the theoretical proposition and the research questions are

presented in Table 8 (p. 86) and discussed in Chapter 3, **Special Methods Employed,** *Data Views and Artifact Designation of CMC Data Types*.

Aggregate Data

The amount of data categorized and reviewed in this analysis totaled 3612 instances (i.e., both asynchronous and synchronous communication) and 342 individual responses to online survey questions. The researcher gleaned this data from a total of 2777 asynchronous messages and 38 synchronous conversation logs. The synchronous message logs ranged from 554 lines to 1716 lines. Therefore, data gleaned from CMC records formed the vast majority of the data considered in this analysis (see Figure 3, p. 92).

The 3612 instances were distributed over the 13 month time frame as shown in Figure 4. This total distribution formed the background for the subsequent analyses. Thus, the analysis accounted for this aggregate movement when considering the individual variables. Because of this aggregate movement, the analysis employed relative percentages of the independent variables and total instances per independent variable to extract meaning from this aggregate backdrop.

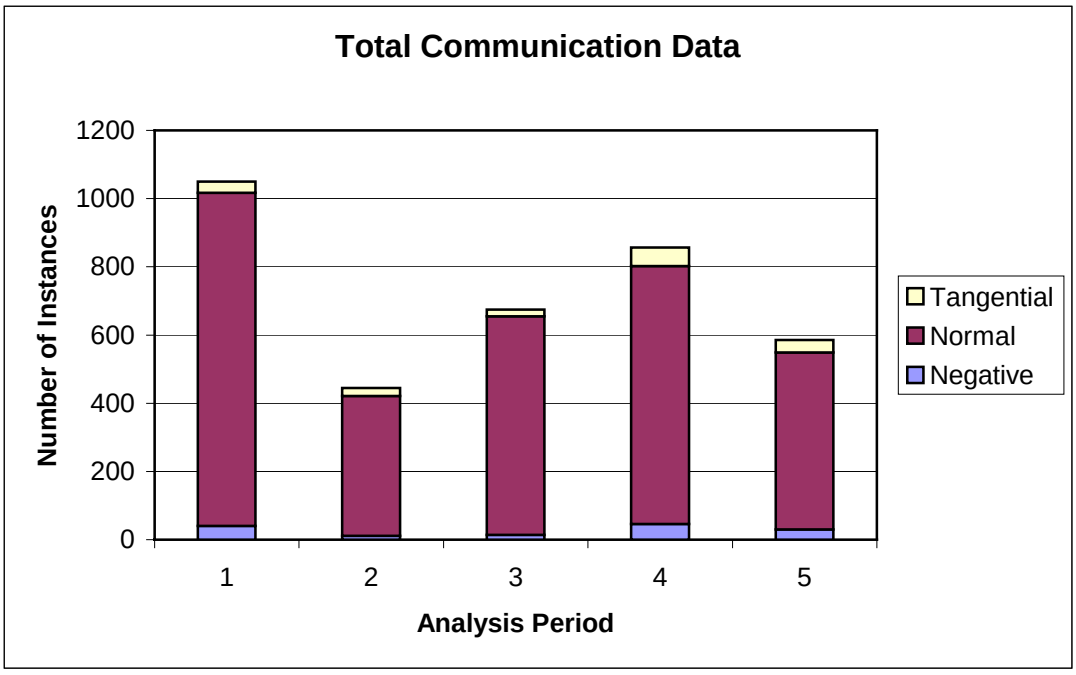

Figure 4. Total trend of total communication data. ($N = 3612$) (Note Analysis Period 5 had a duration of one month).

Survey data consisted of 342 responses, 117 of which were from the random sample and 225 were from the purposive sample. In addition to the difference in response rates, the following factors contributed to the difference in number of responses: 1) not all respondents completed the entire online questionnaire, and 2) some questions allowed multiple answers.

As outlined in Chapter 3 (see **Specific Procedures to Be Employed**, *Time-Series Analysis*), the purpose of time series analysis was to address periods and events. Moreover, the analysis periods in the following subsections represented the division of the first large event (i.e., the initial online course of WIA); therefore, the time periods were divided into three-month periods — with Analysis Period #5 being incomplete having a duration of one month:

- Analysis Period #1: January 1, 2002 to March 31, 2002.
- Analysis Period #2: April 1, 2002 to June 30, 2002.
- Analysis Period #3: July 1, 2002 to September 30, 2002.
- Analysis Period #4: October 1, 2002 to December 31, 2002.
- Analysis Period #5: January 1, 2003 to January 31, 2003.

Because analysis of events produced no conclusive evidence, this analysis was not presented in this chapter. Events were designated according to a list of events gleaned from the main WIA Web page (see Appendix G). Events did not seem to influence the trends in any of the periods, nor did they stand out from the total trends in any way (see Chapter 5, **Conclusions**, *Weaknesses*). Rather, events followed the total fluctuation of the messages (see Figure 4), rather than exhibiting any behavior of their own. Although splitting the time periods into months revealed fluctuations, these fluctuations did not correspond to any events. Possible reasons for this phenomenon are discussed in Chapter 5.

Vertical Division of the Communication Data into CMC Types

The categorized communication acts divided into CMC communication types: 74% asynchronous ($N = 2673$) and 26% synchronous ($N = 939$). Figure 5 illustrates this division over the five analysis periods.

Synchronous data were not available for the fifth analysis period, which itself was an incomplete time period of one month — compared to the three-month periods of the other analysis periods. Therefore, all data in the fifth analysis period were asynchronous.

In addition, the total trends of the two data types differed. Although both types of data had the highest amounts in the first analysis period; synchronous instances had a second peak during the third analysis period, whereas asynchronous instances reached their peak in the fourth analysis period. Figure 5 portrays these total trends.

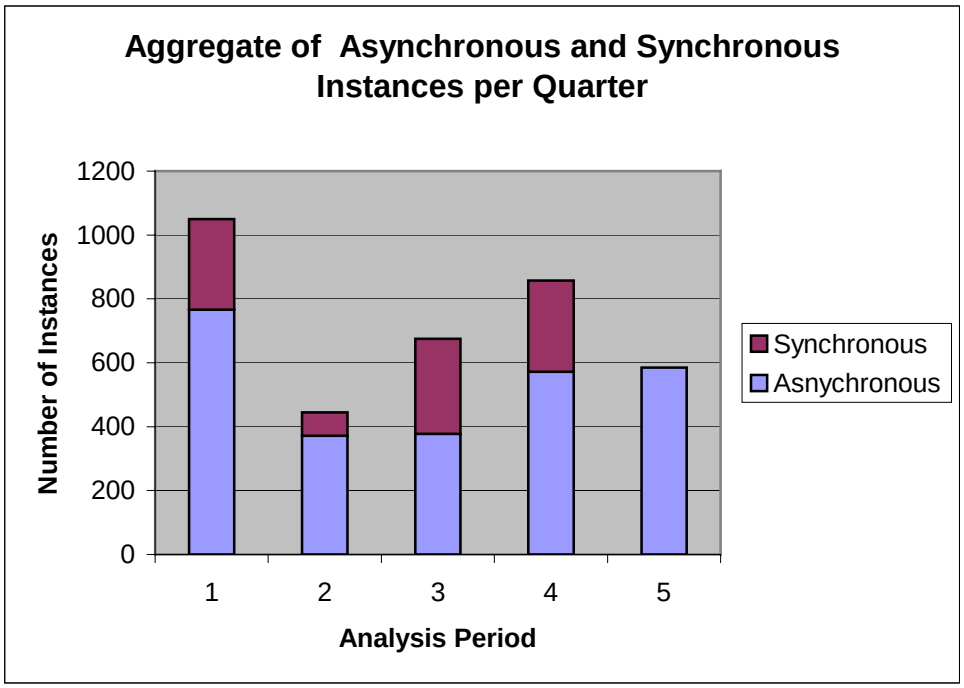

Figure 5. Total Normal Asynchronous (N = 2673) and Synchronous (N = 939) Instances per Analysis Period (Total N = 3612).

In order to analyze CMC tools, it was necessary to combine Research Question #3 with the theoretical proposition and other research questions. This was because Research Question Number 3 addressed specifically CMC tools. Therefore, the following sections (i.e., **Theoretical Proposition, Research Question #1, and Research Question #2**) also present views of asynchronous and synchronous data in connection with the variable distributions.

Theoretical Proposition

Theoretical Proposition: The virtual community Webheads in Action exhibits behavior of a distributed community of practice if it possesses all nine characteristics unique to distributed CoPs. Instances of negative or tangential behavior with respect to the nine characteristics weaken, or possibly negate, the theoretical proposition that distributed CoP behavior is exhibited by this virtual community.

In order to fully support the theoretical proposition, normal instances would need to be greater than the combined negative and tangential instances. This refers to the variables to the depth of Sublevel 1 (see Table 7, pp. 82). If combined negative and tangential instances were greater than the "normal" instances of a particular variable, then the theoretical proposition would be weakened.

A first glance at Figure 4 (p. 109) shows normal instances well above negative and tangential instances. In fact, normal instances made up over 88% of the total instances in all five of the analysis periods (see Table 7, p. 82). However, looking at the variables with respect to communication data at Sublevel 1 painted a different picture.

All variables at Sublevel 1 showed high relative percentages of normal instances in all analysis periods with a minimum of 81% — except one. The variable EMG-BP, which symbolized boundary practices under the main level category of emergence, showed a combined negative and tangential count that was higher than the normal instances. The pie chart in Figure 6 illustrates this distribution. Appendix E comprises a complete presentation of the categorization instances.

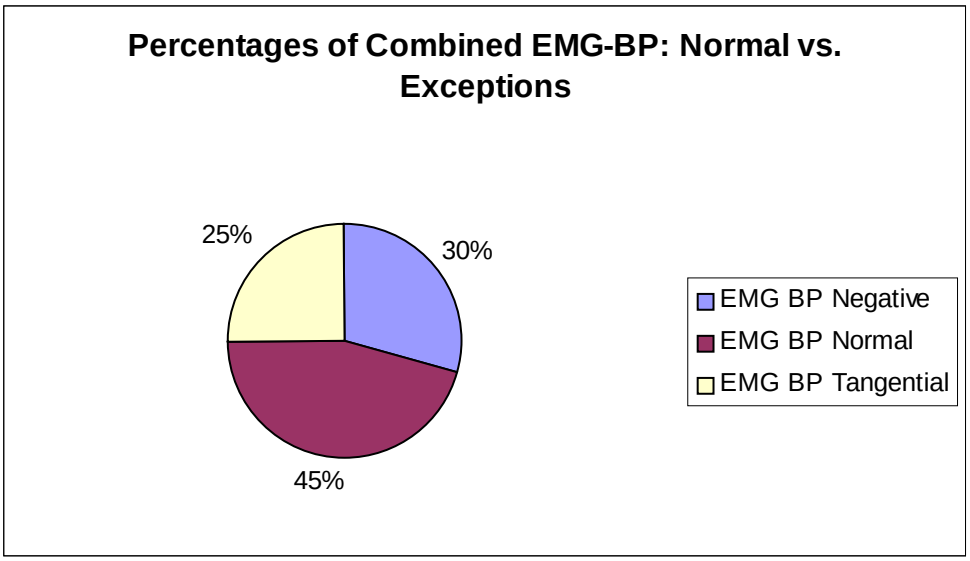

Figure 6. Total percentages of the Emergence/Boundary Practices Variable ($N = 71$)

Figure 7 depicts the distribution of EMG-BP variable by analysis period. The normal instances were above the exceptional instances in every analysis period except the last incomplete Analysis Period 5, which represents January 2003. The reader can also note that the number of instances of this variable ($N = 71$) was low compared to the total number of 3612 instances. The researcher addressed this issue when considering Research Question #1.

Therefore, the theoretical proposition was supported in eight of the nine Sublevel 1 variables. This result is discussed further in Chapter 5.

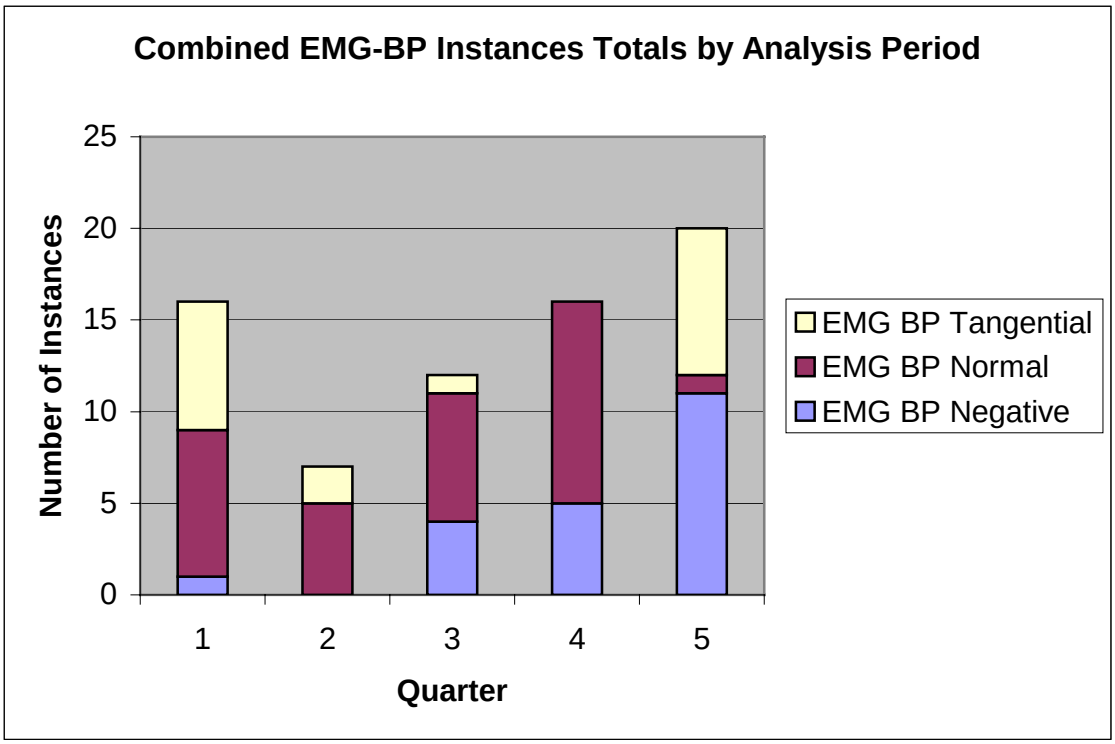

Figure 7. Distribution of the Emergence/Boundary Practices Variable by Analysis Period. (*N* = 71)

Testing the Theoretical Proposition with Research Question #3

The following reiterates Research Question Number 3: In what ways does the interaction and community understanding of the community members with its artifacts, specifically CMC and Web technology, aid the community in reaching its learning goals? In which ways do these tools help or hinder this interaction?

In the previous subsection, which analyzed the theoretical proposition with respect to total communication data (see **Final Analysis of Communication Data** in this chapter), the researcher found that the combined negative and tangential instances exceeded the amount of normal instances of the following variable: emergence with respect to boundary practices (EMG-BP).

Dividing the data based on the two CMC tools showed that synchronous data supported the theoretical proposition because its percentage of normal instances was greater than the combined negative and tangential instances. However, all available Analysis Period 5 data were asynchronous, and the surplus of negative and tangential data for EMG-BP (boundary practices) was found in Analysis Period 5. Thus, asynchronous data did not support the theoretical proposition. Figure 8 displays the total percentages for this variable for each type of CMC.

As can be seen in Figure 8, the 20% normal data constituted a clear rejection of the theoretical proposition at the asynchronous level. However, the other asynchronous variables were strongly represented at a minimum of 83%. The synchronous variables had a minimum normal percentage of 72%. Supporting tables can be found in Appendix E.

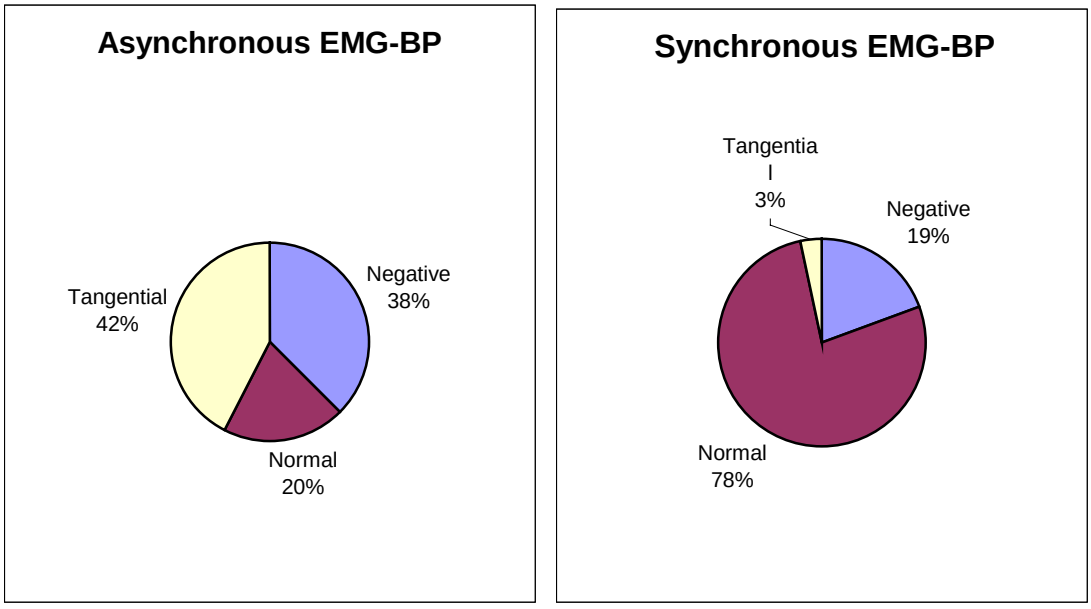

Figure 8. Comparison of Asynchronous (N = 40) to Synchronous Percentages of Emergence (N = 31) with Respect to Boundary Practices.

Survey Data and the Theoretical Proposition

Survey data comprised two types of samples: purposive and random. The implementation and sampling procedures are discussed in Chapter 3 (See **Specific Procedures Employed**, *The Survey*).

In the case of survey data, designated survey questions were designed to address the theoretical proposition as shown in Table 11. Appendix D shows a detailed breakdown of survey question with respect to the research questions, as well as lists the survey questions with the coding for each response. Several of the questions were discarded for reasons that they were too context specific. The reason for each question being discarded is also noted with the corresponding question in Appendix D.

Table 11. Survey Question Numbers Corresponding to the Theoretical Proposition.

Independent Variable	Survey Question Number
EMG-BP	13, 14, 15
EMG-CORE	7, 22
EMG-P2C	8, 9, 27
TIK-P	19
TIK-S	16, 17
LPG-KD	26, 28

(see Appendix D for the corresponding Question)

Like the previous subsections, a higher number of negative and tangential coded responses than normal responses of a given independent variable or variables would weaken the theoretical proposition. For the five variables that had multiple survey questions (see Table 11), there were two possible coding interpretations: 1) at an

aggregate level, which means that the coding for questions relating to a given independent variable was summed and an aggregate percentage of negative, tangential, and normal was compared, or 2) examining the negative, tangential, and normal percentages of individual questions. The aggregate level was a rougher interpretation of the survey data, whereas the individual question level was finer. In other words, at the aggregate level, rejection or support of an individual question could have been masked by the totals of a group of variables. Therefore, a rejection at the aggregate level would make the case for a clearer weakening of the theoretical proposition.

Table 12 shows mixed results with regard to independent variable, level of interpretation, and type of sample. Because of the mixed results in the case of independent variables with multiple questions, as well as the clear rejection of the two variables (i.e., EMG-P2C & TIK-P); the theoretical proposition was not supported. Tables D2 and D3 in Appendix D list the detailed coding for each survey question.

Table 12. Survey Results by Independent Variable With Respect to Theoretical Proposition.

	Aggregate Level		Individual Question Level	
Independent Variable	**Purposive Sample**	**Random Sample**	**Purposive Sample**	**Random Sample**
EMG-BP	Supported	Supported	Rejected with Question 13	Supported
EMG-CORE	Supported	Supported	Rejected with Question 7	Supported
EMG-P2C	Rejected	Rejected	Rejected with Questions 9 & 27	Rejected with Questions 8 & 27
TIK-P	N/A (single question)	N/A (single question)	Rejected	Rejected
TIK-S	Supported	Supported	Supported	Supported
LPG-KD	Supported	Supported	Supported	Question 28 (normal & exception responses cancel each other out)

Survey Data With Respect to the Research Questions

Although several of the survey questions addressed the three research questions, the responses provided no conclusive support of the research questions. The analysis was not strong enough to elaborate here. There were two reasons for this.

First, even though two of the questions allowed for time series analysis (see Appendix D, Questions 9 & 10); the majority of the responses for these two questions

indicated no direct participation in any events. For this reason, the participative results were too few to track and establish any sort of trend.

Second, comparison of percentages between the two types of data is meaningless because the data types and sources are completely different. Furthermore, there were differences in the questions themselves, some of which allowed for multiple and freeform answers. Thus, no metric comparison was possible. Finally, the survey data played a minor and supplementary role as compared to communication in the interpretation of this study (Yin, 1993).

Research Question #1

Combined Communication Data

In what ways does the observed virtual community correspond to theoretical aspects of communities of practice? How are these theoretical aspects represented or not represented in the virtual community of WIA? How do they deviate? To what degree are each of these characteristics represented in WIA?

The nine variables represented the theoretical aspects that are the distinguishing characteristics of CoPs. Because the Sublevel 1 variables were under the three main level variables in the embedded subunit hierarchy, the total communication data was divided among the six Sublevel 1 variables (see Table 7, p. 82). As summarized in Table 8 (p. 86), examining their relative percentages and distributions over the time period addressed Research Question #1.

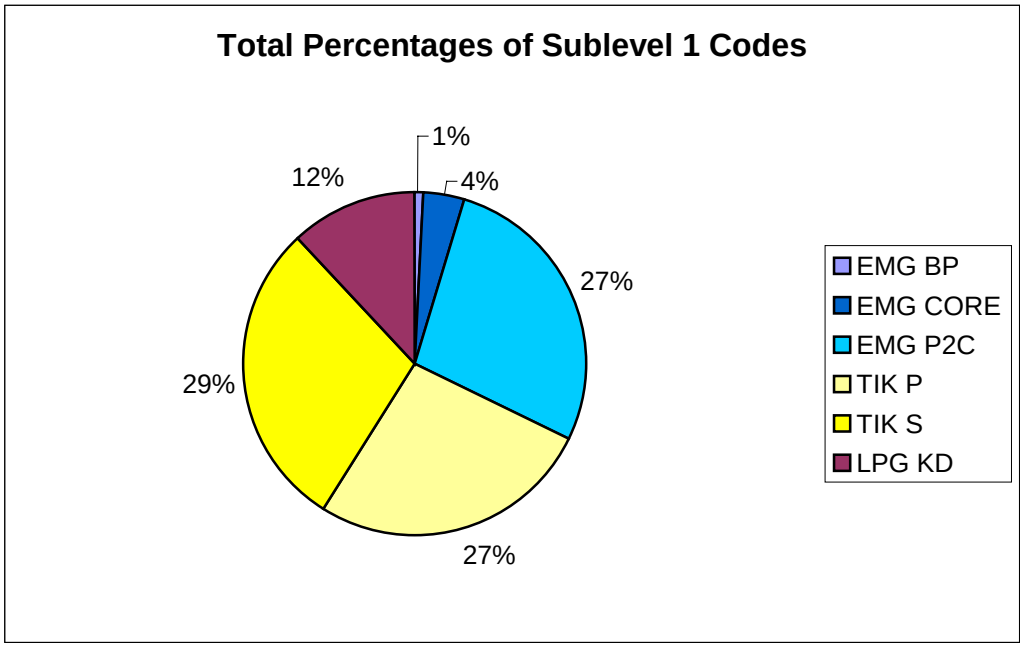

Figure 9. Percentage Distribution of Sublevel 1 Variables (*N* = 3303).

In examining Figure 9, the value of *N* represents the total number of normal instances that coincide with instances that match the variables, that is, the instances that are neither negative nor tangential. An ideal representation of each independent variable would have been one-sixth, or 16.67%, for each of the six Sublevel 1 variables. The researcher considered variables under 10% as being underrepresented (see Chapter 3, **Specific Procedures Employed**, *Data Views and Artifact Designation of CMC Data Types*).

Looking at Figure 9, one can see that three of the variables were well represented with over 25% each: 1) TIK-S (transfer of implicit knowledge via stories), 2) TIK-P (transfer of implicit knowledge via practice), and 3) EMG-P2C (emergence via peripheral to center movement). In this respect, these aspects of CoP theory corresponded to

distributed CoP theory, as developed and interpreted in this study. Although less than 25%, LPG-KD was still well represented at 12%.

However, the two variables that represented core behavior (EMG-CORE) and boundary practices (EMG-BP) were comparatively low, that is, 4% and 1% respectively. These low percentages showed that the theoretical representations of these variables did not present as strong of a case for the existence of a distributed CoP as the other variables.

Table 11 displays relative percentages (i.e., the percentages are relative to the other variables in a given analysis period) to compensate for the fluctuation of total amounts per analysis period (see Figure 4, p. 109). Appendix E displays the total instances for each analysis period. Although core behavior (EMG-CORE) was still low in comparison to most of the other variables, its proportion reached 7% by Analysis Period 5. This aspect can be compared to the learning as principal goal variable (LPG-KD), in which its fluctuation dipped down to as low as 7%. Nevertheless, the LPG-KD variable was 23% of the Analysis Period 5 totals, indicating a higher proportion of almost double of its original percentage.

Therefore, the percentages of Analysis Period 5 showed a different distribution of variables than Analysis Period 1. In short, there was higher proportion of both core behavior (EMG-CORE) and behavior corresponding to learning as a principal goal with respect to the community's knowledge domain (LPG-KD).

However, boundary practices (EMG-BP) remained low and were consistently underrepresented throughout all analysis periods, in which EMG-BP never rose more than 1%. Moreover, it dropped to 0% in Analysis Period 5. As in the case of EMG-CORE (i.e., core behavior), an increase in the variable percentage over the analysis periods

strengthened the case for distributed CoP behavior. On the other hand, a percentage decrease, as in the case of EMG-BP (i.e., boundary practices), in Analysis Period 5 weakened the case for the boundary practices attribute with respect to distributed CoP behavior. Fluctuations between analysis periods, as in the case of LPG-KD (i.e., learning as principal goal / knowledge domain) tended to confuse tendency towards distributed CoP behavior or tendencies to the contrary of CoP behavior.

Table 11. Relative Percentages of Variable Data by Analysis Period.

Variable	Analysis Period 1	Analysis Period 2	Analysis Period 3	Analysis Period 4	Analysis Period 5
EMG- BP	1%	1%	1%	1%	0%
EMG- CORE	3%	1%	2%	4%	7%
EMG- P2C	31%	34%	20%	25%	28%
TIK-P	22%	20%	33%	38%	17%
TIK-S	31%	36%	31%	25%	24%
LPG-KD	12%	7%	11%	8%	23%
Total	100%	100%	100%	100%	100%

One must consider these interpretations in light of interpreting case studies and qualitative studies in general (Yin, 1993; Yin, 1994, Miles & Huberman, 1984). Chapter 5 (see **Conclusions**, *Weaknesses*) expands on this area.

Research Question #1 with Research Question #3: CMC Artifacts

By combining Research Question #3 together with Research Question #1, the difference between using artifacts could be examined. This subsection analyzed the

differences in the representative aspects of distributed CoP behavior with respect to CMC tool type.

Research Question #1: In what ways does the observed virtual community correspond to theoretical aspects of communities of practice? How are these theoretical aspects represented or not represented in the virtual community of WIA? How do they deviate? To what degree are each of these characteristics represented in WIA?

Research Question #3: In what ways does the interaction and community understanding of the community members with its artifacts, specifically CMC and Web technology, aid the community in reaching its learning goals? In which ways do these tools help or hinder this interaction? Splitting the data into asynchronous and synchronous codes focused on Research Question #3, which considered how the community perceives and uses its artifacts.

In examining Figure 10, asynchronous data had greater percentages of the variables that signify transfer of implicit knowledge via stories (TIK-S) and learning as principal goal (LPG-KD). Synchronous data showed higher percentages of emergence via peripheral to center movement (EMG-P2C), as well as transfer of implicit knowledge via practice (TIK-P). This was confirmed by dividing the data into analysis periods, which is listed in Tables 13 and 14.

As described in the previous subsection, two of the variables had low percentages: emergence via core behavior (EMG-CORE) and emergence via boundary practices (EMG-BP). That was also the case with splitting the variables into asynchronous and synchronous types. Again, these low percentages showed that the theoretical representations of these variables did not present as strong of a case for the existence of a distributed CoP as with the other variables.

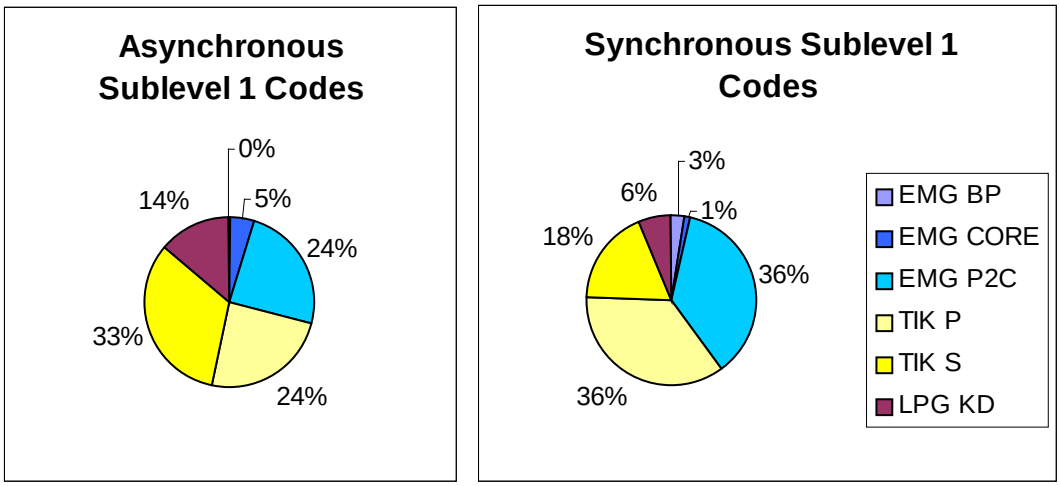

Figure 10. Percentage Distribution of Sublevel 1 Independent Variables by Asynchronous (N = 2427) and Synchronous (N = 876) Division.

However, viewing the data in both asynchronous and synchronous categories did show differences between the analysis periods with respect to core behavior (EMG-CORE). With respect to asynchronous data, core behavior was higher in the fourth analysis period and reached its peak in the fifth analysis period (see Table 12). In the case of synchronous data, its percentage actually dropped; however, the number of synchronous instances of EMG-CORE (N = 10) was very low in comparison to the number of asynchronous instances (N = 110). Thus, no real trend can be determined by such a low number of instances (see Table 13).

Table 12. Relative Percentages of Asynchronous Data by Analysis Period.

Variable	Analysis Period 1	Analysis Period 2	Analysis Period 3	Analysis Period 4	Analysis Period 5
EMG- BP	0%	1%	0%	1%	0%
EMG- CORE	4%	1%	4%	5%	7%
EMG- P2C	27%	34%	15%	18%	28%
TIK-P	19%	18%	29%	38%	17%
TIK-S	36%	38%	38%	30%	24%
LPG-KD	15%	8%	14%	8%	23%
Total	100%	100%	100%	100%	100%

Table 13. Relative Percentages of Synchronous Data by Analysis Period.

Variable	Analysis Period 1	Analysis Period 2	Analysis Period 3	Analysis Period 4	Analysis Period 5
EMG- BP	3%	4%	2%	3%	N/A
EMG- CORE	2%	1%	1%	1%	N/A
EMG- P2C	43%	33%	28%	38%	N/A
TIK-P	32%	33%	38%	38%	N/A
TIK-S	16%	23%	23%	13%	N/A
LPG-KD	4%	4%	8%	7%	N/A
Total	100%	100%	100%	100%	N/A

A final major difference between asynchronous and synchronous data were the difference between the relative percentages of learning as a principal goal (LPG-KD). In addition to having the higher overall percentage regarding asynchronous data, the asynchronous Analysis Period 5 displayed a large increase to 23% (see Table 12). There was also a higher percentage with the synchronous data of LPG-KD in the third and fourth analysis periods; however, these percentages did stay under 10% (see Table 13).

Furthermore, the number of instances of asynchronous instances ($N = 339$) exceeded considerably the number of instances of synchronous data ($N = 55$).

The artifact analysis of CMC (computer mediated communication) with respect to Research Question #1 confirmed and supported the analysis of total communication. Asynchronous data showed exaggerated versions of the total trends described in the previous section of this chapter. In addition, there were marked increases in the relative percentages of two of the variables: EMG-CORE (core behavior) and LPG-KD (learning as principal goal). However, one must bear in mind that the number of core behavior instances was low. Synchronous data was more pronounced with two of the variables having the vast majority of the total percentage.

Research Question #2

Introduction

In what ways can a community of practice, whose interactions are mainly carried out online, evolve with the founding of a virtual community designed specifically to enhance the emergent aspects of a community of practice (Wenger, 1998)?

Sublevel 2 variables described communication instances that exemplified behavior that applied to the corresponding Sublevel 1 variable within the embedded subunit hierarchy (see Table 7, p. 82). By analyzing Sublevel 2 variables in relation to each other using Time Series analysis, the researcher gained insight into the evolutionary aspects of distributed CoP behavior.

This section analyzes Research Question 2 in the following ways. First, there is a broad comparison between opening codes and the total communication data, as well as dividing the data into the CMC artifact views of asynchronous and synchronous. This

comparison checked to see if there had been any effect on the Sublevel 1 results described in the last section. Second, each Sublevel 1 variable was analyzed with respect to its corresponding set of Sublevel 2 variables, that is, within the hierarchical positions.

Removal of Opening Codes and Its Effect on Percentage Distribution

Chapter 3 described the three opening codes as introductory codes, that is, codes that represented potential follow-up activity that could emulate distributed CoP behavior — according to this study's interpretation of CoP theory (see **Special Procedures Employed**, *Data Views and Artifact Designation of CMC Data Types*). Table 7 (p. 82) lists all of the independent variables with their embedded subunits (see Appendix F for a full description of each variable). The three opening codes are also indicated in Table 7 and are restated here:

1. TIK-P-PROP (transfer of implicit knowledge via proposed collaboration),
2. TIK-S-PART (transfer of implicit knowledge via partial stories), and
3. LPG-KD-OPEN (learning as principal goal with respect to knowledge domain with respect to opening statements and opinions).

Opening codes represented 37% of all data that was coded as normal (i.e., N = 2084 without opening codes & N = 3303 with opening codes). As shown in Figure 11, the TIK (transfer of implicit knowledge) variables were reduced in relative percentage value; whereas the EMG (emergence) variables, principally EMG-P2C (emergence via peripheral to center movement), gained in relative percentage value.

This gain in the EMG variables is not surprising because the EMG variables did not have any opening codes – as was the case with both the TIK variables (see Figure 11). However, two factors are interesting to note. First, LPG-KD (learning as principal goal /

knowledge domain) did not change with respect to its relative percentage of 12% — even though it contained an opening code at the Sublevel 2 embedded subunit. Second, the EMG variable that increased most in its relative percentage was EMG-P2C (emergence via peripheral to center movement). The other two EMG variables, EMG-CORE (emergence via core member behavior) and EMG-BP (emergence via interaction with boundary members), showed minimal changes of 2% or less in their relative percentages (see Figure 11).

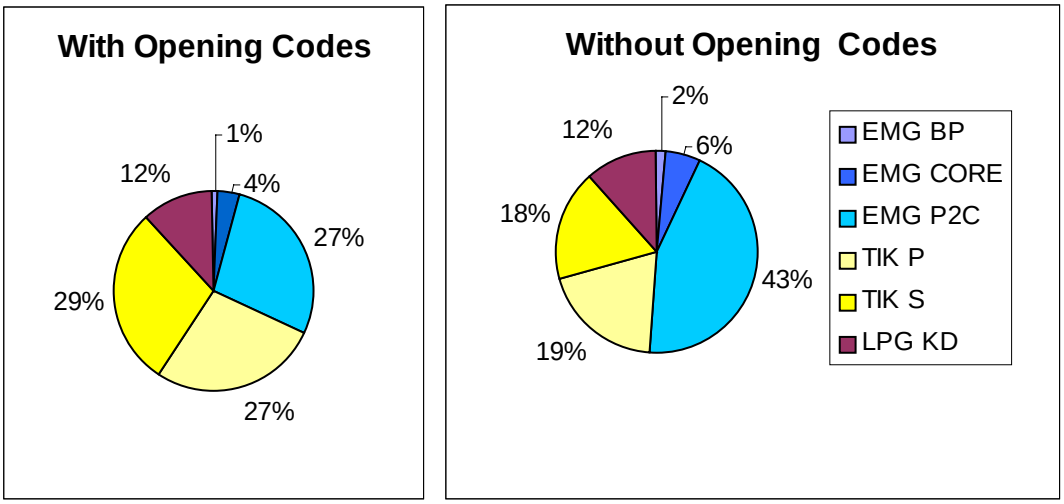

Figure 11. Relative Percentages of Sublevel 1 Data with Opening Codes ($N = 3303$) and Without Opening Codes ($N = 2084$).

In dividing the data into CMC type, asynchronous data did not show much change after removal of opening codes. As with the total communication data, the percentage of emergence codes (EMG), particularly peripheral to center movement (EMG-P2C), rose because EMG variables lacked opening codes. Conversely, transfer of implicit knowledge via practice (TIK-P) and stories (TIK-S) showed a reduced percentage because they did contain opening codes at the embedded layer of Sublevel 2. Figure 12 illustrates these relative percentages.

Synchronous data with and without opening codes is compared in Figure 13. Transfer of implicit knowledge via stories (TIK-S) fell below 10%. This meant that two of the six variables were well-represented, whereas the other four were underrepresented. The next subsection examines this occurrence in more detail.

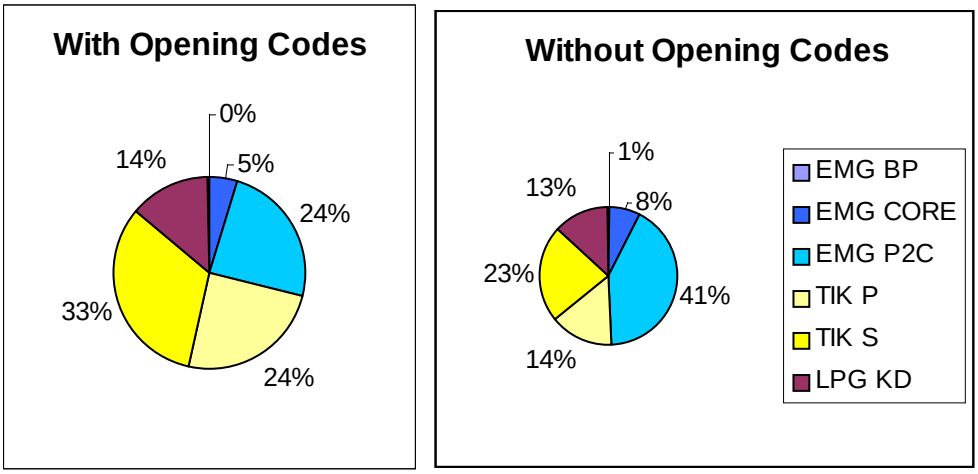

Figure 12. Relative Percentages of Asynchronous Sublevel 1 Data with Opening Codes (N = 2427) and Without Opening Codes (N = 1445).

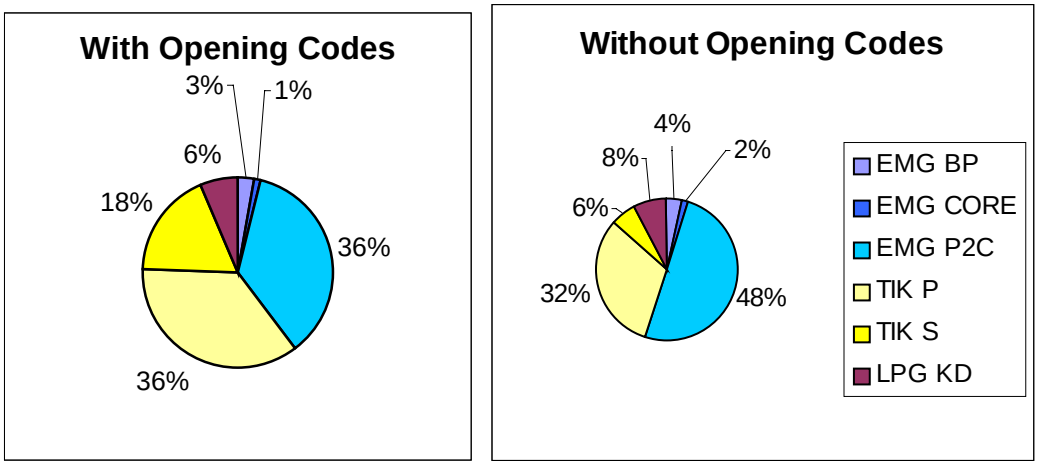

Figure 13. Relative Percentages of Synchronous Sublevel 1 Data with Opening Codes (N = 876) and Without Opening Codes (N = 639).

Thus, as described in the previous section, the discussion of Research Question #1 — with respect to the low relative percentages of EMG-CORE and EMG-BP — remained consistent after removal of opening codes (see the previous section). In addition, the relatively constant LPG-KD percentage was addressed further with respect to Research Question #2. As previously mentioned, the change in the amounts of the other variables can be explained by the fact that the EMG-P2C variable did not contain any opening codes at the Sublevel 2 level, whereas TIK-P and TIK-S did. This pattern stayed consistent after breaking the relative percentage data into analysis periods (see Appendix E). The following subsections compare opening codes with other Sublevel 2 variables in addressing Research Question #2.

Research Question #2: Learning as Principal Goal

Figure 14 illustrates the percentage comparison between the LPG-KD (learning as principal goal / knowledge domain. The three Sublevel 2 variables represent a progression from stating individual opinions (LPG-KD-OPEN) to meta-discussions about the community itself (LPG-KD-GOAL) (see Table 7, p. 82, as well as Appendix F for a more detailed description of all variables). The middle variable, LPG-KD-NEG, corresponds to a discussion of opinions.

As shown in Figure 14, the higher percentage of the LPG-KD-NEG (negotiation) variable indicated evolution of opening opinions (LPG-KD-OPEN) to a negotiation level (LPG-KD-NEG). This was supported by the breakdown of the variables into analysis periods as illustrated in Figure 15 (p. 132). However, in Analysis Periods 2 and 4, LPG-KD-OPEN exceeded LPG-KD-NEG, which did not support this assertion.

On the other hand, LPG-KD-NEG exceeded LPG-KD-OPEN by the largest margin in Analysis Period 5, which did support the evolution from opening codes to the negotiation level. Nevertheless, a consistent rise in the difference between the two variables would have presented a stronger case. Furthermore, increases in the third variable, which symbolizes meta-conversations about the community itself (i.e., LPG-KD-GOAL) would have further supported this theory. However, in the case of LPG-KD-GOAL, the opposite effect was observed, in which there was a decrease from the first analysis period to zero instances in the fifth analysis period.

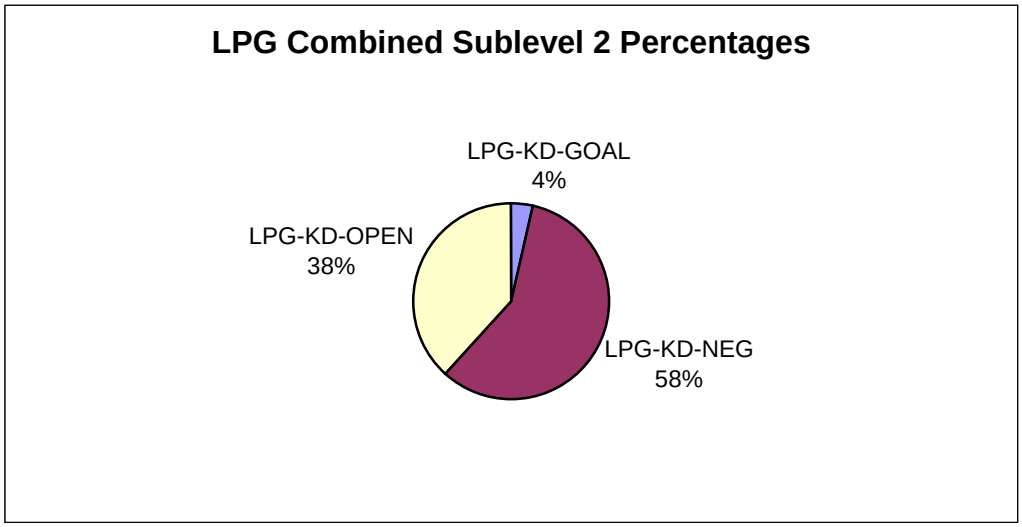

Figure 14. Percentage Distribution of Learning as Principal Goal / Knowledge Domain: Embedded Subunits (N = 394).

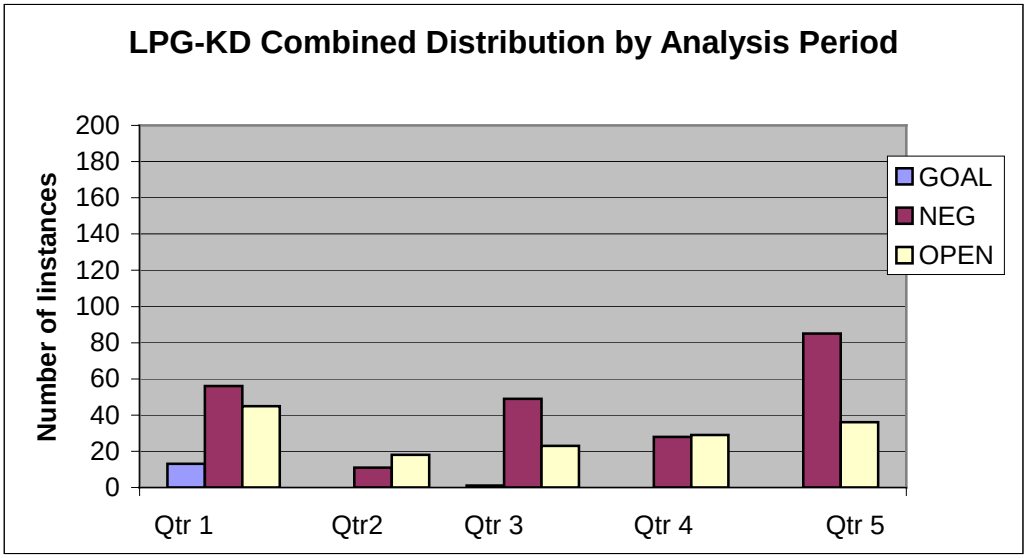

Figure 15. Distribution of Learning as Principal Goal / Knowledge Domain: Embedded Subunits by Analysis Period (*N* = 394).

Research Question #2 with Research Question #3: Learning as Principal Goal

Splitting the data to asynchronous and synchronous types addressed Research Question #3 with respect to the Learning as Principal Goal/Knowledge Domain variable (LPG-KD). Figure 16 shows both the asynchronous and synchronous percentages of the LPG-KD variable (learning as principle goal with respect to the knowledge domain) at Sublevel 2. Both genres of data displayed a higher percentage of negotiation (LPG-KD-NEG) than introductory instances (LPG-KD-OPEN). Keeping in mind the differences between the number of instances between asynchronous (*N* = 339) and synchronous (*N*= 55), synchronous data indicated a much higher relative percentage of negotiation to opening data.

Another area of difference is the lack of goal oriented discussion (i.e., LPG-KD-GOAL), that is, discussion and negotiation relating to the goals of the community itself.

Although asynchronous data registered a small percentage, synchronous data did not contain any instances of this independent variable.

Breaking up the data into analysis periods depicted increases in the negotiation variable in the latter analysis periods. For asynchronous data, the difference between the introductory variable (LPG-KD-OPEN) and the negotiation variable (LPG-KD-NEG) increased and reached its maximum in the fifth analysis period (see Figure 17). In the case of synchronous data, the negotiation variable is higher in the latter two analysis periods (see Figure 18).

As in the previous subsection, which discussed total communication data, a more consistent trend would have presented a stronger case of CoP behavior. However, the higher numbers of instances in the latter analysis periods are a positive indication of CoP behavior.

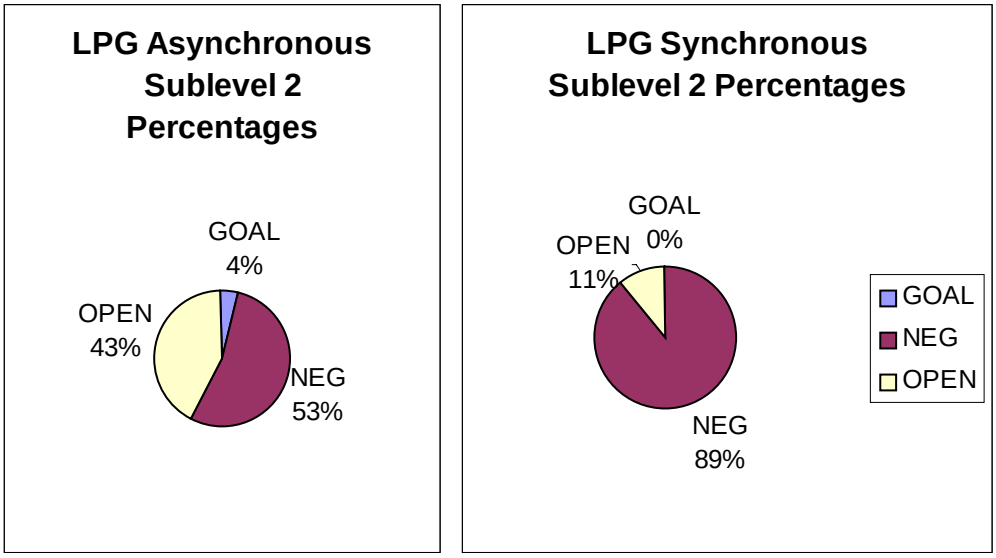

Figure 16. Asynchronous Percentage Distributions of Learning as Principal Goal / Knowledge Domain: Embedded Subunits ($N = 339$ & $N = 55$).

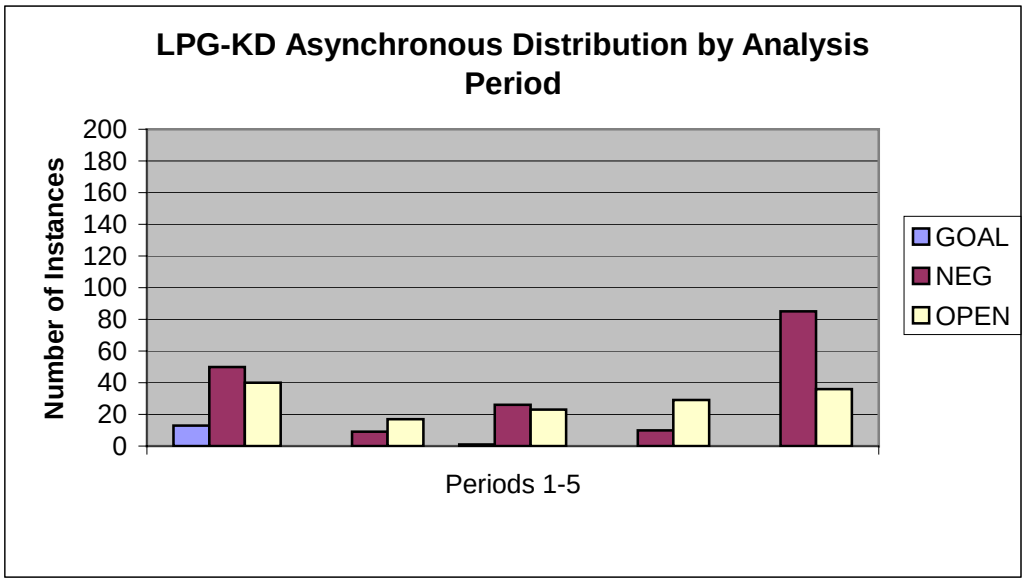

Figure 17. Asynchronous Distributions of Learning as Principal Goal / Knowledge Domain: Embedded Subunits by Analysis Period ($N = 339$).

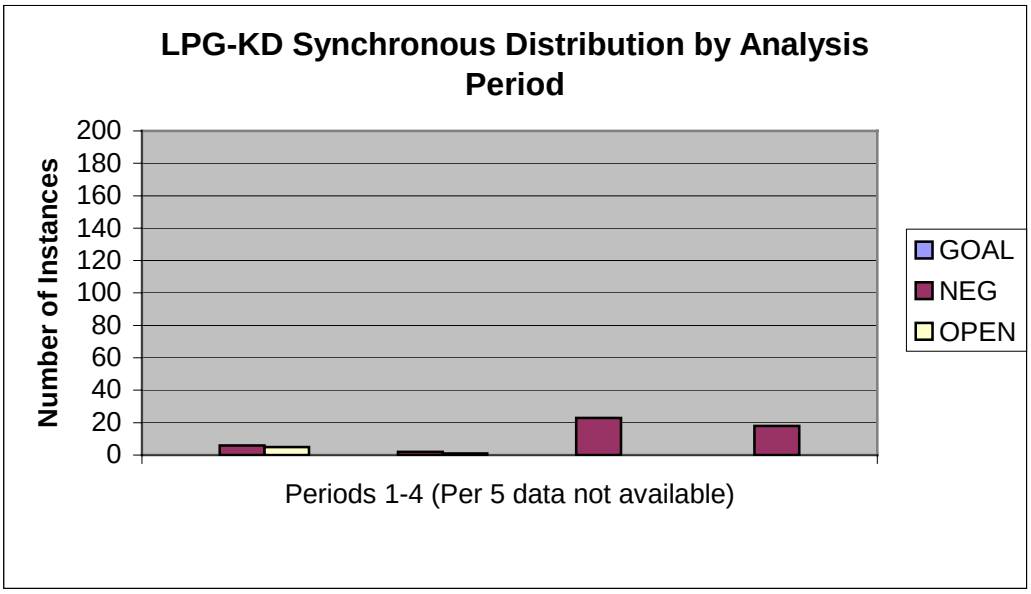

Figure 18. Synchronous Distributions of Learning as Principal Goal / Knowledge Domain: Embedded Subunits by Analysis Period ($N = 55$).

Research Question #2: Transfer of Implicit Knowledge via Practice

The Sublevel 1 variable TIK-P (transfer of implicit knowledge via practice consisted of three embedded Sublevel 2 units (see Table 7, p. 82):

1) the opening code TIK-P-PROP (proposed collaboration),
2) TIK-P-ACT (actual collaboration observable in the communication), and
3) TIK-P-REP (reported collaboration of current or present activities).

TIK-P-ACT was mainly observable in synchronous environments. TIK-P-REP could be observed in both environments, for example, if certain community members were using other tools than those that produced the communication logs (e.g., private chat) and reporting the results in community communication logs.

The relation of the opening code TIK-P-PROP to the other two variables in TIK-P differed to the learning as principal goal progression (LPG-KD), as described in the previous subsection. The difference was that the opening code of TIK-P-PROP could spawn postings of either TIK-P-REP or TIK-P-ACT, rather than the progression of each variable to the next, as was in the case of learning as a principal goal (i.e., LPG, see the previous two subsections).

Figure 19 displays the relative percentages between the opening code (TIK-P-PROP) and the other two variables. As shown in Figure 19, the ratio of proposed collaboration to collaboration that actually takes place is almost 50-50.

Figure 20 shows the breakdown of the TIK-P Sublevel 2 variables by analysis period. In all analysis periods, the combination of proposed collaboration (TIK-P-OPEN) with real collaboration (TIK-P-ACT & TIK-P-REP) approached 50%, ranging between 49% and 64% (see Appendix E).

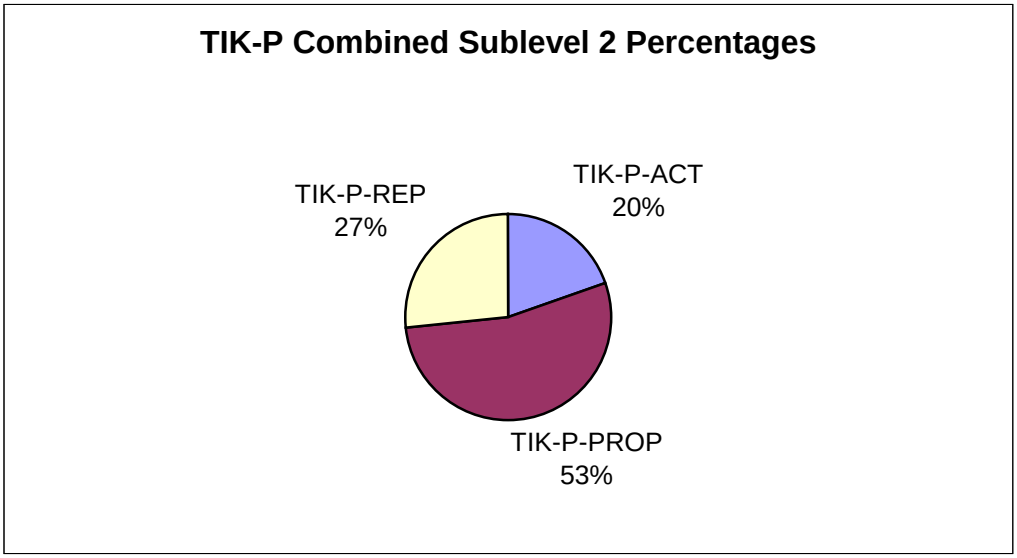

Figure 19. Percentage Distribution of Transfer of Implicit Knowledge via Practice: Embedded Subunits (N = 888).

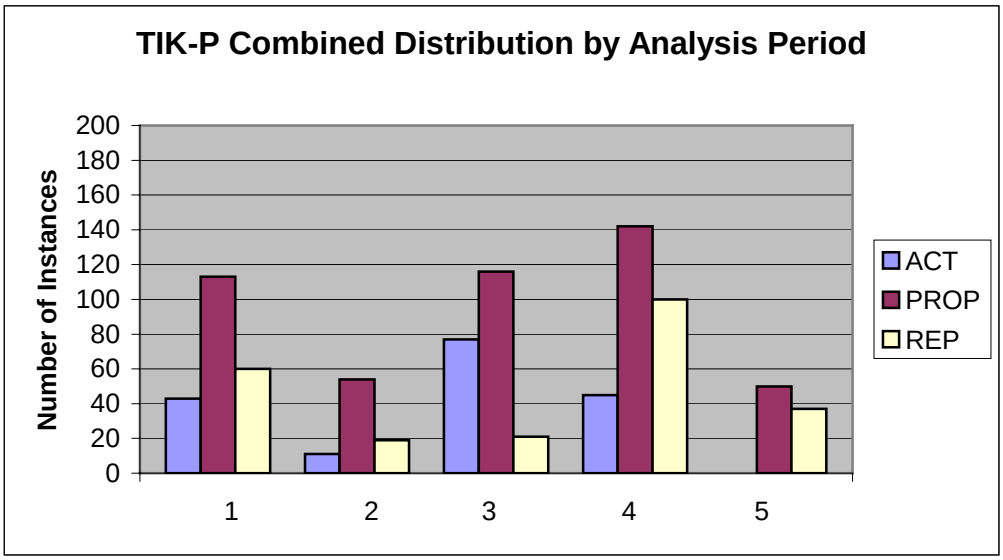

Figure 20. Distribution of Transfer of Implicit Knowledge via Practice: Embedded Subunits by Analysis Period (N = 888).

Research Question #2 with Research Question #3: Transfer of Implicit Knowledge via Practice

The split of each variable into asynchronous and synchronous modes is displayed in Figure 21. The total asynchronous percentages showed an almost two-thirds to one-third ratio between the opening code that proposed collaboration (TIK-P-PROP) and the other variables that represented collaboration through practice (i.e., TIK-P-ACT & TIK-P-REP). The synchronous percentages exhibited the opposite case with approximately one-third of the cases being proposed collaboration.

Looking at Figure 22, the proportion of proposed collaboration to actual collaboration (i.e., TIK-P-ACT & TIK-P-REP) increased in the final two analysis periods. On the other hand, synchronous data showed a consistently higher proportion of actual collaboration to proposed collaboration (see Figure 23).

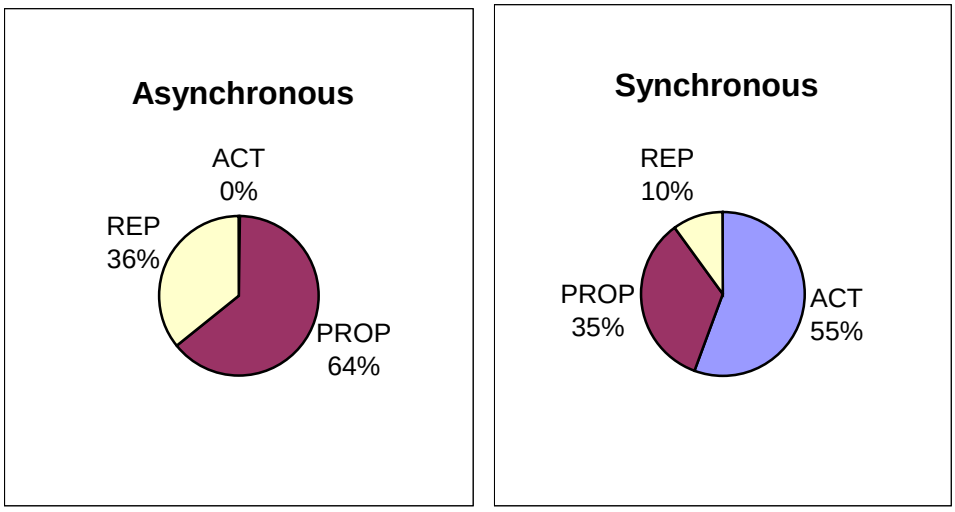

Figure 21. Asynchronous and Synchronous Percentage Distributions of Transfer of Implicit Knowledge via Practice: Embedded Subunits ($N = 575$ & $N = 313$).

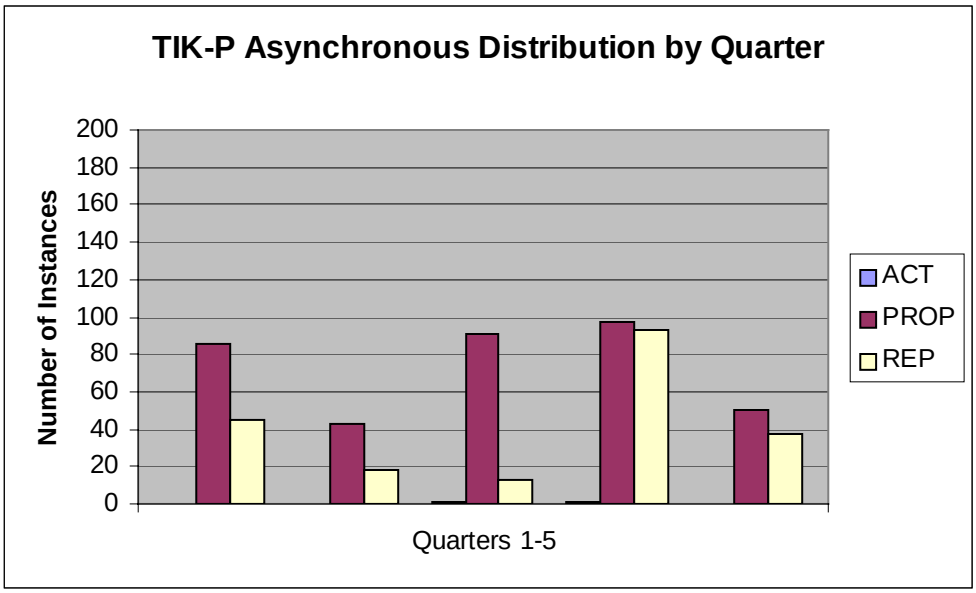

Figure 22. Asynchronous Distributions of Transfer of Implicit Knowledge via Practice: Embedded Subunits by Analysis Period ($N = 575$).

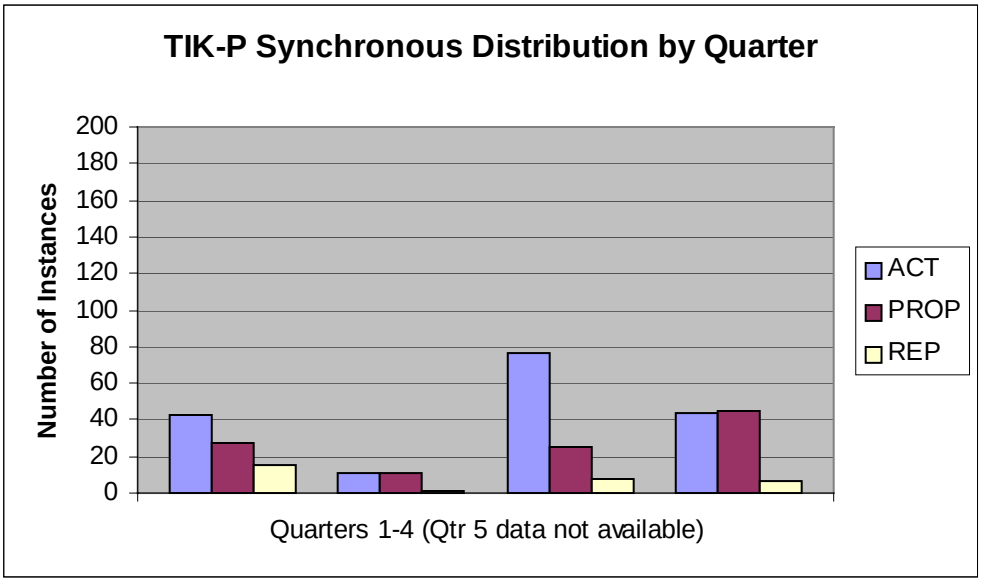

Figure 23. Synchronous Distributions of Transfer of Implicit Knowledge via Practice: Embedded Subunits by Analysis Period ($N = 313$).

Research Question #2: Transfer of Implicit Knowledge via Stories

Transfer of implicit knowledge via stories was more straightforward than the variables used in practice. There were only two variables: 1) the opening variable (TIK-S-PART), which symbolized partial stories, and 2) complete stories (TIK-S-COMP). Complete stories contained all three elements of stories as described by Wenger, McDermott, and Snyder (2002).

As depicted in Figure 24, the opening code (TIK-S-PART) had a greater percentage difference than the percentage differences in the variables that represented transfer of implicit knowledge via practice (TIK-P). However, Figure 25 shows this difference decreasing with each successive analysis period – with the exception of Analysis Period 2. Moreover, there is a consistent decrease in this percentage difference in the last three analysis periods. In fact, complete stories actually exceed partial stories in Analysis Period 5.

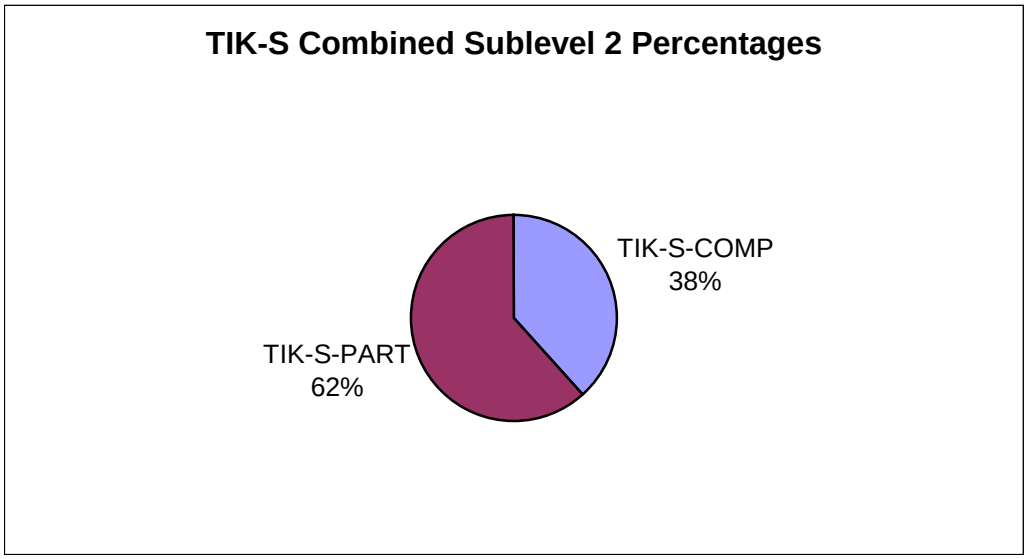

Figure 24. Percentage Distribution of Transfer of Implicit Knowledge via Stories: Embedded Subunits ($N = 961$).

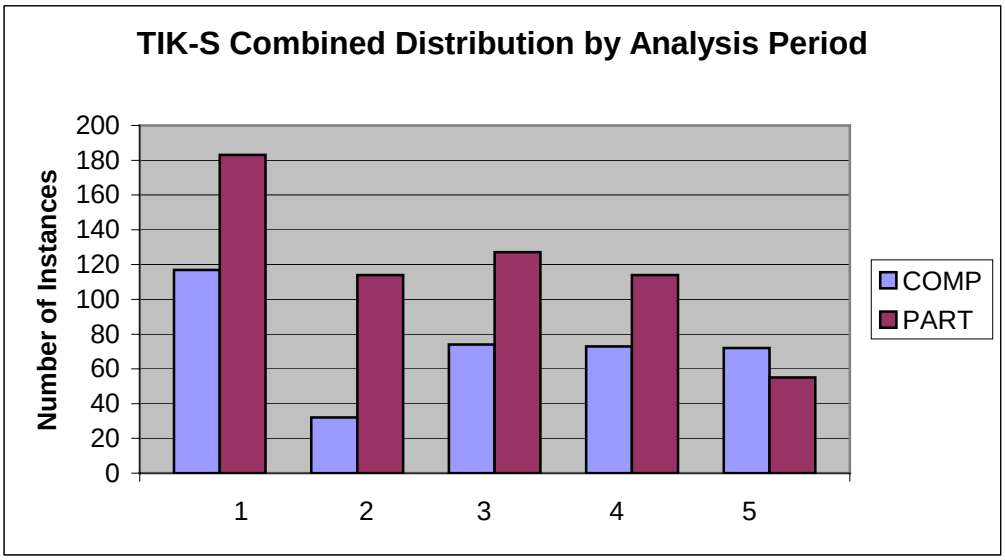

Figure 25. Distribution of Transfer of Implicit Knowledge via Stories: Embedded Subunits by Analysis Period (N = 961).

Research Question #2 with Research Question #3: Transfer of Implicit Knowledge via Stories

As in previous subsections, Research Question #3 divides the data into asynchronous and synchronous views. As displayed in Figure 26, asynchronous data depicted an approximate three to two proportion of complete stories to partial stories. With respect to synchronous data, the proportion of partial stories exceeded complete stories by more than three to one. This is confirmed by breaking the data up into analysis periods.

Asynchronous data showed an increase in the proportion of complete to partial stories in the last three analysis periods, with Analysis Period 5 showing the number of complete stories actually exceeding partial stories (see Figure 27). With synchronous

data, the number of partial stories remained consistently higher than complete stories (see Figure 28).

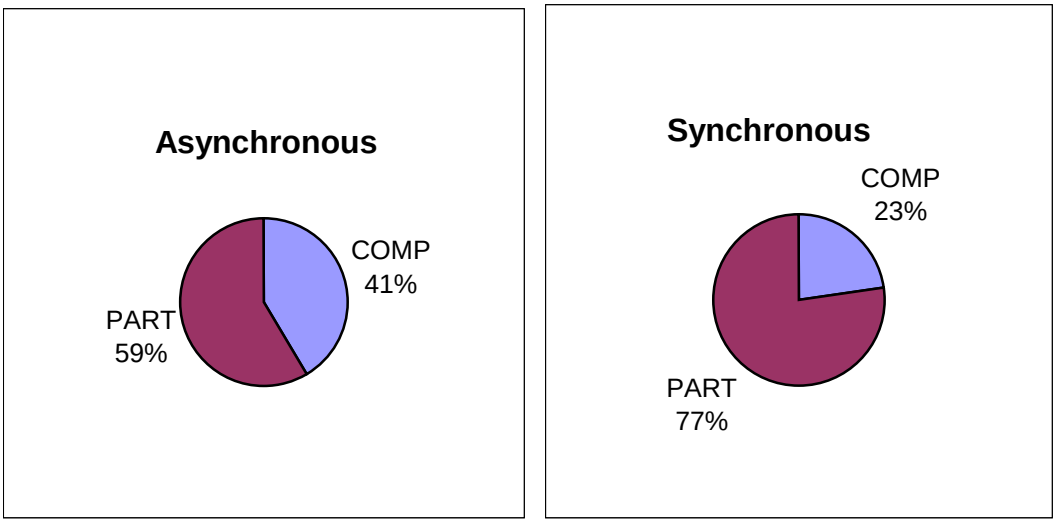

Figure 26. Asynchronous and Synchronous Percentage Distributions of Transfer of Implicit Knowledge via Stories: Embedded Subunits (N = 802 & N = 159).

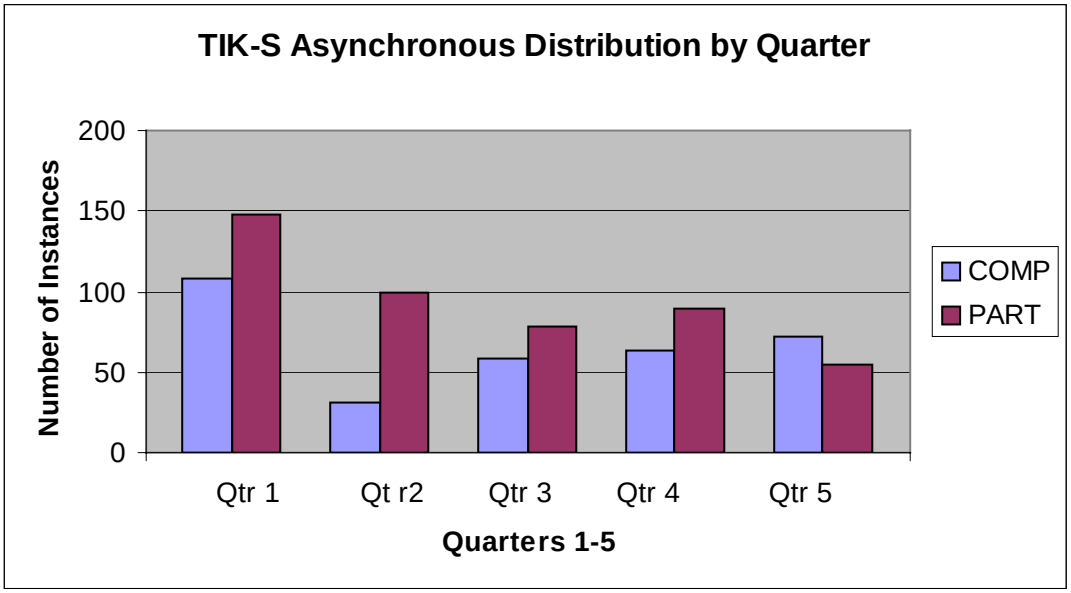

Figure 27. Asynchronous Distributions of Transfer of Implicit Knowledge via Stories by Analysis Period: Embedded Subunits (N = 802).

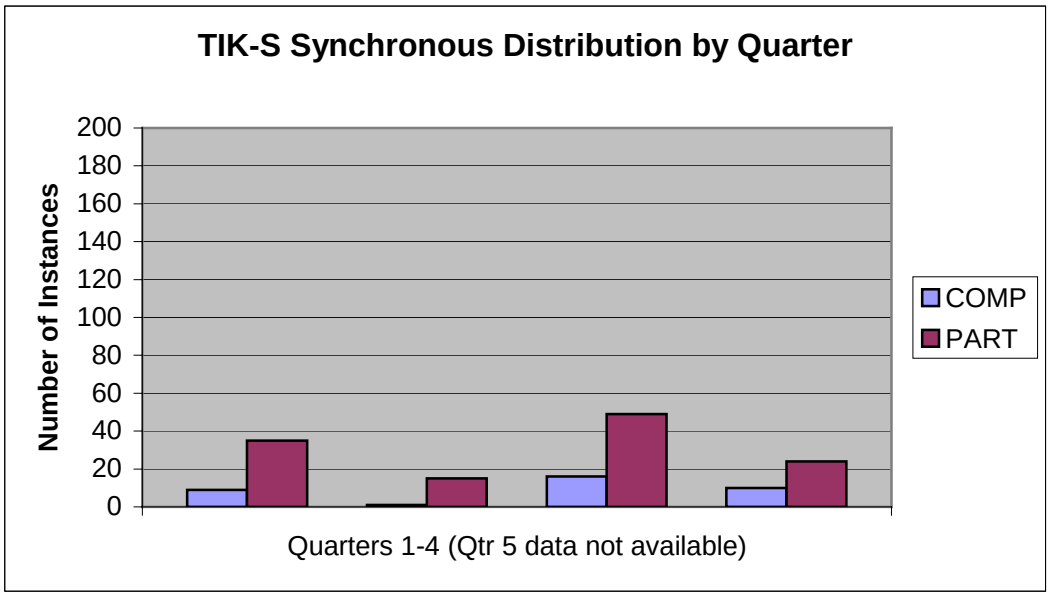

Figure 28. Synchronous Distributions of Transfer of Implicit Knowledge via Stories: Embedded Subunits by Analysis Period (N = 159).

Research Question #2: Emergence With Respect to Peripheral to Center Movement

In the case of emergence with respect to peripheral to center movement (EMG-P2C), the researcher did not consider this variable to have an opening code. This was because of the nature of the variable itself, which is discussed further in Chapter 5.

Figure 29 displays the breakdown of the EMG-P2C Sublevel 1 variable into its embedded subunits at Sublevel 2. As shown in Figure 29, acknowledgement of gained expertise (EMG-P2C-ACKN) had a negligible percentage compared to the other three variables. EMG-P2C-ACKN represented a more evolutionary status than the other variables. The other three EMG-P2C variables interacted with each other.

This intertwined nature of the other three variables can yield some insight. The EMG-P2C-EX represented a live question and answer exchange found in synchronous environments. The interactive exchange represented by the bi-directional EMG-P2C-EX

variable in itself described CoP behavior; therefore, a large relative percentage of this variable applies to CoP behavior.

The other two variables represented a longer and more divided exchange typically, but not necessarily, found in asynchronous environments. A high percentage of asking questions (EMG-P2C-QUE) to receiving responses (EMG-P2C-REC) would show CoP-type behavior. Although the receiving variable (EMG-P2C-REC) represented a high percentage in total (see Figure 29), its percentage is comparatively lower in the final three analysis periods – especially when compared to the first analysis period (see Figure 30).

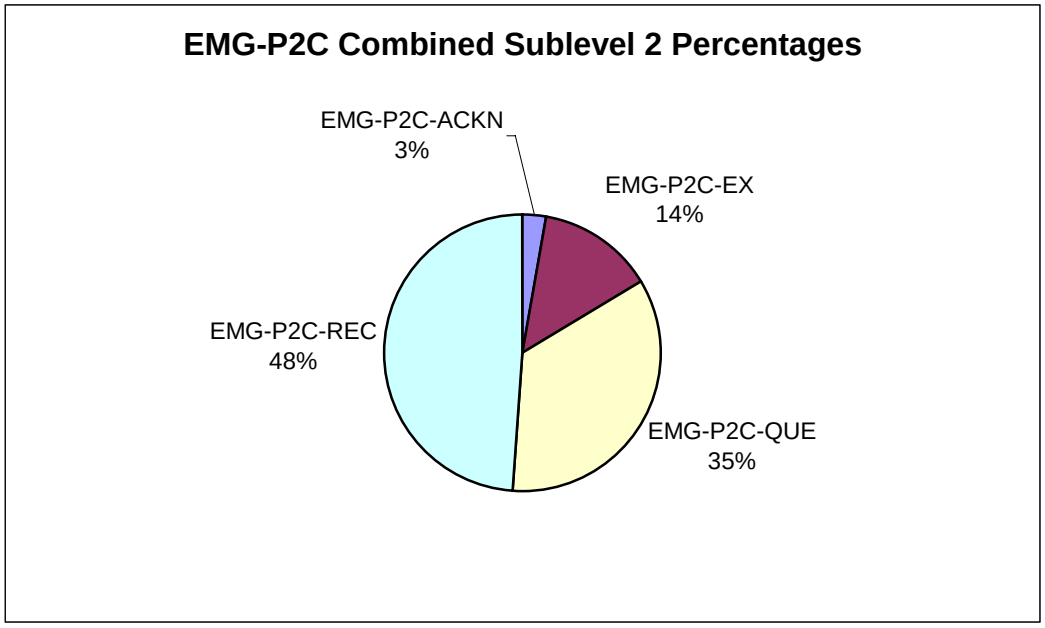

Figure 29. Percentage Distribution of Emergence via Peripheral to Center Movement: Embedded Subunits (*N* =908).

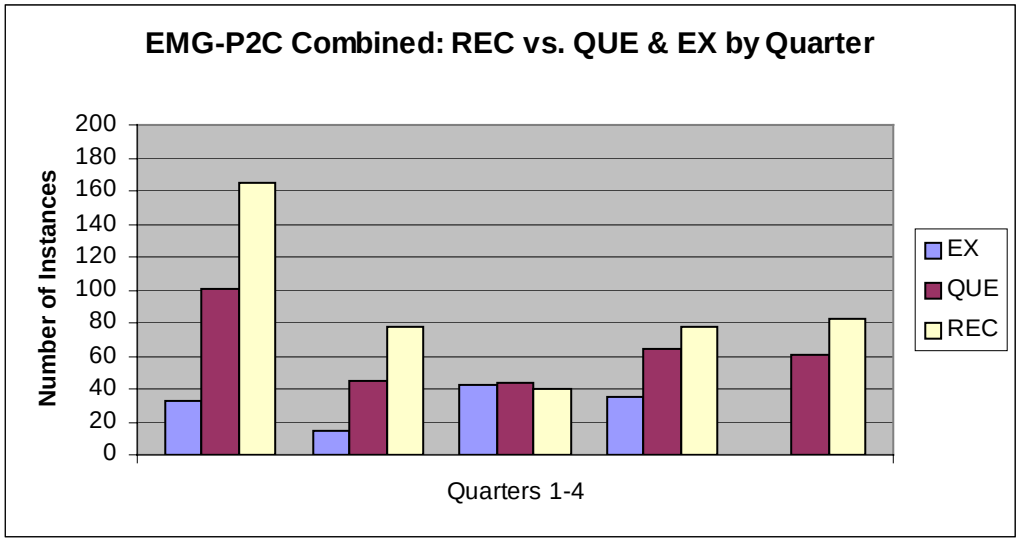

Figure 30. Distribution of Transfer of Implicit Knowledge via Stories: Embedded Subunits by Analysis Period. (N = 884). Note: does not include EMG-P2C-ACKN.

This subsection presented the data analysis for the Sublevel 2 variables, in which the evolutionary aspects of WIA as a distributed CoP were discussed. Because the Sublevel 1 percentages were so small for the core behavior variable (EMG-CORE) and the boundary practices variable (EMG-BP), the researcher did not find further division into their Sublevel 2 variables useful for this analysis.

Research Question #2 with Research Question #3: Emergence With Respect to Peripheral to Center Movement

Figure 31 displays the breakdown of the EMG-P2C Sublevel 1 variable into its embedded subunits at Sublevel 2 with regard to asynchronous and synchronous categories. As shown in Figure 31, with respect to both categories; acknowledgement of gained expertise (EMG-P2C-ACKN) had a negligible percentage compared to the other

three variables. EMG-P2C-ACKN represented a more evolutionary status than the other variables. The other three EMG-P2C variables interacted with each other.

In the case of synchronous communication, the question to response percentages are almost even with 29% and 30% respectively. In addition, the question and response exchange variable (EMG-P2C-EX) made a strong case for CoP behavior. However, asynchronous communication showed a larger percentage of the response variable, although both variables were well above 10%.

Data divided into analysis periods depicted synchronous data as response data being lower than question data in Analysis Period 3 and Analysis Period 4 (see Figures 33 and 34). Although response data were higher in asynchronous analysis periods, the comparative number of instances was lower in Analysis Period 4 and Analysis Period 5. Chapter 5 interprets these results.

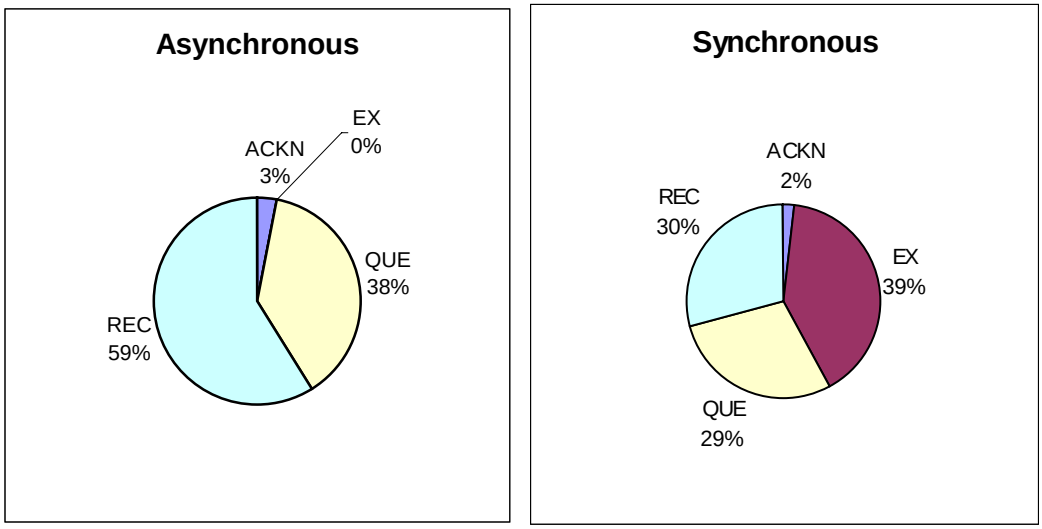

Figure 31. Asynchronous and Synchronous Percentage Distributions of Emergence With Respect to Peripheral to Center Movement: Embedded Subunits (N = 593 & N = 315).

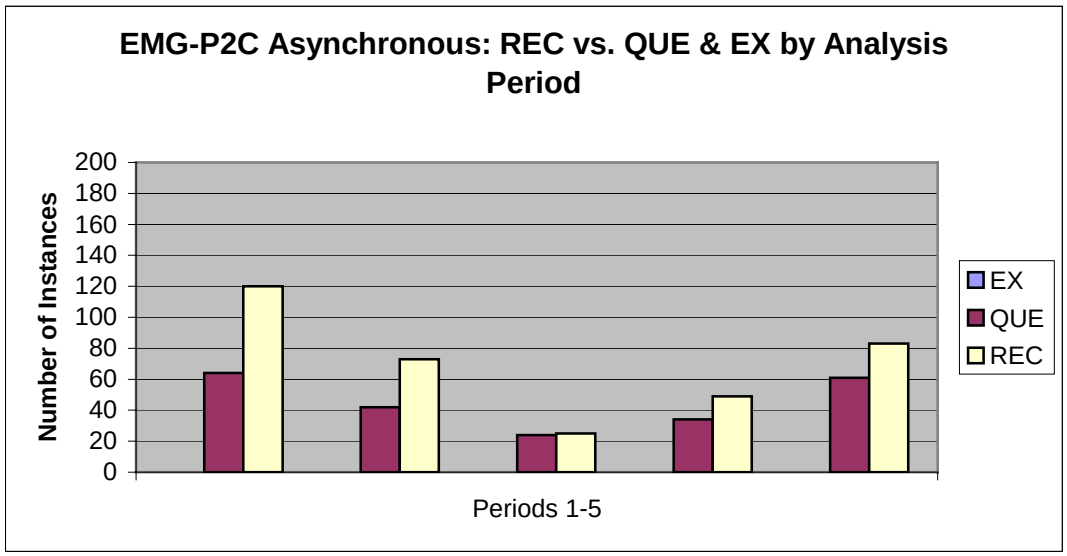

Figure 32. Asynchronous Distributions of Emergence With Respect to Peripheral to Center Movement: Embedded Subunits by Analysis Period (N = 593).

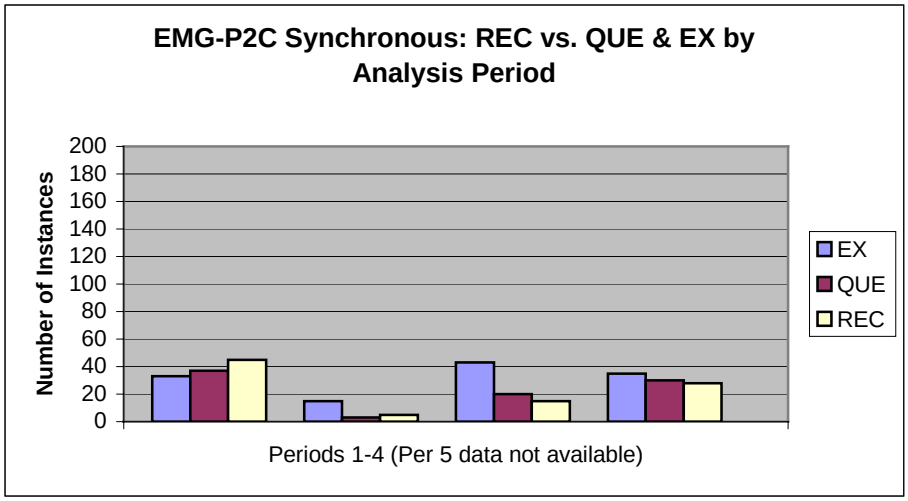

Figure 33. Synchronous Distributions of Emergence With Respect to Peripheral to Center Movement: Embedded Subunits by Analysis Period. (N = 315).

Summary of Results

The analysis conducted in this study followed qualitative methods for an interpretive, explorative, and longitudinal case study designed to investigate CoP theory with respect to an online learning community. Forming the bulk of the data analysis, communication logs were compared to the independent variables embedded in subunits of three levels. In order to address the research question pertaining to artifacts, the communication data was divided into asynchronous and synchronous CMC data types. Survey data served as supporting analysis.

In the final analysis of communication data, this study used time series analysis to track the evolution of the variables over the 13-month analysis period. However, the researcher found no association between events and any of the independent variables. In addition, there was no association between events and smaller time divisions, such as, monthly divisions. Thus, time series analysis was restricted to analysis periods of three-month intervals, with the final analysis period of one month.

For communication data, the theoretical proposition was supported in all theoretical areas represented by the variables, except one. The variable representing emergence with respect to boundary practices had higher percentages of combined tangential and negative instances. Moreover, these higher negative and tangential instances occurred in the last analysis period. If they had occurred in the first analysis period, then a trend toward distributed CoP behavior with respect to boundary practices could have been justified..

In order to address Research Question #3, which considered community use and understanding of its artifacts regarding CMC and Web technology; the researcher divided the communication data into asynchronous and synchronous classifications. Therefore,

the theoretical proposition and other research questions were considered with respect to Research Question #3.

Regarding the boundary practices variable, synchronous data supported the theoretical proposition, whereas asynchronous data did not. Moreover, asynchronous data showed this higher percentage of negative and tangential data in Analysis Period 5 only, by which time more CoP type behavior should have been prevalent — assuming the CoP had evolved since its inception as an online instructor-based course.

Survey data played a minor supporting role, compared to the bulk analysis of communication data. It consisted of a comparison of two types of samples: purposive and random. For both types of samples, the theoretical proposition was not supported in the case of emergence via peripheral to center movement, as well as transfer of implicit knowledge via practice.

Survey data did not support two of the independent variables. Survey data supported the communication data in the sense, that is, there was not a complete acceptance of the theoretical proposition. However, the two variables that were not supported were different from the boundary practice variable, which was not supported by the communication data. Because of the inconclusive evidence of the questions that focused on time series analysis, the survey data did not address the research questions further.

Research Question #1 addressed the correspondence and representation of each variable to CoP theory. Of the six Sublevel 1 variables, four variables showed high representation of the theoretical aspects of CoP theory, and two variables showed low representation: core behavior and boundary practices. Although the other variables were

well represented, fluctuations within the analysis periods, rather than consistent trends, weakened somewhat the case for their correspondence to CoP theory.

With respect to Research Question #3 in relation to Research Question #1, the emergence variables representing core behavior and boundary practices had very low synchronous percentages and low total number of synchronous instances. They also resulted in low percentage values in the asynchronous category; however, the core behavior variable did show a percentage increase in the latter analysis periods.

Sublevel 2 variables described communication that exemplified a given Sublevel 1 variable within the embedded subunit hierarchy (see Table 7, p.82). They pertained to Research Question 2, which examined how distributed CoPs evolve. First, the researcher filtered out codes that represented introductory behavior of CoPs (i.e., proposed collaboration, an opinion that could potentially open discussion, or a partial story). Temporarily removing them from the data body revealed "purer" CoP behavior, for these variables represented the first step in a given evolutionary process of communication within a distributed CoP.

Regarding synchronous data, removal of opening codes revealed four of the six Sublevel 1 variables as having percentage values under 10%. Only the variables representing transfer of implicit knowledge via practice and emergence via peripheral to center movement were well-represented above 30% each. Asynchronous data distribution was similar to the combined distribution. However, the variable representing learning as a principle goal gained a percentage well above 10%.

In comparing all of the related Sublevel 2 variables to each other, Research Question #2 showed mixed results with regard to the evolution of a CoP over time. The embedded subunits of emergence via peripheral to center movement, learning as a

principal goal in relation to the knowledge domain, as well as transfer of implicit knowledge via practice and stories all were strongly represented. These embedded subunits symbolized the exchange between introductory behavior and movement towards more developed CoP behavior. However, variables that represented meta and higher level community planning were underrepresented.

Finally, this section examined Research Question #2 in the context of Research Question #3. With asynchronous data, learning as principle goal confirmed the results of the combined communication data. However, synchronous communication showed a much higher percentage of negotiation of learning goals with respect to introduction of topics. In the case of transfer of implicit knowledge via practice, synchronous communication also registered higher in proportion of proposed collaboration to actual collaboration.

Synchronous communication depicted a more even exchange of variables representing the exchange of peripheral to center behavior. Conversely, asynchronous communication exhibited a higher percentage of complete stories as described by Wenger, McDermott, and Snyder (2002). The next and final chapter deals with the conclusions, implications, recommendations of this study.

Chapter 5

Conclusions, Implications, Recommendations, and Summary

Conclusions

Introduction

This case study was a qualitative study, which compared theory to a large amount of data. In addition, the study entailed a focusing process, using the theory in the form of independent variables as a guideline. In other words, the independent variables were gleaned out of the theory as unique identifiers of a distributed community of practice, and they were applied to an existing online community.

The researcher categorized and summarized this gleaned data. This meant the conclusions of this study were based on a focused analysis of uncontrolled events. During the categorization, the researcher captured his train of thought in the form of written memos. The content of these memos is summarized in a chronological journal in Appendix C.

Thus, the researcher assumed the interpretive burden of this study (Hagelin, 1999), hence the designation of interpretive case study. Its goal was to test theory against a real community to develop new theory and research questions, in contrast to establishing cause and effect under controlled conditions (Yin, 1993). Because of this previously described nature as a qualitative and interpretive case study, these conclusions

are not generalizable to other studies. Establishing whether the independent variables are true tests of online communities of practice would require many other tests of these variables with other online communities.

However, the researcher can recommend and has recommended this study's approach to future studies (see the **Recommendations** section of this chapter). Furthermore, he has introduced further interpretations of CoP theory with respect to online communities and groups (see the **Implications** section of this chapter).

Conclusions of the Data Analysis

Yin (1993) cited triangulation from different sources of data as the method to form conclusions in case studies. He also noted constructing a case study database to support the conclusions against theory. This study employed and triangulated the following data sources as presented in Chapter 4:

1. Communication data, which was based on data from the two principal communication logs as viewed in total.
2. Artifact data, which was based on Web sites and vertical division of communication data logs into asynchronous and synchronous categories. Because Web site data were inconclusive, this study relied on the division of communication data into asynchronous and synchronous categories for the conclusions of the artifact data.
3. Survey data, whose results were derived from the questionnaire presented in Appendix D.

Survey data played a secondary and minor supporting role in deriving these conclusions. The bulk of the conclusions weighted more heavily on communication data

in total, as well as its vertical division into asynchronous and synchronous categories based on artifact usage. The following subsections address the theoretical proposition, as well as Research Questions #1 and #2. Research Question #3 is discussed within these subsections with respect to the division of data into asynchronous and synchronous categories.

The Theoretical Proposition

The virtual community Webheads in Action exhibits behavior of a distributed community of practice if it possesses all nine characteristics unique to distributed CoPs. Instances of negative or tangential behavior with respect to the nine characteristics weaken, or possibly negate, the theoretical proposition that distributed CoP behavior is exhibited by this virtual community.

As explained in Chapter 4, the theoretical proposition was not supported for one variable. The independent variable that described emergence with respect to boundary practices (EMG-BP) had a higher percentage of negative and tangential instances than those that corresponded with the variable's description. The survey data supported the results of the communication data, albeit with two other variables.

As the primary data source, communication data showed that the number of tangential and negative instances of emergent behavior, with respect to boundary practices, exceeded the number of instances that corresponded with this variable in Analysis Period 5. Because Analysis Period 5 was the last data period considered in the 13-month analysis period, this result ran counter to the theoretical concepts of a CoP's evolution. In other words; in Analysis Period 1, the online group of WIA started as a conventional online course that was more or less centered on an instructor or key figure.

As the WIA organization continued after the online course had ended (i.e., after April 2002); theoretically, the group should have assumed more CoP traits — including what the boundary practices variable represented, as it evolved over time. This Analysis Period 5 rejection of boundary practices ran counter to that assumption.

In general, communication that contradicted treatment of participants as individuals received negative or tangential classifications. This was especially true in the emergence category, of which boundary practices was an embedded subunit (see Table 14). Emergence via peripheral to center movement totals (EMG-P2C) also contained examples of negative and tangential classifications; however, the normal classifications (i.e., those that matched the researcher's interpretation of the theory) exceeded tangential and negative instances for this independent variable.

In all of these emergence categories, negative and tangential instances exhibited more conventional education communication methods, in which participants are put into groups and given standard materials, responses, and treatment — that is, not treating a situation and person as an individual. In the case of boundary practices, the researcher looked for communication that portrayed members' questioning of boundary members about their usage of knowledge gained from the WIA group. This questioning would have represented interest of more active members in how boundary members utilize WIA knowledge.

Negative and tangential instances showed either lack of interest in what boundary members were doing, or making boundary members responsible for bringing knowledge in on their own. This behavior described lack of interest by members that were positioned more towards the center or core of the community. However, Wenger (1998) pointed out that this particular characteristic is a common weakness in real CoPs. In other words,

boundary members are a source of new ideas, and core members should, but often do not, pay attention to them. Therefore, the WIA community's behavior within this theoretical area was not so unusual.

Table 14. Independent Variables According to Their Embedded Subunits.

Classification and Description of Independent Variables		
Main level	**Sublevel 1**	**Sublevel 2**
Emergence (EMG)	Core Membership (CORE)	Rotating Expertise (ROT) Distributed Expertise (DIS).
	Peripheral to Center Movement (P2C)	Receiving Instructions (REC) Asking Questions (QUE) Question and Answer Exchange (EX) Acknowledgement of Gained Expertise (ACKN)
Transfer of Implicit Knowledge (TIK)	Boundary Practices (BP)	Background Questions (BG) Eliciting Background Knowledge (EBK) Use of Community Knowledge (COM)
	Practice (P)	Proposed Collaboration (PROP). Note: this is an opening code. Reported Collaboration (REP) Actual Collaboration (ACT)
	Exchange of Stories (S)	Partial Stories (PART) Note: this is an opening code Complete Stories (COMP)
Learning as Principal Goal (LPG)	Negotiation/ Definition of Knowledge Domain (KD)	Opening Statements (OPEN) Note: this is an opening code. Active negotiation and definition of Community Goals (NEG) Declaration of Overall Community Goals (GOAL)

In addressing artifacts via type of CMC tool used, these rejection results in Analysis Period 5 were present in asynchronous data, whereas synchronous data supported the theoretical proposition. However, the low number of instances of both categories must be considered.

It is interesting to note the way members accessed each type of communication forum. Although synchronous data did contain some logs of private communication (i.e., using Yahoo Messenger with two to five people); the vast majority of the content was logs of the public forum (i.e., the Tapped In environment at www.tappedin.org). The Tapped In environment was open to the public, that is, one did not need to be a WIA member to participate in this synchronous forum. However, although membership was free and anyone could join; one did have to apply to join the asynchronous Yahoo Group in order to be able to post messages.

This factor of required application to the asynchronous forum may have influenced the results. On the other hand, the results may have been reached because of the nature of the asynchronous forum itself.

Survey data also did not support the theoretical proposition, albeit with different variables. This rejection triangulates with the total communication data and the asynchronous data in a general sense. Because of the differences in the nature of the two types of data, it is unlikely there would be a one-to-one relation in the data, that is, the triangulation would not likely exist with the same independent variables. This is discussed further in the *Weaknesses* subsection of this section.

In summary, communication data were the main source of conclusions. Whether being viewed in total, or in relation to their division into CMC data types; the theoretical proposition was not supported in one of the Sublevel 1 variables. In addition, this area of

rejection was cited as weakness in most CoPs, according to Wenger (1998) Finally, the number of instances for this independent variable was the lowest of all the independent variables. Therefore, it is useful to examine and interpret the results of communication data with respect to the other research questions.

Discussion of Research Question #1

In what ways does the observed virtual community correspond to theoretical aspects of communities of practice? How are these theoretical aspects represented or not represented in the virtual community of WIA? How do they deviate? To what degree are each of these characteristics represented in WIA?

The researcher made the following assumptions in interpreting the time series analysis of this study. He regarded them as starting points for discussion on Research Question #1.

First, he examined relative percentages of the variables to compensate for the fluctuation in total instances that took place during the analysis period. Second, an ideal, but impossible, representation of the independent variables would be that all six Sublevel 1 variables would have the same percentage distribution throughout the data analysis period of 13 months — namely, one-sixth or 16.67% each. Third, the researcher also chose 10% as the point, less than which he considered a given independent variable as underrepresented. Finally, he also assumed consistent trends in the variables' percentage movements between time periods would present a clearer interpretation of results than fluctuating movements.

Two of the variables, boundary practices (EMG-BP) and core behavior (EMG-CORE), had values under 10%. Using the previously described assumptions, the

researcher concluded the following. First, the underrepresentation of boundary practices at a maximum of 1% could indicate isolation of the core members. This seems consistent with the fact that 60% of the asynchronous postings were posted by seven members, as confirmed in taking the purposive sample for the survey data.

The core behavior variable (EMG-CORE) ended with a higher percentage in the last two analysis periods than the first three analysis periods. This could be an indication of increase in members recognizing each other's expertise and deferring other members towards this given expertise — as well as moving away from a leader-centered or instructor-centered environment. However, because the trend was not consistent and the percentage never reached 10%, the case for this assertion is not strong.

The same reasoning can be applied to the learning as a principal goal variable (LPG-KD). Its relative percentage value fluctuated with lows in the second and fourth analysis periods, as opposed to peaks in the first, third, and fifth analysis periods. Again, a steady increase or decrease would have made a stronger case.

However, its increase in the fifth analysis period almost doubled that of the third analysis period. The final relative percentage could indicate a more reflective period in the community; whereas, in more active periods, practice (TIK-P) may be lowered. This theory is supported by the data, although the subjective nature of this qualitative interpretation cannot and does not establish any sort of cause and effect.

After splitting the data into asynchronous and synchronous categories, the researcher found that the relative percentage of the learning as a principal goal variable (LPG-KD) was greater with asynchronous data than synchronous data. In fact, the learning as a principal goal variable was lower than 10% in the synchronous category. These results could imply that the asynchronous environment is more reflective and, thus,

more conducive to discussions about the community's learning goals. However, this conclusion is weakened by the low number of synchronous instances. A larger percentage of synchronous instances with respect to total instances would have presented a stronger case.

In addition to a greater relative percentage of learning as principal goal (LPG-KD), asynchronous communication also had a larger relative percentage of transfer of implicit knowledge via stories (TIK-S). As with the learning as principal goal variable, stories may be more conducive to an asynchronous environment, in which participants have more time for reflection.

Synchronous communication showed a higher relative percentage of transfer of implicit knowledge via practice (TIK-P) and emergence via peripheral to center movement (EMG-P2C). Both of these variables contain dynamic interaction between participants. Perhaps a synchronous environment facilitates this type of communicative exchange in contrast to an asynchronous environment.

Opening Codes

In Chapter 4 of this study, the researcher discussed opening codes as introductory communication, which can possibly, but not necessarily, evolve into communication that more closely demonstrates the characteristics of CoPs. This analysis revealed 37% of all instances were opening codes. Opening codes were placed in Sublevel 2 of the categorization scheme, that is, the second embedded subunit that exemplified communication instances that conform to the first embedded subunit (Sublevel 1) (see Table 14, p. 155). The three opening codes represented:

1. suggestions or proposals to collaborate in practice, which would facilitate the transfer of implicit knowledge (TIK-P-PROP),
2. introduction of an opinion on a topic for discussion (LPG-KD-OPEN), which could evolve into discussions on the learning community and its goals; as well as
3. partial stories, which could evolve into complete stories over time and facilitate the transfer of implicit knowledge (TIK-S-PART).

In the cases of 1 and 2, if the analysis of Chapter 4 had identified all of the communication instances as opening codes; there would have been no migration to CoP behavior. This would have been an indication that the WIA community was not a CoP, according to the criteria of this study. In other words, there would have been no dialog between the community's participants, that is, no sense of community in the sense of working together in practice would have existed.

One of the three main level categories, emergence, contained no opening code. The reason for this was that the variables symbolized and depended on a back and forth exchange between participants. This exchange was much faster and of a different nature than the evolutionary characteristic of progression to the next Sublevel 2 variable under the other main level categories — as portrayed by what the researcher labeled as opening codes. This back and forth exchange described the behavior of the peripheral to center movement variable (EMG-P2C) and its Sublevel 2 units (i.e., EMG-P2C-QUE, EMG-P2C-REC, & EMG-P2C-EX). The percentage of exchange indicated whether a dialog was taking place.

Partial stories (TIK-S-PART) were stories that did not satisfy the three requirements, as described by Wenger, McDermott, and Snyder (2002) (see Chapter 2, *Characteristics of CoPs: 4. Knowledge: Community, Explicit, and Implicit*). Partial

stories contained one or two of these requirements. Because the analysis was done at the community level, the researcher did not track individual stories, rather he looked at the relative percentages between partial stories and complete stories. This is discussed further in the next subsection.

In summary, removing the opening codes from the relative percentages did two things. First it reduced the total number of instances by 37%. Second, it revealed a "purer" representation of CoP behavior. In the case of relative percentages of asynchronous data, the difference between relative percentages of asynchronous data and total communication data was not great (i.e., 40% & 37% respectively). However, the synchronous communication proportion was considerably lower, for opening codes comprised 27% of the synchronous data. One possible explanation for this is that the simultaneous presence of participants in synchronous communication created a situation, in which it was more difficult to ignore a suggestion or proposal — as represented by an opening code.

Discussion of Research Question #2

In what ways can a community of practice, whose interactions are mainly carried out online, evolve with the founding of a virtual community designed specifically to enhance the emergent aspects of a community of practice (Wenger, 1998)? The previous subsection discussed the concept of opening codes, which resided in the second embedded subunit in the communication data (i.e., Sublevel 2). Comparison of the variables within this level addressed Research Question #2.

The learning as a principle goal variable (LPG-KD) had three Sublevel 2 variables, which represented progression between an introductory opinion (LPG-KD-

OPEN), negotiation among community members of a given opinion (LPG-KD-NEG), and finally discussion of the community's goals (LPG-KD-GOAL). The analysis results showed that the relative percentage of the negotiation variable was greater than the introductory variable. As in the case of the previous analyses of Research Question #1, the increase from introductory opinion to negotiation was not a consistent trend; however, the Analysis Period 5 results of the negotiation variable were much higher than Analysis Period 1.

Dividing the data into asynchronous and synchronous categories showed the relative percentage of the negotiation variable (LPG-KD-NEG) to be higher than introductory opinions (LPG-KD-OPEN) — as was with combined totals. However, the proportion was much higher in the synchronous category, even though the total Sublevel 1 percentage of LPG-KD was much lower. This could indicate that the synchronous environment is more conducive to debate of topics, that is, this movement from opening opinions to discussion is faster. Because of the higher relative percentage at Sublevel 1, the first embedded subunit; asynchronous communication might be more conducive to discussion of learning goals in general. However, as previously discussed, the low number of synchronous instances in this category weakens this conclusion. In both asynchronous and synchronous data, there was a comparatively lower percentage of discussion of community goals (LPG-KD-GOAL). In fact, synchronous data had no recorded instances of this variable at all.

The previously discussed progression of the learning as a principle goal variable did exhibit an evolution to CoP behavior, but the evolution would have been further established if there had been similar progression to negotiation of the community's goals (LPG-KD-GOAL). However, the negative trend of this variable indicated that this

transfer did not take place. One reason may be that there might be no natural progression from negotiation of a particular topic to one addressing the community's specific learning goals. An alternative explanation might be that some sort of conscious effort is needed by the community's members to steer such conversations into the direction of the community's learning goals. These particular research questions evolved from this analysis.

This analysis also addressed the relative percentage between proposed collaboration (TIK-P-PROP) and actual collaboration (TIK-P-ACT & TIK-P-REP). For the purposes of this study, the researcher adopted a very strict view of what constituted collaboration. He also equated actual collaboration with practice. He based this adoption on Wenger's (1998) original study of insurance claim analysts, in which live collaboration within physical proximity formed the basis for his theory of practice. Thus, the researcher looked for hard evidence of participants working together, as opposed to reporting back results of individual work, which would qualify as a story in this study. This concept is discussed further in the **Implications** section of this chapter.

For total communication data, the ratio between proposed collaboration and actual collaboration was approximately one-half. Whether this established if WIA behaved like a CoP is unknown, for several studies on multiple communities would be needed to reach such a conclusion. However, a one-to-one match, as in the case of this study, showed that there is at least an even amount of actual collaboration per individual collaboration proposal. Therefore, the researcher concluded that a percentage of greater than 50% would show responses from multiple participants for the same proposal. An alternative explanation could be that a given participant would respond multiple times to an individual instance of proposed collaboration.

Synchronous data showed a similar distribution to the total communication data of nearly 50%. With asynchronous data, the proportion of proposed collaboration (TIK-P-PROP) to actual collaboration (TIK-P-ACT or TIK-P-REP) was much greater. A possible explanation is that the synchronous environment is more suitable for collaboration. Alternatively, it may take more asynchronous messages to set up and confirm collaboration between two or more participants. In addition to type of communication; the number of participants that are present, the turnaround time in answering asynchronous messages, as well as the group size of the collaborators could also be factors.

Stories comprised the next transfer of implicit knowledge subunit, which further divided into partial stories (TIK-S-PART) and complete stories (TIK-S-COMP). According to the theory, as the culture of practice of a CoP evolves over time; the number of complete stories should increase (Wenger, McDermott, & Snyder, 2002). The data analysis showed this growth consistently, especially in the last three analysis periods. These results could indicate evolution of stories within the WIA community, which are necessary for CoP development. Thus, time allows the CoP history to evolve, which creates background for more refined and more intricate stories (Wenger, 1998).

Furthermore, asynchronous stories showed a much higher relative percentage of complete stories to partial stories than the synchronous environment. A possible explanation is that an asynchronous environment is more suitable for longer complete stories, given the time for reflection and little interruption during composition. A synchronous environment, especially text-based and full of interruptions, may not be conducive to a full story environment. However, this may depend on the number of users.

These results bring into question how stories develop. For example, are complete stories collections of partial stories put together? What factors determine the transition

from partial stories to complete stories? These questions assume a relationship between partial stories and complete stories, but perhaps partial stories also interact with other variables, for example peripheral to center movement (EMG-P2C) or practice (TIK-P).

The results of the emergence category showed interaction between participants with less expertise in a given area being helped by participants with more expertise, that is, a portrayal of peripheral to center movement (EMG-P2C) within the WIA community. This was determined by the relative proportion of requested help (EMG-P2C-QUE) vs. help provided by other participants (EMG-P2C-REC). A third variable (i.e., EMG-P2C-EX), which represented a fast back and forth dialog of requested help versus provided help, also figured in this analysis.

The researcher theorized that a high relative percentage (e.g., 75%) of provided help (EMG-P2C-REC) would have indicated an instructor driven environment, in which information was not given according to the requests of other participants. In fact, such communication instances were classified as negative in this study. Because the latter three analysis periods had a smaller relative ratio of requested help versus provided help than the first two analysis periods, the researcher concluded that a CoP type environment was indeed evolving. However, an alternative explanation for the first two analysis periods could have been multiple participants providing help to the same request. The community level analysis of this study did not track individual participants, which would have determined the previously mentioned alternative more clearly.

Synchronous data showed a relatively more even proportion of requested help to provided help. The researcher noted three possible explanations for the asynchronous results:

1. asynchronous requests for help were being ignored;

2. asynchronous behavior may have exhibited more of an instructor led environment, as opposed to an environment of expertise belonging to multiple participants (e.g., as in a CoP); or, as previously discussed,
3. multiple responses to a given request for help.

This subsection presented the conclusions of the study with respect to Research Questions #2 and #3 with respect to the individual variables. The researcher believed these conclusions provided further insight with respect to CoP theory.

Conclusions of Artifacts Versus Documentation

As portrayed in Chapter 3, (see Chapter 3, **Research Methods Employed**, *The Interim Case Study Report: Artifacts vs. Documentation*), no evidence of collaborative use of Web sites was shown. Rather, as discussed in detail in the previous subsection, the division of data into asynchronous and synchronous categories formed the basis of artifact analysis. This was a strict interpretation of the definition of artifacts that was adopted by the researcher.

This strict interpretation of artifacts could challenge the definition of collaborative use. During data classification, the researcher saw several examples of suggestive use of Web sites; however, the communication consisted of individuals reporting back on their individual use of a given Web site. Perhaps the constellation of individual PCs in the Internet environment and the current, mostly passive use, design, and publishing of Web sites are not conducive to collaboration — in the active and synchronous sense. Theoretically, it is possible to work together with Web sites using a synchronous online tool, such as, a private chat application.

Wenger, McDermott, and Snyder (2002) emphasized that too much documentation, especially during the beginning stages of a CoP, can actually inhibit a CoP's growth. During the study, the researcher differentiated between CMC tools and Web sites in the sense of documentation. He referred to CMC tools as "ubiquitous artifacts" because they are transparent to the participants while they are using them. This was the case in the particular online community he was analyzing.

The previous subsections comprised the conclusions of this case study. Strengths and weaknesses of the study are presented in the next two subsections.

Strengths of the Study

This study employed the following measures to strengthen its validity and conclusions. First, it drew upon a large volume of communication and high richness of data. Second, the data represented a long period of time, 13 months — in which its time period of over one year qualified the study as longitudinal.

Furthermore, the researcher performed meticulous record keeping. Every extracted instance referenced the original data source: asynchronous message numbers or line numbers in synchronous records.

In classifying the data, the researcher developed categories of communication relationships that were not content specific. Rather, the categories, or independent variables, represented the purpose of the communication, as opposed to any specific information or background history. The community level approach to this analysis (i.e., not tracking individual participants in the communication) aided in promoting this policy of classification.

As the study developed, the researcher continually refined a stricter interpretation of what constituted evidence of DCoP identifiers. Every effort was made to identify concrete examples of the theory. The culmination of this effort was the second embedded subunit of his variable scheme to provide model examples of communication instances coinciding the upper levels of the variable scheme.

Weaknesses of the Study

This study comprised a subjective interpretation of the data. Although the methods were rigorous and the reasoning is traceable via data logs and memos, all qualitative studies are subjective and not generalizable to other studies. Rather, this study was generalized to theory and designed to generate new research questions and theory (Yin, 1993).

The researcher employed the survey data as a secondary and minor role, while committing the bulk of the data analysis with the communication data. He used both purposive and random samples as an attempt to reduce the bias common in survey questionnaires — namely, extreme viewpoints and opinions from the respondents.

Because of only 30% response for the random sample and 50% response for the purposive sample, it must be assumed that some of the bias of extreme viewpoints was still present in the responses. It stands to reason that those selected with more neutral viewpoints did not fill out the online survey at all. Therefore, the researcher concludes that, although the random sample helped reduce extreme bias, it did not eliminate this bias completely.

Another factor that needs to be considered is that the purposive sample was based on a snapshot of the membership of a range of participants. Because the membership of

WIA is dynamic, with new members joining and others dropping out, this factor influenced the study.

There was a third weakness with the survey data. It was not a primary data source, rather the classifications were indirect. In other words, it was based on members' subjective opinions and possibly faulty memories and perceptions of certain events. In contrast, the researcher analyzed the communication data as a direct source, that is, he applied the categories directly to the data. For this reason, as well as the sheer bulk and availability of the communication data, the communication data formed the majority of the analysis.

The communication data served as primary data for the study. However, the analysis of the communication data contained the following weaknesses. Even though the researcher used other researchers in the initial classification, as well as meticulous data logging and memo journaling procedures; the researcher did not eliminate bias.

The main reason for any existing bias was that the researcher assumed the interpretive burden of delineating communication acts (Hagelin, 1999; Henri, 1992; Jonassen & Kwon, 2001). This was because of his knowledge of CoP theory, compared to that of the other researchers (Rourke & Anderson, 2004). Some of the asynchronous messages were very long and covered multiple areas that applied to CoP theory. These messages had an extremely high interpretive burden when compared to shorter, more succinct messages. The same problem existed in gleaning conversation threads out of the synchronous communication logs. The **Implications** section of this chapter discusses a possible approach for this issue.

The fact that 17 participants out of 93 posted 80% of the asynchronous communication data is also a weakness in this study. However, this percentage is close to

the research of Schlager, Fusco, and Schank (2002), who found that approximately 15% (i.e., 14.65%) of members of online groups do not post messages.

Because no evidence of collaborative use of Web sites was established, the third data source was considered as the division of CMC data into asynchronous and synchronous modes. The researcher employed this division to address Research Question #3. It can be argued whether this division of communication data qualified as a third data source, or whether it was a further subdivision of the communication data. If the latter interpretation is considered, then this study would have used two forms of data (i.e., communication data and survey data) to triangulate the results.

However, it was only through the data analysis that the researcher developed his strict view of Web site collaboration as evidenced through the communication data. That is, two individuals needed to be using a Web site beyond a suggestion for a participant to look at a Web site individually. Because the communication data did not establish this strictly interpreted collaborative use, the researcher was left to look at CMC tools as the second form of artifacts. Thus, he divided the CMC tools into asynchronous and synchronous categories.

This division into asynchronous and synchronous categories was fundamentally different from the other divisions employed in the study, such as opening codes and the three embedded subunits of the independent variables. The other divisions spanned all of the communication data, whereas the division into asynchronous and synchronous modes (i.e., CMC type) split the data vertically. For this reason, the researcher considered it a third source of triangulation and a type of meta-analysis — as opposed to a further subdivision of the communication data. However, this can be argued, and it stands as a weakness in this study.

The final weakness in this case study was with the proposed time-series analysis with respect to periods and events. Regarding periods, fluctuations and lack of consistent upward or downward trends weakened the conclusions for most of the independent variables. The last analysis period (i.e., Analysis Period 5) often showed indications of distributed CoP trends, in comparison to the first analysis period; however, consistent trends in the analysis periods between Analysis Period 1 and Analysis Period 5 would have made the case stronger.

Moreover, no conclusive evidence existed for correspondence between the analysis periods, monthly periods, and WIA events (see Appendix G for the list of events). Perhaps this was due to the high percentage of community members who did not post messages or did not participate directly in the WIA events — or different clientele using the synchronous versus the asynchronous CMC tools.

Implications

This study was a first attempt to try to find characteristics common to all CoPs; however, the results discussed here were unique to WIA. As mentioned at the beginning of this chapter, the qualitative nature of this study does not make it generalizable to other studies. However, it can serve as a beginning of a series of studies whose ultimate goal is generalizability and transferability.

Current CoP theory describes CoPs as unique social entities that cannot be compared; for example, no two communities would ever use the same artifacts in the same way (Roth, 1998). No current literature to 2005 compared DCoPs' use of artifacts. However, this study assumed that certain behavior patterns unique to online CoPs could

be identified in order to start some sort of benchmarking system between CoPs via their identifying characteristics.

In other words, as the study evolved; the variables developed for this case study analyzed the purpose of the communication, as opposed to the actual content. The study's goal was to open the debate on a benchmarking and identifying system of DCoPs. Such a benchmarking system could be helpful in establishing the current condition of a DCoP (e.g., stage of maturity, changes to another form of community, or beginning of fragmentation & dissolution). Furthermore, this sort of analysis can provide a method of cross-case comparison between online communities that are theorized to be DCoPs. This analysis of the WIA community was a step in this direction.

Because these characteristics defined as independent variables were a first attempt, they need to be examined and revised in future studies. This includes especially the relationships between the variables themselves.

Implications of Methodology

In general, future research will need to tighten the analysis techniques in several areas. Essentially, each of the following implications represents a focusing of the methodology employed in this study. The researcher suggests methodology refinements in the following areas:

1. Clearer delineation of communication acts in order to apply more sophisticated metric analysis of the communication with respect to the variables. This study employed sample communication acts and multiple researchers; however, the researcher gleaned the communication acts from the messages. One of the problems encountered in this study was the difference between short focused

messages which concentrated on one topic versus longer messages that mixed and skipped around topics. The latter were much harder to classify and split up according to Henri (1992). Thus, the interpretive burden was much too high to include realistically other researchers unfamiliar with the development of the independent variables, as well as the background theory required for classification of a bulk percentage of the total data. One suggestion is to use researchers that are experts in CoP theory, for example, doctoral candidates researching this area (Rourke & Anderson, 2004).

2. Focus on a smaller number of variables (e.g., learning as a principal goal) in order to concentrate resources on a specific characteristic of CoPs. In addition, conducting multiple case studies of different online communities that focus on fewer variables.
3. A shorter data analysis period while increasing the number of researchers. This suggestion is an attempt to increase the integrity of data classification.
4. Selective classification of short clear messages for a longer data analysis period, whereas leaving the longer multifaceted messages out of the study. This would help raise the comparative metrics of the variables between the short messages, although some data may be lost from the longer messages.
5. Concentration on the interaction of the variables, but not necessarily the variables that fall under the same embedded subunits. In other words, new research questions can be spread across the embedded unit hierarchy.
6. Trace of variables via communication threads using social network analysis (Alani, Dasmahapatra, O'Hara, & Shadbolt, 2003; Haythornthwaite & Wellman, 1998; Garton, Haythornthwaite, & Wellman, 1999; Haythornthwaite, 2000;

Haythornthwaite, 2002; Lee & Neff, 2004; Lundkvist, 2004; Preece, 2001). Analysis of such threads could increase understanding of how individual variables interact over time. However, this method does depart from the community as the unit of analysis and replaces the analysis unit with the individual, for social network analysis tracks communication of individuals.

7. Further development of communication analysis methods. Communication analysis at the utterance level is too fine because it does not address the communicative intent between individuals with respect to community behavior. Second level communication analysis lacks instruments, although development of such instruments is in progress (Luppicini, 2002; Rourke & Anderson, 2004). In this study, establishment of communication examples in the second embedded subunit of the variable hierarchy attempted to provide a model of comparison to actual communication instances.

Implications of Further CoP Research

The development of the original nine characteristics that distinguish distributed CoPs from other types of online community was originated by the researcher. It is by no means the last word on this distinction. Future research can challenge, revise, or even develop new distinguishing characteristics. Moreover, the distinguishing characteristics can be further broken down. In addition, future research can also challenge the hierarchy of the variables developed in this study.

Future research can also expand on the idea of variable ranges versus delineated subunits. The first two embedded subunits (i.e., the Main Level & Sublevel 1) were an attempt to delineate identifying characteristics, for original CoP theory presents broad

ranges of characteristics (Wenger, McDermott, & Snyder, 2002). However, the second embedded subunits (i.e., Sublevel 2) continued this idea of ranges within the scope of a given Sublevel 1 embedded subunit. The literature discussed CoPs as existing within ranges of attributes (see Chapter 2, **The Theory and Research Literature Specific to the Topic**, *What are communities of practice*?). This study attempted to delineate and narrow down these ranges; however, a range relationship did exist between the Sublevel 2 variables themselves to show evolution within the Sublevel 1 concepts. Future research could explore the degrees of CoP behavior more closely by addressing delineation and ranges, for example, delineating characteristics further and examining the ranges between them.

One implication of this study is the blurring of artifact data and communication data. This study showed that it is not clear if the two overlap (Roth, 1998). Roth observed that the integration of tools and participants (i.e., a synergy effect) influences independence of data with respect to communication and artifacts.

A further implication addresses the concept of practice, in which the researcher interpreted strictly as collaboration between individuals. Judging from the research and the results of this study, practice seems to be a broader concept than collaboration. However, the researcher equated practice with collaboration, that is, two or more people actively exchanging communication while working on something. Based on his analysis, posting Web site links on asynchronous and synchronous forums for others' information did not constitute collaboration. However, Lipnack and Stamps (2000) describe virtual teamwork as task division with periodic reporting back to the team. This study, in addition to the literature, seems to imply degrees of collaboration. Future research can

address degrees or ranges of collaboration, or perhaps even some kind of explicit distinction between collaboration and practice.

Recommendations

This section comprises recommendations for future studies in the area of distributed communities of practice. The following subsections categorize the area of recommended studies, many of which can be accomplished via multiple case comparisons.

State of a Community of Practice

1. What distribution of percentages among the distinguishing characteristics identify a distributed CoP? Are certain characteristics comparatively low or high? What distributions are typical for DCoPs at various stages of their lifecycles (i.e., birth, growth, maturity, & death)?
2. What is the distribution of distinguishing characteristics of DCoPs that are "self-aware", as opposed to DCoPs that are not. "Self-aware" means that a given community recognizes itself as being a DCoP.
3. What distribution of "opening characteristics" (i.e., classifications that provide an introductory characteristic of a DCoP) to characteristics that actively represent DCoP activity indicate a functioning DCoP?

Collaboration

1. What is the relationship of collaboration to practice? What degrees or ranges of collaborative exchange exist? How do these degrees or ranges affect transfer of implicit knowledge?
2. Does collaboration on concepts, rather than tasks, constitute a collaborative effort with transfer of implicit knowledge?
3. How does time affect implementation of collaborative effort? For example, what kind of delay in response can cause specific suggested collaboration to fail, that is, not be acted upon?
4. How does the ratio of proposed collaboration versus actual collaboration affect a distributed CoP?

Ways of Using CMC Tools and Their Effect on Distributed CoPs

1. How do CMC tools affect practice and collaboration with respect to either the CMC tool itself or the way the community uses it?
2. How do access privileges (e.g., public or restricted) affect CoP development? For example, does restricted access exclude important boundary activity?
3. How does separation of tools (e.g., at different Web sites, different software applications, CMC tools) affect CoP development and activity? Can this separation cause fragmentation of a community or actually spawn two or more different communities ?
4. How does group size in various CMC environments affect CoP activity and development?
5. How does asynchronous message length affect CoP activity?

Artifacts

1. What are the differences in community perception between the use of "ubiquitous artifacts" versus "determinable artifacts"? Ubiquitous artifacts (e.g., CMC tools) form the communication or working environment and are transparent to the participant. Determinable artifacts (e.g., Web sites) are visible to the participant and possibly the target of their consideration or focus.
2. What types of artifacts are generated in an online distributed environment? Do browsers and the isolated physical environment of distributed participants decrease community understanding and community culture with respect to artifacts? Are Web sites a form of documentation by their nature or can they be used in practice or collaboratively?

Individual Distinguishing Characteristics of Distributed CoPs

1. How does boundary knowledge that is elicited by more active members enrich a distributed community? How does it compare to communities, in which this elicitation does not take place?
2. Does encouragement in the form of genuine interest increase boundary member participation?
3. Is lurking a form of practice and legitimate participation?
4. Does an influx of boundary members cause an increase in discussion of community purpose and learning goals?
5. How do community stories evolve over time? What is the role of partial stories in this evolution? How do shared stories within the community and stories brought

in from boundary members compare? What factors cause some stories to die out and others to continue?

6. What is the role of partial stories in other areas, for example, practice and peripheral to center movement? In what ways do they facilitate these other areas?
7. How do different CMC environments affect the development of stories?
8. What is the relationship of general announcements (e.g., refer to a Web site for help) to addressing directly individuals' questions? How do either or both of these methods affect development of peripheral to center movement within a distributed CoP? Do too many general announcements cause negative development within a distributed CoP?
9. How do CMC tools affect discussion of learning goals? Is one type of tool more conducive than another for this purpose? Does reflection time increase the "richness" of these discussions?
10. Do core members of the community need to open discussion of community learning goals or does this discussion evolve naturally in the community?
11. Does discussion of learning goals naturally have a lower percentage of community attention than other distinguishing areas, such as emergence or practice? Does discussion of learning goals increase during periods of lower active practice?
12. How does the number of active participants affect discussion of learning goals of the community?

Recommendations for the WIA community itself.

Based on the analysis and conclusions of this study, the researcher would like to make the following recommendations to the WIA community as gratitude for the

permission to study this fine community. The researcher hopes the WIA community will benefit from these recommendations.

First, he recommends a special program to welcome boundary members. By welcoming them, it means gleaning their interests and use of community knowledge, rather than a standard welcome message. This would involve a team of volunteer participants that is not in the core of WIA activities. However, these members should be alert to new knowledge that would benefit the community as a whole and introduce it to community discussion — giving recognition to the boundary member or members that originated the knowledge.

Second, he recommends a team within the WIA community that matches individuals with similar interests. These individuals with common interests would not be at the same participative position within the community. Rather, they would span the range from boundary member to core member. This range would also encourage CoP style collaboration and practice within these interest groups. Although this has been implemented to some degree within WIA, the researcher recommends a range of expertise to expose core members to new ideas. This includes periodic review by other teams and core members.

Third, the researcher proposes collaborative development and use of Web sites beyond individual development and hyperlinking. More specifically, this would entail collaborative transfer to the page level rather than the site level (i.e., a site would be developed by two or more members simultaneously in close collaboration). This collaboration would include synchronous communication or asynchronous communication with fast responses during the collaboration. This would further enrich

the community's collaborative spirit, which is already prevalent in their joint testing of new online tools.

Finally, the researcher recommends that core members purposefully and periodically steer reflective discussion to address community and learning goals of the community itself. Or, more precisely, he suggests they be alert for negotiations and discussions that might go in this direction and cultivate them.

Summary

Communities of practice (CoPs) are entities whose purpose is to advance both the knowledge of its participants, as well as to advance knowledge in the subject area, with which the community is concerned. Members of distributed CoPs (DCoPs) communicate primarily via computer-mediated communication with little to no face-to-face contact.

This study analyzed the formation of a virtual community of teachers of English as a Foreign Language (EFL) and English as a Second Language (ESL), who were interested in applying technology in language teaching. The community called itself Webheads in Action (WIA).

Based on criteria that differentiate distributed CoPs from other types of virtual communities, the author conducted a case study that compared WIA with CoP theory, specifically nine aspects that uniquely identify CoPs. Because there were areas, in which CoP theory and practice in virtual communities conflict; this dissertation generated insight and new research questions into these areas. In the literature, CoPs were presented as organic entities, which need to achieve a state of "homeostasis" between a range of extremes in several areas. This dissertation attempted to further develop theory in

distributed CoPs by producing more delineated criteria, in which distributed CoPs can be compared and examined.

In a detailed examination of the background literature of CoPs, the researcher recognized and designated the nine unique identifiers of distributed CoPs, which represented characteristics that differentiated distributed CoPs from other types of virtual community. Furthermore, aspects common to both distributed CoPs and other types of virtual communities were exposed and examined.

These nine characteristics formed the basis of the methodology conducted as a case study, which was interpretive, exploratory, and longitudinal (Yin, 1993; Yin 1994). The case study was longitudinal because it employed analysis of data representing a time span of over one year, that is, 13 months. It was exploratory because it attempted an approach to analyze an online community as a single case, using characteristics representing community behavior — with the goal of eventually developing a benchmarking system for CoPs in general. It was interpretive because its results were generalized to CoP theory.

First, the nine characteristics were designated as independent variables in two embedded subunits. Second, the researcher, with help of other researchers during the preliminary stages of the study, classified applicable excerpts gleaned from a thorough examination of the data according to this independent variable scheme. Time series analysis was performed in congruence with summarized data that was classified in this embedded subunit hierarchy.

The researcher developed a theoretical proposition, against which the nine independent variables were tested. Actually, this test was against six variables designated to be in the first embedded subunit. This was because the three variables at the main

levels were considered broader concepts, under which the variables in the first embedded subunit were subcategories.

The theoretical proposition also extended to three research questions that addressed aspects of CoP behavior. The theoretical proposition and research questions were stated as follows:

- Theoretical Proposition: The virtual community Webheads in Action exhibits behavior of a distributed community of practice if it possesses all nine characteristics unique to distributed CoPs. Instances of negative or tangential behavior with respect to the nine characteristics weaken, or possibly negate, the theoretical proposition that distributed CoP behavior is exhibited by this virtual community.
- Research Question #1: In what ways does the observed virtual community correspond to theoretical aspects of communities of practice? How are these theoretical aspects represented or not represented in the virtual community of WIA? How do they deviate? To what degree are each of these characteristics represented in WIA?
- Research Question #2: In what ways can a community of practice, whose interactions are mainly carried out online, evolve with the founding of a virtual community designed specifically to enhance the emergent aspects of a community of practice (Wenger, 1998)?
- Research Question #3: In what ways does the interaction and community understanding of the community members with its artifacts, specifically CMC and

Web technology, aid the community in reaching its learning goals? In which ways do these tools help or hinder this interaction?

The researcher analyzed primary data consisting of asynchronous and synchronous communication logs, as well as gathered secondary data from an online survey designed by the researcher. Survey data functioned as supporting analysis. During the classification of the data body, the researcher identified and classified instances that corresponded to the descriptions of the independent variables — as well as instances that ran counter and tangential to the instances that conformed to the independent variable descriptions. If the number of conforming instances was greater than the number of negative and tangential instances in all nine categories, then the theoretical proposition would be supported.

The analysis of the 13-month period showed that the theoretical proposition was supported for all variables except one. This variable represented boundary practices and behavior of a community of practice, that is, how core members of a community interacted with members that were little involved. Negative and tangential instances portrayed behavior that showed lack of interest of core members with respect to boundary members. In CoP theory, boundary members are an important source of new ideas and debate. Thus, they are an important factor in continuing the advancement of a community of practice's knowledge domain.

Because this rejection occurred in the last data analysis period, it showed a negative development in CoP theory with respect to boundary practices. However, this variable also represented the lowest number of instances of all the variables. Four of the other variables were strongly represented.

Survey data did not support the theoretical proposition with two other variables. This rejection triangulated with the communication data in a general and supporting sense.

In the case of Research Question #1, two variables exhibited a low number of instances, resulting in underrepresented variables. These variables represented boundary practices and core behavior. Although the other variables were well represented, fluctuations within the analysis periods, rather than consistent trends, weakened somewhat their case for correspondence to CoP theory.

The study resulted in adding a second embedded subunit to the independent variable hierarchy. This second embedded subunit outlined specific communication examples to be found in the communication data. In addition, these communication examples also represented a range of attributes of the corresponding variable in the higher level of the hierarchy. These ranges, which represented introductory communication to a more evolved representation of the corresponding variable, were addressed in Research Question #2.

Research Question #2 showed mixed results with regard to the evolution of a CoP over time. The embedded subunits, which symbolized the exchange between introductory behavior and movement towards CoP behavior, were well represented. However, variables that represented meta and higher level community planning were underrepresented.

Research Question #3 examined the use of artifacts with respect to the independent variables. Because of his strict interpretation of CoP theory with regard to what constituted an artifact versus documentation, the researcher found extremely little evidence of Web sites being used collaboratively. Therefore, he did not consider Web

sites in the final analysis. However, he divided the data vertically into asynchronous and synchronous categories to address the community's use of CMC (computer mediated communication) tools. The following results were found.

Synchronous data supported the theoretical proposition, whereas asynchronous data did not. However, both types of data split the already low number of instances of the rejected variable. In general, synchronous data showed higher relative percentages of variables that represented frequent interaction, whereas asynchronous data had higher percentages of variables that exhibited more reflective communication. For Research Question #2, synchronous communication showed a much higher percentage of middle range variables to variables that represented introductory communication.

The study concluded with suggestions for refining methodology with respect to usage of other researchers in data categorization and lowering the interpretive burden of message classification — as well as using this type of variable scheme for multiple case studies. This included initiation of metric comparison of the characteristics over time, as well as possible future development in this area via tighter research methods. It also delineated the criteria for the differentiation between documentation and artifacts, in which collaborative use needs to be evidenced.

This study contributed to the distributed CoP field by addressing criteria unique to distributed CoPs; thus providing a starting point in comparing different distributed CoPs. The results of this study provided further advancement in this field in several ways. First, it opened the debate of what criteria constitutes a DCoP, perhaps generating further criteria or modifications of the criteria presented in this study. Second, it posed research questions that call for further research in each of the distinguishing criteria outlined in this study. Third, it brought out the process of delineation of DCoP characteristics.

Furthermore, it examined the ranges that exist within these characteristics, as ways of further refining these characteristics.

CoP theory has been traditionally presented as ranges of attributes, between which CoPs are situated. Although the variable classification in this study was an attempt to narrow down the definitions to distinguishing and differentiating factors, this study showed that the variables themselves represent ranges. Questions of what constituted their essence (e.g. collaboration) arose during the analysis and conclusions. Because the literature is rather liberal in identifying what a CoP is; this study identified factors, on which participants can focus in order to aid a CoP's continuing development. CoPs are a natural human phenomenon, but over-institutionalizing and other natural behavior (e.g., isolation of core members and splintering) also occur. Knowledge and awareness of these factors can possibly extend and enrich a CoP's lifetime; although death of organic entities, including CoPs, is a fact of life.

Appendix A

Approval of the Case Study by the Institutional Review Board for Research with Human Subjects (IRB)

Approval by the Institutional Review Board for Research with Human Subjects (IRB)

Date: Mon, 17 Mar 2003 09:14:13 -0500
From: James Cannady <j.cannady@computer.org>
To: Christopher Johnson <johnschr@nova.edu>
Cc: Laurie P. Dringus Ph.D. <laurie@nova.edu>
Subject: Re: Resubmission of IRB forms

Christopher,

After reviewing your IRB Submission Form and Research Protocol I have approved your continuing research for IRB purposes. Your research has been determined to be exempt from further IRB review based on the following conclusion:

> Research using survey procedures or interview procedures where subjects' identities are thoroughly protected and their answers do not subject them to criminal and civil liability.

Please note that while your research has been approved, additional IRB reviews of your research will be required if any of the following circumstances occur:

1. If you, during the course of conducting your research, revise the research protocol (e.g., making changes to the informed consent form, survey instruments used, or number and nature of subjects).

2. If the portion of your research involving human subjects exceeds 12 months in duration.

Please feel free to contact me in the future if you have any questions regarding my evaluation of your research or the IRB process.

Dr. Cannady

James Cannady, Ph.D.
Assistant Professor
Graduate School of Computer and Information Sciences
Nova Southeastern University

Appendix B

Example Excerpts from the Data Collection and Classification Logs

Sample Asynchronous Communication Data Log Sheet

CA Number	Source Date	Review Date	Yahoo Message Number	Classification Code
0686	03/18/02	06/18/03	0703	TIK-S-PART

I remember that someone did a project on a list once, they asked all list members to record a passage that was supposed to have an example of every vowel sound existing in English. The idea was to get a sampling from as many regional variations of native speaker as possible. I recorded a file and sent it in. I think it was the Irish Pig.

CA Number	Source Date	Review Date	Yahoo Message Number	Classification Code
0687	03/19/02	06/18/03	0705	TIK-P-PROP

Do you have in mind a sort of workshop where participants would share knowledge on these tools and get together online to experiment with them?

CA Number	Source Date	Review Date	Yahoo Message Number	Classification Code
0688	03/19/02	06/18/03	0710	TIK-S-COMP

when there are no cameras, just text, it is difficult to know who is here or there. So he certainly made the right decision in asking us to make a comment now and then, so he'd know who was still there. I loved the opportunity to make one or two funny 'text remarks' that made him laugh.

CA Number	Source Date	Review Date	Yahoo Message Number	Classification Code
0689	03/19/02	06/18/03	0710	TIK-P-REP

BTW, at a certain point, I was having a voice conference with Participant 55 in Ulster.

CA Number	Source Date	Review Date	Yahoo Message Number	Classification Code
0690	03/19/02	06/18/03	0711	LPG-KD-OPEN

Talking about fables, I think they can really be useful starting points for carrying out discussions on moral principles and can enliven the English lessons.

CA Number	Source Date	Review Date	Yahoo Message Number	Classification Code
0691	03/19/02	06/18/03	0713	TIK-P-PROP

It would be very nice if some of you guys form a quartet to sing Grandfather's Clock over the net. Ladies and gentlemen, here's the Webheads Barbershop Quartet for English learners.

I like the song for my class use as links are available to readings telling a bit of US history, how the song was written and about the woman who still builds one. My objective is not just having students learn to sing certain lyrics but to have them read or skim through a lot of text information.

CA Number	Source Date	Review Date	Yahoo Message Number	Classification Code
0692	03/19/02	06/18/03	0714	TIK-S-COMP

I would use a song not just for study of the lyrics or poetry. I would take students to reading stories behind the song. In case of London Bridge is Falling Down, students were thrilled to find that stores and a chapel were built on it and that an old London Bridge is now a tourist spot in Havasu, AR. This strategy causes students to read/skim quite a bit of textual material available on the Net.

Sample Synchronous Communication Data Log Sheet

CA Number	Source Date	Review Date	Raw Data Source	Classification Code
0253	03/24//03	07/22//03	Tapped-In Chat Log	EMG-P2C-QUE

280 Participant 17 says, "Oh, I see. I'm all ears - no nothing about TI Carnival"

CA Number	Source Date	Review Date	Raw Data Source	Classification Code
0254	03/24//03	07/22//03	Tapped-In Chat Log	EMG-P2C-REC (negative)

284 PARTICIPANT 8 [HelpDesk] says, "there are transcripts from past carnivals in the emailer under 2000 and 2001 transcripts"

CA Number	Source Date	Review Date	Raw Data Source	Classification Code
0255	03/24//03	07/22//03	Tapped-In Chat Log	EMG-P2C-QUE

291 Participant 17 asks, "How do you sign up to do a Carnival session?"

CA Number	Source Date	Review Date	Raw Data Source	Classification Code
0256	03/24//03	07/22//03	Tapped-In Chat Log	EMG-P2C-REC (negative)

293 PARTICIPANT 8 [to Participant 17]: "we're at the planning stage right now..."
294 PARTICIPANT 8 [to Participant 17]: "read the whiteboard"

CA Number	Source Date	Review Date	Raw Data Source	Classification Code
0257	03/24//03	07/22//03	Tapped-In Chat Log	TIK-P-PROP

298 PARTICIPANT 8 [HelpDesk] says, "we will also need lots of volunteers to help guests get to the sessions..."
299 PARTICIPANT 8 [HelpDesk] says, "and volunteers to help moderate the sessions"

CA Number	Source Date	Review Date	Raw Data Source	Classification Code
0258	03/24//03	08/12//03	Tapped-In Chat Log	EMG-P2C-EX

347 Participant 3 says, "You should try Paltalk, Participant 9 "
350 Participant 3 says, "I like it better than ivisit"
352 Participant 9 asks, "Hmmm. does Paltalk work w Mac??"
353 Participant 9 says, "I will check it out"
382 Participant 9 says, "No, only PC owners can use Paltalk"
383 Participant 9 says, "I was looking it up"
385 Participant 9 says, "It is good, then I can add it to my compability list"
386 Participant 3 says, "the sound is very good"
387 Participant 9 says, "NOw, the only one left that I know of, is iVisit"
389 Participant 3 says, "and it is less messy with the cameras"
390 Participant 10 asks, "Shouldn't it be imcompatibility list, Participant 9?"
391 Participant 9 says, "Dunno yet how the sound is"

Appendix C

Chronological Journal of Memo Annotations

Chronological Journal

Date	Analysis Type	Specific Analysis Type	Comments
March 24, 2003	**Memo No. 0001** Pre-pilot 1	Pre-pilot study memo	First memo documenting pilot study setup and correspondence
March 26, 2003	**Memo No. 0002**	Pre-pilot study memo	Memo Content: Sampling decisions and order of data or pilot study Memo shows decisions of data sampling. Order: first, second, third, etc.
March 28, 2003	**Memo No. 0003**	Pre-pilot study memo	Memo Content: Category fit of this message for EMG-CORE, not sure, criteria of categorization, created log sheet to track private communication Memo addressing the problem of coding out of context.
March 29, 2003	**Memo (2 memos) Memo No. 0004 & Memo No. 0005**	Pilot study	Questions and resolved issues about coding and methodology, esp. with respect to notifications and individual follow-up actions as being collaborative.
March 29, 2003	**Memo No. 0006**	Pilot study	Memo Content: Arbitrary selection of dates in pilot study can take conversation out of context or weakness of CMC?
March 31, 2003	**Memo No. 0007**	Pilot study	Memo Content: Knowledge Domain, Sketchy classification, inception of WIA community questions.
March 31, 2003	**Memo No. 0008**	Pilot study	Memo Content: Artifact selection for categorization (note: use titles as keywords, do this for previous memos)
March 31, 2003	**Memo No. 0009**	Pilot study	Memo Content: What constitutes a story
March 31, 2003	**Memo No. 0010**	Pilot study	Memo Content: Are encouraging messages to boundary members inviting new ideas?
April 1, 2003	**Memo No. 0011**	Pilot study Synchronous Communication, pre-analysis	Memo Content: Synchronous communication branching problem. Solution = Private communication file.
April 1, 2003	**Memo No. 0012**	Pilot study, Synchronous Communication, initial analysis;	Memo Content: Utterances in synchronous communication logs - an utterance takes place between 2 or more people.

		raw data classification	
April 1, 2003	**Memo No. 0013**	Pilot study, Synchronous Communication, initial analysis; raw data classification	Memo Content: Practice during chat sessions and possible differences in variable frequency in asynchronous and synchronous modes.
April 2, 2003	**Memo No. 0014**	Pilot study, Synchronous Communication, initial analysis; raw data classification	Memo Content: Expanded definition of utterance, threads in chat conversations, direct and indirect evidence
April 2, 2003	**Memo No. 0015**	Pilot study	Memo Content: Solution for Alias issue
April 4, 2003	**Memo No. 0016**	Pilot study, Synchronous	Memo Content: Synchronous Coding procedures
April 4, 2003	**Memo No. 0017**	Pilot study, Synchronous	Memo Content: Data observation of Synchronous Log
April 4, 2003	**Memo No. 0018**	Pilot study, Synchronous	Memo Content: Varying utterance length
April 6, 2003	**Memo No. 0019**	Pilot study, Synchronous	Memo Content: Utterance length during collaboration
April 7, 2003	**Memo No. 0020**	Pilot study, Synchronous	Memo Content: CoP boundaries, mixture of virtual organizations and chat
April 7, 2003	**Memo No. 0021**	Pilot study, Synchronous	Memo Content: More on aliases
April 7, 2003	**Memo No. 0022**	Pilot study, Synchronous	Memo Content: What constitutes an artifact.
April 12, 2003	**Memo No. 0023**	Pilot study, Synchronous	Memo Content: More on artifacts in the pilot study
April 13, 2003	**Memo No. 0024**	Pilot study: second researcher	Memo Content: Exclusive categories, weighting communication (latter classifications carry more weight),

			and moment as term for "utterance"
April 15, 2003	**Memo No. 0025**	Main Study: Data preparation. Interviews/surveys.	Memo Content: Surveys/Interviewing set up and coordination, new questions wrt artifacts
April 15, 2003	**Memo No. 0026**	Main Study: Data preparation.	Memo Content: Chat logs as artifacts
April 15, 2003	**Memo No. 0027**	Synchronous Coding Procedures	Memo Content: Synchronous coding procedures - raw data identification before classifying in log - augments Memo 0016
April 16, 2003	**Memo No. 0028**	Pilot Study - interaction with other researchers	Memo Content: Refinement of emergence variables' definitions.
April 18, 2003	**Memo No. 0029**	Pilot Study	Memo Content: Changing term from Utterance to something from Conversational Analysis.
April 18, 2003	**Memo No. 0030**	Synchronous Raw Data Classification	Memo Content: Negative case of EMG-BP, marking potential moments/communication units
April 21, 2003	**Memo No. 0031**	Pilot Study	Memo Content: Pilot study: Results of inter-researcher classification
April 27, 2003	**Memo No. 0032**	Pilot Study	Memo Content: Action taken as a result of the pilot study - added new sublevel in classification scheme.
April 27, 2003	**Memo No. 0033**	Main study	Memo Content: Difference between peripheral to center and knowledge domain
April 27, 2003	**Memo No. 0034**	Main study	Memo Content: Partial stories
April 29, 2003	**Memo No. 0035**	Main study: Asynchronous Log	Memo Content: Tracking who the message is to, as well as alias list
April 29, 2003	**Memo No. 0036**	Main study: Asynchronous Log	Memo Content: Tracking codes: possible artifact ref and definite artifact ref, private communication ref
April 29, 2003	**Memo No. 0037**	Main study: Asynchronous Log	Memo Content: Centering around one expert
April 29,	**Memo No. 0038**	Main study:	Memo Content: Information

2003		Asynchronous Log	announcements are not stories, but thick descriptions to get a feel of a situation are. TIK-P-REP vs. TIK-S
April 29, 2003	**Memo No. 0039**	Main study: Asynchronous Log	Memo Content: Introduction messages that are factual do not qualify unless interaction is shown or stated interest in what the newcomer wants to learn from the community.
April 29, 2003	**Memo No. 0040**	Main study: Asynchronous Log	Memo Content: Introduction messages, in which new members state their interests
April 30, 2003	**Memo No. 0041**	Main study: Asynchronous Log	Memo Content: References to other communication in logs.
April 30, 2003	**Memo No. 0042**	Main study: Asynchronous Log	Memo Content: New Level 2 subcategory in TIK-P = TIK-P-PROP, similarities to LPG-KD-OPEN, differences to EMG-BP-EBK
April 30, 2003	**Memo No. 0043**	Main study: Asynchronous Log	Memo Content: General announcements and instructions as EMG-P2C-REC??? No; coincides with documentation
May 1, 2003	**Memo No. 0043**	Survey	Memo Content: Survey preparation. Sampling, online posting, notification.
May 2, 2003	**Memo No. 0044**	Main study: Asynchronous Log	Memo Content: Distributed expertise as a response to an announcement
May 2, 2003	**Memo No. 0045**	Main study: Asynchronous Log	Memo Content: Simple posting of info does not qualify as P2C help, learning info - how to accomplish something.
May 4, 2003	**Memo No. 0046**	Main study: Asynchronous Log	Memo Content: How general announcements and references to documentation sites are classified - need a "value addition" in message. Trend in general announcements should go down in time.
May 5, 2003	**Memo No. 0047**	Main study - Survey	Memo Content: Survey Update and reminder correspondence
May 5, 2003	**Memo No. 0048**	Main study: Asynchronous Log	Memo Content: An example of P2C movement as "expert" is a relative newcomer and not Participant 1,

			also mentioned distributed expertise from guidelines.
May 6, 2003	**Memo No. 0049**	Main study: Asynchronous Log	Memo Content: EMG-P2C-REC & EMG-P2C-QUE are directional indicators, not absolute.
May 7, 2003	**Memo No. 0050**	Main study: Asynchronous Log	Memo Content: Departure from course structure towards community structure
May 7, 2003	**Memo No. 0051**	Main study: Asynchronous Log	Memo Content: More on general announcements / RTFM type messages (see Memos 0037, 0043, 0045, 0046)
May 7, 2003	**Memo No. 0052**	Main study: Asynchronous Log	Memo Content: Follow-up on Memo 0051. Documentation of Cybertour/stories, general announcements vs. specific help.
May 7, 2003	**Memo No. 0053**	Main study: Asynchronous Log	Memo Content: Negotiation about community: part of knowledge domain???
May 8, 2003	**Memo No. 0054**	Main study: Asynchronous Log	Memo Content: Coded quotes copied by Participant 1: boundary activity (EMG-BP) as active effort by core members interacting (not copying from outside)
May 9, 2003	**Memo No. 0055**	Main study: Asynchronous Log	Memo Content: Classified as a story with instructional (EMG-P2C-REC) qualities? Why? Help not solicited. Difference between P2C and story.
May 10, 2003	**Memo No. 0055**	Main study: Asynchronous Log	Memo Content: Classified as a story with instructional (EMG-P2C-REC) qualities? Why? Help not solicited. Difference between P2C and story.
May 10, 2003	**Memo No. 0056**	Main study: Asynchronous Log	Memo Content: Criteria for deciding whether a post falls under LPG, EMG, or TIK.
May 10, 2003	**Memo No. 0057**	Main study: Asynchronous Log	Memo Content: Showing both expertise and soliciting others' advice simultaneously.
May 10, 2003	**Memo No. 0058**	Main study: Asynchronous Log	Memo Content: Dominance of group discussion by other members (not Participant 1)
May 10, 2003	**Memo No. 0059**	Main study: Asynchronous	Memo Content: CA division: what constitutes a communication act:

		Log	contiguous text.
May 11, 2003	**Memo No. 0060**	Main study: Asynchronous Log	Memo Content: Peer help. Advice on status but no solutions, but info that helps a peer..
May 12, 2003	Asynchronous Log	Main study: Asynchronous Log	Categorized to Yahoo Message 0500
May 12, 2003	**Memo No. 0061**	Main study: Asynchronous Log	Memo Content: P2C or core, coding based on no knowledge of a member's "status" within the community. Expertise is relative.
May 13, 2003	Asynchronous Log	Main study: Asynchronous Log	Categorized to Yahoo Message 0550
May 13, 2003	**Memo No. 0062**	Main study: Asynchronous Log	Memo Content: Tracking whether help (P2C) was solicited or not.
May 13, 2003	**Memo No. 0063**	Main study: Asynchronous Log	Memo Content: Why this code and not EMG-P2C-QUE. Seems more like a discussion opening than a call for advice.
May 13, 2003	**Memo No. 0064**	Main study: Asynchronous Log	Memo Content: Tracking notes. Difference between "response to" and "ref". "Response to" directly refers to a previous message. Ref. does not, but relates to previous messages because of its subject matter or content.
May 14, 2003	**Memo No. 0065**	Main study: Asynchronous Log	Memo Content: Testing a feature takes precedence over the content (why it is posted as TIK-P-PROP)
June 17, 2003	**Memo No. 0066**	Main study: Asynchronous Log	Memo Content: My stricter interpretation of CoP theory based on review and categorization of this case.
June 17, 2003	**Memo No. 0067**	Pre-artifacts analysis and categorization	Memo Content: Ideas for analyzing artifacts (possible procedure).
June 17, 2003	**Memo No. 0068**	Main study: Asynchronous Log	Memo Content: "Higher order" discussions that may not directly refer to learning goals of the community. Possible new category under LPG.
June 19, 2003	**Memo No. 0069**	Main study: Asynchronous Log	Memo Content: Referring to distributed expertise and divided tasks - departure from leader centered approach. Reported

June 19, 2003	**Memo No. 0070**	Main study: Asynchronous Log	Memo Content: Example of anti-CoP activity: RTFM and then come to us if you need help.
June 19, 2003	**Memo No. 0071**	Main study: Asynchronous Log	Memo Content: Partial stories as vehicles in collaboration and problem solving.
June 24, 2003	**Memo No. 0072**	Main study: Asynchronous Log	Memo Content: What constitutes collaboration? Suggested individual work and commentary? Or should there be more task division with common product?
June 27, 2003	**Memo No. 0073**	Main study: Synchronous Log	Memo Content: Exclusivity of coding breaks down in synchronous mode. Suitability of variable scheme for synchronous communication categorization. Note: solution, break up messages into components as was done here.
July1, 2003	**Memo No. 0074**	Main study:	Memo Content: Revised variable scheme. Post-pilot study and Pre-interim report. New variable to address issue in synchronous mode. Reconsideration of Memo 0073.
July2, 2003	**Memo No. 0075**	Main study: Synchronous Log	Memo Content: CA length. Variable length in conversation. How can actual collaboration be indicated by one speaker (doesn't look like it can)
July 21, 2003	**Memo No. 0077**	Main study: Synchronous Log	Memo Content: Knowing disbursed knowledge vs. soliciting it.
July 21, 2003	**Memo No. 0078**	Main study: Synchronous Log	Memo Content: CA division: what constitutes a communication act in Synchronous communication for this study. Justification of contiguous (not breaking them up more). See Memo 0059
July 23, 2003	**Memo No. 0079**	Main study: verification with other researchers, sample data, pre-interim report.	Memo: Issues of live meeting with other researchers.
July 25, 2003	**Memo No. 0080**	Main study: Artifact analysis	Memo Content: Artifact analysis.
August 13, 2003	**Memo No. 0081**	Main study: verification with other researchers, sample data, pre-interim report.	Memo: Suggestions for coding to other researchers (see Memo 0079)

September 3, 2003	**Memo No. 0083**		Memo Content: Coding survey data. 1st level coding only.
September 8, 2003	**Memo No. 0084**	Survey Analysis	Memo Content: Proposal Appendix D changes to survey questions. Questions Number 11 & 12. Variables as general concepts and not concept specific.
September 8, 2003	**Memo No. 0085**	Survey Analysis	Memo Content: Response rate of survey (as of September 8, 2003). Observation of extreme viewpoints in purposive sample
February 24, 2004	**Memo No. 0086**	Interim Report	Memo Content: Web site showings or projections in synchronous tool (i.e., Tapped In) do not necessarily constitute evidence of collaborative use of static Web sites (i.e., the static Web site as an artifact).
May 1, 2004	**Memo No. 0087**	Final Study: Asynchronous Log	Memo Content: Response to request for help by multiple community members.
May 1, 2004	**Memo No. 0088**	Final Study: Asynchronous Log	Memo Content: Suggestions/coordination for practical use – Artifact setup proposal
May 1, 2004	**Memo No. 0089**	Final Study: Asynchronous Log	Memo Content: reporting a problem—not a direct request
May 1, 2004	**Memo No. 0090**	Final Study: Asynchronous Log	Memo Content: Long explanations of expertise—not CORE or REC. Reclassifying EMG-P2C-REC instances to this code – if unsolicited (not directly solicited) and showing what the writer knows.
May 2, 2004	**Memo No. 0091**	Final Study: Asynchronous Log	Memo Content: Length of story has nothing to do with classification as PART or COMP.
May 2, 2004	**Memo No. 0092**	Final Study: Asynchronous Log	Memo Content: Stories vs. practice (Events vs. individuals) in asynchronous reporting
May 2, 2004	**Memo No. 0093**	Final Study: Asynchronous Log	Memo Content: Chapter 5 research q from level 2 boundary practice. Does boundary encouragement (real) increase boundary participation?
May 14, 2004	**Memo No. 0098**	Final Study: Asynchronous Log	Memo Content: Observing TIK-P-PROP are all messages coming from the same proposal.

May 15, 2004	**Memo No. 0099**	Final Study: Asynchronous Log	Memo Content: Follow up to Memo 0098. General announcements to questions (EMG-P2C-QUE) to answer (EMG-P2C-REC) to (TIK-P-PROP). General announcments are necessary to CoPs, but not a distinguishing factor.
May 15, 2004	**Memo No. 0100**	Final Study: Asynchronous Log	Memo Content: TIK-S-PART (Tangential). Future oriented, about individual plans, not a past experience.
May 15, 2004	**Memo No. 0101** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: Member use of community knowledge outside of community, but not silent member or elicited by others –volunteered EMG-BP-COM (Tangential)
May 16, 2004	**Memo No. 0102** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: TIK-S-PART / TIK-S-COMP. Evolution of a complete story. Participants comparing notes on a shared incident. Will this evolve to a complete story (WIA "lengend")
May 16, 2004	**Memo No. 0103** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: TIK-S-PART. Does exchange of mutual experience with a current theme imply some sort of collaboration? Individual work / reporting vs. Actual (often real time) collaboration.
May 16, 2004	**Memo No. 0104** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: EMG-P2C- ACKN Tangential. Acknowledgement by a peer, however, not clear whether expertise is gained.
May 20, 2004	**Memo No. 0105** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: (EMG-P2C-QUE vs. EMG-CORE-DIS). This message could be a core member eliciting peer knowledge. It is categorized in this way because the member posted as an all points/general request, rather than knowing who in the community posseses the expertise.
May 20, 2004	**Memo No. 0106** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: (LPG-KD). This range of messages shows the first LPG progression – and a boundary member /seldom poster (or at least he was only active at this time) sparked a lot of the discussion.
May 21, 2004	**Memo No. 0107** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: (TIK-P-PROP Tangential) An express proposal to lurk. Is lurking a form of practice and participation – in a boundary practice sense. Question for Chapter 5.
May 22,	**Memo No. 0108**	Final Study:	Memo Content: Copied and pasted

2004	Log/ **Memo** / Diagram	Asynchronous Log	text (e.g. from articles) is not classified. It is not so thought through as annotated areas, unprocessed, and done by all kinds of virtual communities, not a distinguishing factor of CoP.
May 22, 2004	**Memo No. 0109** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: Surprise! It seems that there is a lot of TIK-P-PROP that goes on back and forth before the actual collaboration starts taking place (TIK-P-REP) (also, are there scripts of the live events—can plot this variable with respect to others to see how this pans out.)
May 23, 2004	**Memo No. 0110** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: an example of communication with someone outside the CoP. Categorized in normal way to show the permeable aspects of a CoP's boundary. No difference in categorization between 2 members.
May 23, 2004	**Memo No. 0111** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: TIK-S-PART to TIK-S-COMP: looks like an indication of my developed theory of partial stories evolving to full ones. However, this may be a coincidence because it is one example.
May 31, 2004	**Memo No. 0112** Log/ **Memo** / Diagram	Final Study: Asynchronous Log	Memo Content: EMG-P2C-QUE & EMG-P2C-REC in same message show possible exchange of expertise, rather than one person holding all the cards.
June 4, 2004	**Memo No. 0113**	Final Study: Asynchronous Log	Memo Content: So far, classifying all stories, but should these only be stories about community activity that qualify. No, on 2nd thought because CoP boundaries are permeable. Discussion point for Chap. 5?
June 4, 2004	**Memo No. 0114**	Final Study: Asynchronous Log	Memo Content: TIK-S-PART. Partial stories also show background for problems in introducing other variables such as a question (EMG-P2C-QUE).
June 9,	**Memo No. 0115**	Final Study:	Memo Content: TIK-P-REP. This

2004		Asynchronous Log	type of collaboration is someone working on a site/presentation with the others providing feedback. Somewhat individual in the collaborative sense, but a la Lipnack & Stamps. Chapter 5….
June 13, 2004	**Memo No. 0116**	Final Study: Asynchronous Log	Memo Content: Applicable copied messages from outside the designated groups are classified. Shows thread and permeability within group. Within Yahoo group copies not reclassified (danger of double posting).
June 13, 2004	**Memo No. 0117**	Final Study: Asynchronous Log	Memo Content: LPG-KD-NEG comes from a debate started outside the community. Brought in by this participant to spark discussion in this area.
June 19, 2004	**Memo No. 0118**	Final Study: Asynchronous Log	Memo Content: EMG-CORE-DIS vs. EMG-P2C-ACKN. EMG-P2C-ACKN shows a clear statement that someone has improved, EMG-CORE-DIS is more straightforward – an acknowledgement of expertise.
June 20, 2004	**Memo No. 0119**	Final Study: Asynchronous Log	Memo Content: TIK-P-REP. Gray area of collaboration. Exchange info for individual web sites. Collaborative effort, but tenuous, future research question, Chapter 5 (different categories of online collaboration).
June 20, 2004	**Memo No. 0120**	Final Study: Asynchronous Log	Memo Content: TIK-S-COMP. Chapter 5 question: Do quoted/copied items and combos of this (snippets) constitute a new way of putting stories together (media dependent question).
June 27, 2004	**Memo No. 0121**	Final Study: Asynchronous Log	Memo Content: Message not classified. Here is a boundary member stating that he finds info useful. This would be an opportunity for active members to enquire what he uses the knowledge for. Will see if this is done.
June 27, 2004	**Memo No. 0122**	Final Study: Asynchronous Log	Memo Content: EMG-CORE-ROT (negative). Leader has returned from being absent (date of posting, Jan. 17, 2003). See if core postings trend changes from this point.
June 27, 2004	**Memo No. 0123**	Final Study: Asynchronous Log	Memo Content: check EMG-CORE-DIS to see if it pertains to my CoP diagram (other postings too). May need to take these out of the analysis because they pertain to me. Could

			influence the results too much.
July 16, 2004	**Memo No. 0124**	Final Study: Asynchronous Log	Memo Content: TIK-S-PART & LPG-KD-NEG. This example shows a partial story coupled with another code in the same message. This anecdote introduces the debate in the second code. Research question: function of partial stories interplaying with other codes. Interplay and network among codes (like social network analysis, but with this functional aspect of communication.
July 17, 2004	**Memo No. 0125**	Final Study: Asynchronous Log	Memo Content: LPG-KD-NEG seems to be showing up more in this range. See if database confirms this in summarization diagrams. This is a section, in which new members (boundary) have enrolled. This messages were flagged (after I noticed). The discussions seem to be going back and forth between boundary and established members. Perhaps an indication of new members bringing in new ideas and causing the core members to redefine the knowledge area.
July 17, 2004	**Memo No. 0126**	Final Study: Asynchronous Log	Memo Content: Potential artifacts are listed in a file, usually because of reference in the communication. Asynchronous communication has referred to certain cites as being useful, but there has been no real reference to collaborative use. Will watch synchronous communication for this phenomenon – if it exists.
July 17, 2004	**Memo No. 0127**	Final Study: Asynchronous Log	Memo Content: TIK-S-COMP vs. LPG-KD-NEG. This message was classified as TIK-S-COMP because, although interspersed with debate questions, it uses an anecdote to illustrate the author's questions and ideas.
July 31, 2004	**Memo No. 0128**	Final Study: Synchronous Log	Memo Content: EMG-P2C-EX vs. EMG-P2C-QUE & EMG-P2C-REC. Posted as separate EMG-P2C-QUE & EMG-P2C-REC unless conversation intertwined. In other words, straight question and straight answer gets the latter.
July 31, 2004	**Memo No. 0129**	Final Study: Synchronous Log	Memo Content: EMG-P2C-EX, EMG-P2C-QUE, & EMG-P2C-REC. Examples of unsolicited vs.

			solicited and direction towards inviduals causes reaction. General announcements do not. These CAs illustrate that.
August 4, 2004	**Memo No. 0130**	Final Study: Synchronous Log	Memo Content: TIK-P-ACT vs. EMG-P2C. This coding as TIK-P differentiates between a consulting/brainstorming collaboration role. Codes represent ranges (still), brainstorming, consulting, as a differentiation from expert—novice relationship (a la peer vs. parent child). Degrees of expertise, to novice.
August 4, 2004	**Memo No. 0131**	Final Study: Synchronous and Asynchronous Logs	Memo Content: EMG-P2C-REC Tangential Unsolicited. This coding shows representation as classroom style training. Not asked for by novices; therefore, expert assumes explicit content is important, as in a classroom

Appendix D

Survey Questionnaire and Results

Webheads in Action: Survey Questions

Table D1. Summary of Survey Question Numbers According to Research Question.

Independent Variable	Theoretical Proposition	Research Question #1	Research Question #2	Research Question #3
EMG-BP	13, 14, 15	3, 4, 5, 6, 11	3, 8, 9, 10	1 vs. 2
EMG-CORE	7, 22	3, 4, 5, 6, 11	3, 8, 9, 10	1 vs. 2
EMG-P2C	8, 9, 27	3, 4, 5, 6, 11	3, 8, 9, 10	1 vs. 2
TIK-P	19	18, 22, 27		18, 19
TIK-S	16, 17			
LPG-KD	26, 28			26

Based upon your experience in the virtual community of Webheads in Action, please answer the following questions based on your opinion. If you feel an answer does not apply to you, please N/A in the field provided.

1. How often do you post to the Yahoo groups discussion forum (i.e., evonline2002_webheads@yahoogroups.com)? (EMG-CORE) (EMG-P2C) (EMG-BP)

❑Never or hardly ever (EMG-BP) ❑Once a month (EMG-P2C) ❑Twice a month (EMG-P2C) ❑At least once a week (EMG-CORE) ❑More than once a week (EMG-CORE)

Note: applies to Research Question #1.

2. How often do you attend the weekly Tapped-In meetings? (EMG-CORE) (EMG-P2C) (EMG-BP)

❑Never or hardly ever (EMG-BP) ❑Once a month (EMG-P2C) ❑Twice a month (EMG-P2C) ❑Most Saturday OR Sunday meetings (EMG-CORE) ❑Most Saturday AND Sunday meetings (EMG-CORE)

Note: applies to Research Question #1.

3. How often do you communicate with other WIA members privately (e.g., private e-mail, using Yahoo Messenger, meeting in Tapped In, talking on the telephone)? (EMG-CORE) (EMG-P2C) (EMG-BP)

❑ Never or hardly ever (EMG-BP) ❑Once a month (EMG-P2C) ❑Twice a month (EMG-P2C) ❑At least once a week (EMG-CORE) ❑ More than once a week (EMG-CORE)

Note: applies to Research Question #1.
Note: Individual question, rather than community question, but used to infer about the community. Research Question #2.
Note: this goes on the theory (see bibliog.) that core members would have frequent contact (privately)

4. How many Webheads have you met face to face? (EMG-CORE) (EMG-BP)

❑None (EMG-BP) ❑One (EMG-CORE) ❑Between 2 and 5 (EMG-CORE) ❑Between 5 and 10 (EMG-CORE) ❑More than 10 (EMG-CORE)

Note: applies to Research Question #1..

5. With how many members are you in close contact (i.e., frequent private communication, for example using Yahoo Messenger, private e-mail, etc.) (EMG-CORE) (EMG-P2C) (EMG-BP)

❑None (EMG-BP) ❑One (EMG-P2C) ❑Between 2 and 5 (EMG-CORE) ❑Between 5 and 10 (EMG-CORE) ❑More than 10 (EMG-CORE)

Note: applies to Research Question #1.

6. Where do you consider yourself to be in a scale of expertise in WIA? (Expertise can mean specialized in a certain area, too). (EMG-CORE) (EMG-P2C) (EMG-BP)

❑Boundary member (EMG-BP) ❑Newcomer (EMG-P2C) ❑Midway between newcomer and core member (EMG-P2C) ❑Between middle and core member. (EMG-P2C) ❑Core member (EMG-CORE)

Note: applies to Research Question #1.

7. In your opinion, how many leaders does WIA have? (Tangential EMG-CORE) (Negative EMG-CORE) (EMG-CORE)

❑None (Tangential EMG-CORE) ❑One (Negative EMG-CORE) ❑Between 2 and 5 (Negative EMG-CORE) ❑Between 5 and 10 (Negative EMG-CORE) ❑More than 10 (EMG-CORE)

Note: applies to hypothesis

Based on a CoP with 200 members, 15 to 20 percent should be core members.. (Lipnack & Stamps, 2000; Schlager, Fusco, and Schank, 2002; Wenger & Snyder, 2000). 15 to 20 percent should be core members. WIA has 135 members (check this) as of the study). Therefore, more than 10 is a conservative estimate of core members.

8. Since you have joined Webheads, please describe your overall level of participation. (EMG-CORE) (EMG-P2C) (EMG-BP)

❑Steady (EMG-CORE, EMG-P2C or EMG-BP, see Question 6) ❑Increasing (EMG-P2C) ❑Decreasing (Negative EMG-P2C) ❑Fluctuating (e.g., some lulls) (Tangential EMG-P2C) ❑Other (code depends on answer given)

Note: applies to Theoretical Proposition

9. With respect to these time periods, please describe your level of participation (January to March 2002, April to June 2002, July to September 2002, October to December 2002, January 2003) (EMG-CORE) (EMG-P2C) (EMG-BP)

❑ Little to no participation (EMG-BP) ❑Steady (EMG-CORE EMG-P2C or EMG-BP, see Question 8) ❑Increasing (EMG-P2C) ❑Decreasing (Negative EMG-P2C) ❑Fluctuating (e.g., some lulls) (Tangential EMG-P2C) ❑Other (code depends on answer given)

Note: applies to Theoretical Proposition and Research Question #2.

10. With respect to the events listed below, please describe your level of participation. The participation levels are explained below. Did not participate Minor participation (e.g., appeared online for a few minutes) Average participation (i.e., attended online, but did not prepare or organize before the event) Major participation (i.e., involved in preparation, presentation, and/or organization of the event itself or WIA's presence at the event). Details on each event can be found at the WIA index at http://www.malhatlantica.pt/teresadeca/webheads/wia-index.htm#Live events (EMG-CORE) (EMG-P2C) (EMG-BP)

❑Did not participate (EMG-BP) ❑Minor participation (EMG-P2C) ❑Average participation (EMG-P2C) ❑Major participation (EMG-CORE)
EgypTesol 2002 Conference - Cairo, Egypt (13-15 Dec. 2002).
Global Learn Day VI - a 24-hour online event covering all time zones (13 Oct. 2002)
EVonline Training for Moderators Oct 21 - Nov 29, 2002:
e-Merging e-Learning Conference - Abu Dhabi, UAE (8-9 Sep. 2002)
NetWorking 2002 (19-30 Aug. 2002)
Cross Cultural Communication Online: perspectives from around the globe - The Webheads Community (21-22 Aug. 2002)
Tapped In Summer Carnival 2002 (17 Jul. 2002)
TESOL 2002: Language and the Human Spirit - Salt Lake City, Utah, USA (9-13 Apr. 2002)
Theory Meets Practice in CALL, a Colloquium (TESOL 2002 CALL-IS Academic Session: Webcast event with participation of Webheads - 10 Apr. 2002)
Webheads at the Internet Fair (12 Apr. 2002):
CALICO 2002 Annual Symposium - University of California at Davis (26-30 Mar. 2002)
Webheads: Online Community Building since 1998 -(30 Mar. 2002)
Tesol Arabia 2002: Critical Reflection and Practice - Abu Dhabi, UAE (20-22 Mar. 2002)
Webheads Evonline session 2002

11. What do you see as your main role in WIA? (EMG-CORE) (EMG-P2C) (EMG-BP)
❑ I apply information and knowledge gained from WIA in other areas (e.g., professionally, with other organizations, etc.) (EMG-BP)
❑ WIA is a community, in which I am becoming more involved. (EMG-P2C)
❑ I am heavily involved in WIA's activities. (EMG-CORE)
❑ Other (please specify) (code depends on answer given)

Note: applies to Research Question #1

12. **(Discarded)** What kind of expertise exists among WIA's members?
❑Technical ❑Pedagogical ❑Technical combined with pedagogical ❑Theoretical ❑Other (please specify)

Note: This question was thrown out because type of expertise is irrelevant to the concept of the variable scheme, which abstracts specific content

13. How are new ideas received in WIA? (EMG-BP)
❑Other members show great interest in new ideas. (EMG-BP)
❑Other members show moderate interest in new ideas. (Tangential EMG-BP)
❑Other members show a little interest in new ideas. (Negative EMG-BP)
❑It is difficult to get other members interested in new ideas. (Negative EMG-BP)
❑Other (please specify (code depends on answer given)

Note: applies to Theoretical Proposition

14. How do newcomers present ideas? (EMG-BP)

❑They are brought to the attention of the active participants (i.e., the core members). (Negative EMG-BP)
❑They are mainly sent to one main participant. (Tangential EMG-BP)
❑They are posted to the entire group for an open discussion. (EMG-BP)
❑Other (please specify) (code depends on answer given)

Note: applies to Theoretical Proposition

15. In what ways does the community acknowledge new ideas? (You can check more than one if you think more than one is applicable). (EMG-BP)

❑Members receive praise for new ideas (Negative EMG-BP)
❑WIA acknowledges ideas via discussion of ideas. (EMG-BP)
❑WIA acknowledges ideas via implementation of ideas. (EMG-BP)
❑Other (please specify)) (code depends on answer given)

Note: applies to Theoretical Proposition

16. Please describe any stories that you have read/received from others about learning experiences and solving a problem related to a WIA activity. (TIK-S) (normal, negative, or tangential code depends on answer given)

Note: applies to Theoretical Proposition

17. Please describe any stories that you have described to others about learning experiences and solving a problem related to a WIA activity. (TIK-S) (normal, negative, or tangential code depends on answer given)

Note: applies to Theoretical Proposition

18. In what ways was collaboration (i.e., collaborative activities) carried out online with fellow WIA members? Please be specific. (TIK-P per instance)

❑Testing CMC tools
❑Testing software
❑Implementing a joint project (e.g., collaboration between students).
❑Participating in an online conference.
❑Co-authoring a report.
❑Other (please specify)

Note: applies to Research Question #1

19. Please describe how you worked together with other community members to solve problems together. More than one answer is possible. (TIK-P)

❑Everyone did their part individually and used CMC to report the results. (Tangential TIK-P)
❑Using CMC tools, collaboration was done live (e.g., walking through a tool during a chat). (TIK-P)
❑Tried out a suggestion in the Yahoo group or by e-mail. (Negative TIK-P)
❑Other (please specify)

Note: applies to Theoretical Proposition, Research Question #3

20. **(Discarded)** Please describe any products you developed as a result of collaborating with other WIA members. Please list the Web address if it is a Web site and it still exists. (TIK-P)
Note: too content oriented. (Possible artifacts)

21. **(Discarded)** Please list any products that you developed that relate to WIA activities. Please list the Web address if it is a Web site and it still exists. (TIK-P)
Note: too content oriented. (Possible artifacts)

22. What customs or ways of interaction have you noticed that are Webheads in Action? (TIK-P, EMG-CORE) More than one answer is possible

❑Informal (EMG-CORE) ❑Formal (Negative EMG-CORE) ❑Democratic (EMG-CORE) ❑ Prescribed (Negative TIK-P) ❑Task-based (TIK-P) ❑ Other (please specify) (code depends on answer given)

Note: applies to Theoretical Proposition

23. **(Discarded)** What do you see as WIA's domain of knowledge (i.e., main purpose or area of development)? (LPG-KD)
Note: too content oriented.

24. **(Discarded)** How does the knowledge domain relate to your professional development? (LPG-KD)
Note: too content oriented.

25. **(Discarded)** What is the ideal knowledge domain for your professional needs? (LPG-KD)
Note: too content oriented.

26. How does WIA negotiate learning with its members? (LPG-KD)

❑It does not have discussions on its learning goals. (Negative LPG-KD)
❑It promotes discussions of its learning goals with its members (e.g., either live or in the Yahoo group). (LPG-KD)
❑It has online meetings with members to discuss these learning goals. (LPG-KD)
❑ Other (please specify)) (code depends on answer given)

Note: applies to Theoretical Proposition

27. How does the community develop plans for learning with its members? (More than one answer is possible.)

❑ There are no plans for learning among members. (Negative EMG-P2C)
❑ It provides materials (e.g., Web sites) for prospective members. members. (Negative EMG-P2C) (implies documentation)
❑ It provides training for newcomers. (EMG-P2C)
❑ It provides collaborative environments for its members. (TIK-P)
❑ Other (please specify) (code depends on answer given)

Note: applies to Theoretical Proposition

28. How does the community seek to advance its knowledge domain? (LPG-KD) (normal, negative, or tangential code depends on answer given)

Note: applies to Theoretical Proposition

Table D2. Purposive Sample Data.

Survey Question	Theoretical Proposition/ Research Question	Code/ Exception	Number of Instances	Code/ Exception	Number of Instances	Code/ Exception	Number of Instances	Total
1	RQ3	EMG-BP Normal	0	EMG-CORE Normal	2	EMG-P2C Normal	2	4
2	RQ3	EMG-BP Normal	1	EMG-CORE Normal	1	EMG-P2C Normal	2	4
3	RQ1 & RQ2	EMG-BP Normal	1	EMG-CORE Normal	3	EMG-P2C Normal	0	4
4	RQ1	EMG-BP Normal	2	EMG-CORE Normal	2	EMG-P2C Normal	0	4
5	RQ1	EMG-BP Normal	1	EMG-CORE Normal	2	EMG-P2C Normal	1	4
6	RQ1	EMG-BP Normal	0	EMG-CORE Normal	1	EMG-P2C Normal	3	4
7	H	EMG-CORE Negative	4					4
8	H & RQ2	EMG-BP Normal		EMG-CORE Normal	1	EMG-P2C Normal	3	3
8	H & RQ2	EMG-P2C Negative	1	EMG-P2C Tangential	1			2
9	H & RQ2	EMG-BP Normal	3	EMG-CORE Normal	3	EMG-P2C Normal	8	14
9	H & RQ2	EMG-P2C Negative	4	EMG-P2C Tangential	7			11
10	RQ2	EMG-BP Normal	45	EMG-CORE Normal	10	EMG-P2C Normal	15	70
11	RQ1	EMG-BP Normal	3	EMG-CORE Normal	1	EMG-P2C Normal	2	6

13	H	EMG-BP Normal	2	EMG-BP Negative	1	EMG-BP Tangential	2	5
14	H	EMG-BP Normal	4	EMG-BP Negative	1	EMG-BP Tangential	0	5
15	H	EMG-BP Normal	8	EMG-BP Negative	3	EMG-BP Tangential	1	12
16	H	TIK-S Normal	4	TIK-S Negative	0	TIK-S Tangential	1	5
17	H	TIK-S Normal	4	TIK-S Negative	1	TIK-S Tangential	0	5
18	RQ1 & RQ3	TIK-P Normal	15					15
19	H & RQ3	TIK-P Normal	3	TIK-P Negative	4	TIK-P Tangential	1	8
22	H & RQ1	EMG-CORE Normal	7	EMG-CORE Negative	2	EMG-CORE Tangential	0	9
22	H & RQ1	TIK-P Normal	4	TIK-P Negative	1	TIK-P Tangential	0	5
26	H & RQ3	LPG-KD Normal	6	LPG-KD Negative	1	LPG-KD Tangential	0	7
27	RQ1	EMG-P2C Normal	1	EMG-P2C Negative	4	TIK-P Normal	5	10
28	H	LPG-KD Normal	3	LPG-KD Negative	1	LPG-KD Tangential	1	5
								225

Table D3. Random Sample Data.

Survey Question	Theoretical Proposition/ Research Question	Code/ Exception	Number of Instances	Code/ Exception	Number of Instances	Code/ Exception	Number of Instances	Total
1	RQ3	EMG-BP Normal	1	EMG-CORE Normal	0	EMG-P2C Normal	1	2
2	RQ3	EMG-BP Normal	1	EMG-CORE Normal	1	EMG-P2C Normal	0	2
3	RQ1 & RQ2	EMG-BP Normal	1	EMG-CORE Normal	1	EMG-P2C Normal	0	2
4	RQ1	EMG-BP Normal	0	EMG-CORE Normal	2	EMG-P2C Normal	0	2
5	RQ1	EMG-BP Normal	0	EMG-CORE Normal	2	EMG-P2C Normal	0	2
6	RQ1	EMG-BP Normal	1	EMG-CORE Normal	0	EMG-P2C Normal	1	2
7	H	EMG-CORE Negative	2					2
8	H & RQ2	EMG-BP Normal	1	EMG-CORE Normal	0	EMG-P2C Normal	0	1
8	H & RQ2	EMG-P2C Negative	0	EMG-P2C Tangential	2			2
9	H & RQ2	EMG-BP Normal	9	EMG-CORE Normal	0	EMG-P2C Normal	4	13
9	H & RQ2	EMG-P2C Negative	0	EMG-P2C Tangential	1			1
10	RQ2	EMG-BP Normal	37	EMG-CORE Normal	0	EMG-P2C Normal	5	42
11	RQ1	EMG-P2C Normal	2	EMG-P2C Tangential	1			3
13	H	EMG-BP Normal	2	EMG-BP Negative	0	EMG-BP Tangential	1	3
14	H	EMG-BP Normal	2	EMG-BP Negative	1	EMG-BP Tangential	0	3
15	H	EMG-BP Normal	5	EMG-BP Negative	2	EMG-BP Tangential	0	7

16	H	TIK-S Normal	1	TIK-S Negative	0	TIK-S Tangential	0	1
17	H	TIK-S Normal	1	TIK-S Negative	1	TIK-S Tangential	0	1
18	RQ1 & RQ3	TIK-P Normal	4					4
19	H & RQ3	TIK-P Normal	1	TIK-P Negative	3	TIK-P Tangential	1	5
22	H & RQ1	EMG-CORE Normal	5	EMG-CORE Negative	1	EMG-CORE Tangential	0	6
22	H & RQ1	TIK-P Normal	0	TIK-P Negative	0	TIK-P Tangential	0	0
26	H & RQ3	LPG-KD Normal	4	LPG-KD Negative	0	LPG-KD Tangential	0	4
27	RQ1	EMG-P2C Normal	2	EMG-P2C Negative	3	TIK-P Normal	0	5
28	H	LPG-KD Normal	1	LPG-KD Negative	0	LPG-KD Tangential	1	2

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Appendix E

Supplemental Data Analysis

Table E1. Number of Combined Instances of Independent Variable Data by Analysis Period: Main and First Embedded Subunit.

Main Level	Variable Sublevel 1	Exception Code	Analysis Period 1	2	3	4	5	Totals
EMG	BP	Negative	1	0	4	5	11	21
		Normal	8	5	7	11	1	32
		Tangential	7	2	1	0	8	18
	CORE	Negative	4	3	2	4	7	20
		Normal	34	6	15	27	38	120
		Tangential	4	1	0	3	0	8
TIK	P2C	Negative	31	6	0	9	8	54
		Normal	305	140	131	187	145	908
		Tangential	19	13	4	22	16	74
	P	Negative	2	2	7	28	4	43
		Normal	216	84	214	287	87	888
		Tangential	1	6	12	26	11	56
	S	Negative	0	0	1	0	0	1
		Normal	300	146	201	187	127	961
		Tangential	1	1	2	1	0	5
LPG	KD	Negative	2	0	0	0	0	2
		Normal	114	29	73	57	121	394
		Tangential	1	1	1	3	1	7
		Totals	**1050**	**445**	**675**	**857**	**585**	**3612**

Table E2. Number of Asynchronous Instances of Independent Variable Data by Analysis Period: Main and First Embedded Subunit.

Main Level	Variable Sublevel 1	Exception Code	Analysis Period 1	2	3	4	5	Totals
EMG	BP	Negative	1	0	1	2	11	**15**
		Normal	1	2	1	3	1	**8**
		Tangential	7	1	1	0	8	**17**
	CORE	Negative	4	3	1	3	7	**18**
		Normal	29	5	13	25	38	**110**
		Tangential	3	1	0	2	0	**6**
TIK	P2C	Negative	27	5	0	5	8	**45**
		Normal	188	117	52	91	145	**593**
		Tangential	11	11	2	10	16	**50**
	P	Negative	0	2	4	0	4	**10**
		Normal	131	61	105	153	87	**537**

		Tangential	1	6	9	1	11	**28**
	S	Negative	0	0	0	24	0	**24**
		Normal	256	130	136	191	127	**840**
		Tangential	1	1	2	20	0	**24**
LPG	KD	Negative	2	0	0	0	0	**2**
		Normal	103	26	50	39	121	**339**
		Tangential	1	1	1	3	1	**7**
		Totals	**766**	**372**	**378**	**572**	**585**	**2673**

Table E3. Number of Synchronous Instances of Independent Variable Data by Analysis Period: Main and First Embedded Subunit

Main Level	Variable Sublevel 1	Exception Code	Analysis Period 1	2	3	4	5	Totals
EMG	BP	Negative	0	0	3	3	0	**6**
		Normal	7	3	6	8	0	**24**
		Tangential	0	1	0	0	0	**1**
	CORE	Negative	0	0	1	1	0	**2**
		Normal	5	1	2	2	0	**10**
		Tangential	1	0	0	1	0	**2**
	P2C	Negative	4	1	0	4	0	**9**
		Normal	117	23	79	96	0	**315**
		Tangential	8	2	2	12	0	**24**
TIK	P	Negative	2	0	3	4	0	**9**
		Normal	85	23	109	96	0	**313**
		Tangential	0	0	3	6	0	**9**
	S	Negative	0	0	1	0	0	**1**
		Normal	44	16	65	34	0	**159**
		Tangential	0	0	0	0	0	**0**
LPG	KD	Negative	0	0	0	0	0	**0**
		Normal	11	3	23	18	0	**55**
		Tangential	0	0	0	0	0	**0**
		Totals	**284**	**73**	**297**	**285**	**0**	**939**

Table E4. Number of Combined Normal Instances of Independent Variable Data by Analysis Period: First and Second Embedded Subunit

Sublevel 1	Variable Sublevel 2	Exception Code	Analysis Period 1	2	3	4	5	Totals
	BG	Normal	4	3	6	7	1	**21**
EMG- BP	COM	Normal	0	2	0	1	0	**3**
	EBK	Normal	4	0	1	3	0	**8**
EMG-	DIS	Normal	20	4	14	23	24	**85**
CORE	ROT	Normal	14	2	1	4	14	**35**
	ACKN	Normal	6	2	4	11	1	**24**
EMG-	EX	Normal	33	15	43	35	0	**126**
P2C	QUE	Normal	101	45	44	64	61	**315**
	REC	Normal	165	78	40	77	83	**443**
	ACT	Normal	43	11	77	45	0	**176**
TIK-P	**PROP****	Normal	113	54	116	142	50	**475**
	REP	Normal	60	19	21	100	37	**237**
TIK-S	COMP	Normal	117	32	74	73	72	**368**
	PART**	Normal	183	114	127	114	55	**593**
	GOAL	Normal	13	0	1	0	0	**14**
LPG- KD	NEG	Normal	56	11	49	28	85	**229**
	OPEN**	Normal	45	18	23	29	36	**151**
		Totals	**977**	**410**	**641**	**756**	**519**	**3303**

****opening codes**

Table E5. Number of Asynchronous Normal Instances of Independent Variable Data by Analysis Period: First and Second Embedded Subunit

Sublevel 1	Variable Sublevel 2	Exception Code	Analysis Period 1	2	3	4	5	Totals
	BG	Normal	0	0	0	0	1	**1**
EMG- BP	COM	Normal	0	2	0	1	0	**3**
	EBK	Normal	1	0	1	2	0	**4**
EMG-	DIS	Normal	18	3	12	22	24	**79**
CORE	ROT	Normal	11	2	1	3	14	**31**
EMG- P2C	ACKN	Normal	4	2	3	8	1	**18**
	EX	Normal	0	0	0	0	0	**0**
	QUE	Normal	64	42	24	34	61	**225**

	REC	Normal	120	73	25	49	83	**350**
	ACT	Normal	0	0	1	1	0	**2**
TIK-P	**PROP****	Normal	86	43	91	97	50	**367**
	REP	Normal	45	18	13	93	37	**206**
TIK-S	COMP	Normal	108	31	58	63	72	**332**
	PART**	Normal	148	99	78	90	55	**470**
	GOAL	Normal	13	0	1	0	0	**14**
LPG- KD	NEG	Normal	50	9	26	10	85	**180**
	OPEN**	Normal	40	17	23	29	36	**145**
		Totals	**708**	**341**	**357**	**502**	**519**	**2427**

****opening codes**

Table E6. Number of Synchronous Normal Instances of Independent Variable Data by Analysis Period: First and Second Embedded Subunit

Variable Sublevel 1	Variable Sublevel 2	Exception Code	Analysis Period 1	2	3	4	5	Totals
	BG	Normal	4	3	6	7	0	**20**
EMG- BP	COM	Normal	0	0	0	0	0	**0**
	EBK	Normal	3	0	0	1	0	**4**
EMG-	DIS	Normal	2	1	2	1	0	**6**
CORE	ROT	Normal	3	0	0	1	0	**4**
	ACKN	Normal	2	0	1	3	0	**6**
EMG-	EX	Normal	33	15	43	35	0	**126**
P2C	QUE	Normal	37	3	20	30	0	**90**
	REC	Normal	45	5	15	28	0	**93**
	ACT	Normal	43	11	76	44	0	**174**
TIK-P	**PROP****	Normal	27	11	25	45	0	**108**
	REP	Normal	15	1	8	7	0	**31**
TIK-S	COMP	Normal	9	1	16	10	0	**36**
	PART**	Normal	35	15	49	24	0	**123**
	GOAL	Normal	0	0	0	0	0	**0**
LPG- KD	NEG	Normal	6	2	23	18	0	**49**
	OPEN**	Normal	5	1	0	0	0	**6**
		Totals	**269**	**69**	**284**	**254**	**0**	**876**

****opening codes**

Appendix F

Web Site Detailed Description of Independent Variables and Categorization Guidelines for Other Researchers

Suggestions/Approaches to Coding Data

1) Consider the relationships between individuals in the Communication Act. If someone is asking for, or giving help then EMG-P2C-XXXX. If someone is deferring to another's expertise then EMG-CORE-XXXX. If someone is eliciting or trying to find out another's background or expertise, then EMG-BP-XXXX.

2) Determine if there is collaboration taking place - solving a current problem with an equal relationship (TIK-P-XXXX).

3) Is someone telling a story? (TIK-S-XXXX).

4) Is someone stating an (informed) opinion or desire (LPG-KD-OPEN)?

5) Is an opinion being debated (LPG-KD-NEG)?

6) Has a discussion evolved to a meta level about the community itself (LPG-KD-GOAL)?

Further background information on the coding approach

1) I classify according to the intepreted relationships between individuals in the communication, as opposed to the content itself. This is an abstraction that forms the basis of my study, which compares CoP theory to an actual situation. This will be mentioned as a limitation of the study and is perfectly legitimate. I find it a cleaner, less biased, and more direct way of interpreting the data. I am also assuming my professors will see it as more rigorous than classifying according to some previously known (and interpreted) background knowledge.

2) I do not classify based on any previous knowledge of the community itself (see No. 1).

3) I interprete opinions (informed or otherwise) as opening discussions of the knowledge domain (LPG-KD-OPEN). I see them as possibly leading to broader discussions of the knowledge domain beacuse an individual joins a community to compare opinions and foster debate; in addition, to be able to collaborate (TIK-P-XXXX) or gain knowledge or expertise (EMG-XXX-XXX). I see the following progression: LPG-KD-OPEN (stating an opinion or desire which is personal) --> broader debate between community members (LPG-KD-NEG) that could lead to active negotiation of the community's goals itself (LPG-KD-GOAL). There are 2 factors here. First, LPG-KD-OPEN and LPG-KD-NEG do not need to explictly address community goals. I see them more as personal interests and opinions that evolve into community goals (LPG-KD-GOAL). Second, if other members of the community are not interested or do not take up these discussions, the debate could die at any point in the progression (i.e. at the LPG-KD-OPEN or LPG-KD-NEG stages). Therefore, this variable assumes this progression and is my interpretation of CoP theory and its background in constructivism. I still feel LPG-KD-OPEN belongs under this category because it does not deal with relationships between individuals, as in the EMG codes. Rif felt that such LPG-KD-OPEN belonged under EMG. However, again I feel it does not because it does not imply a relationship between individuals.

4) If collaboration/practice (TIK-P-XXXX) or stories are being imparted (TIK-S-XXXX), it is assumed that implicit knowledge is being transferred under the explict knowledge that is on the surface. This is an assumption of my study, and there is no real proof that implicit knowledge is actually being transferred

Additional background information is below.

Here's an example taken from our discussion:
"OtherResearcher1: if I kisyt look at the end categoreis, I agree but when it comes to what is more core and what is preipheral, I think you need to know the history!"

My comments: I am not basing the classification on knowing the history, rather the current relationship of the "actors" or "speakers". I interprete their communication as an equal or unequal relationship (EMG-P2C-XXXX or EMG-CORE-XXXX), plus the fact they are trying to either gain or defer expertise. I do not base the expertise on the content on what someone is communicating. Here's why. Expertise in the the CoP's knowledge domain would be CORE expertise. Expertise brought in from outside would be BP (boundary practices). At this point (and maybe even at the end of my study), it is not clear what the knowledge domain of this community is.

OtherResearcher1: now you see how difficult it is to agree upon all three levels - this is definitely a core member speaking
OtherResearcher2: it's really a series of questions implying that these companies will wash out
OtherResearcher1: and it is following up on an earlier posting
OtherResearcher3:, did you purchase a domain and hosting from geocities/yahoo? Did I? I don't know what the figures are, but I imagine that this approach to marketing is less than a great success
PrimaryResearcher: remember that the EMG stuff is realtionship between members

My comments: This is another example of the same thing. Again, the difference between what I am doing and what you all seem to be doing is that I am looking at relationships between members, and not the content of what this person is saying. I interpreted as an informed opinion, but an opinion, nonetheless, which was inviting discussion and debate (reference CA 0803)

Classification and Description of Independent Variables - Iteration 3

Main level	Sub-level 1	Sub Level 2
Emergence (EMG) These variables describe the *relative* expertise (as opposed to absolute) position between virtual community members. In other words, the communication	**Core Membership (CORE)** Rotating or changing expertise by central members. This contrasts to reliance on one or the same individuals for information and action. Implies an equal relationship between members with respect to action being taken and knowledge being addressed. back to Enlarged Diagram	**Rotating Expertise (ROT)** Acknowledgement and deference of expertise to the person possessing the needed expertise at a given time (need-based expertise and leadership). back to Enlarged Diagram
		Distributed Expertise (DIS) Acknowledgement of specific expertise that is possessed by different members (i.e., a network of expertise, who knows what). This takes precedence over possessing expertise in an area by an individual expert. back to Enlarged Diagram

shows this relative position, rather than some kind of previously defined status. This reflects the dynamic movement of expertise within CoP theory. Expertise is based on knowledge at a given moment, as opposed to a permanent structure - such as a hierarchy. back to Enlarged Diagram	**Peripheral to Center Movement (P2C)** Net increased participation and expertise over time by novice members. Implies an unequal relationship between members with respect to knowledge being addressed. back to Enlarged Diagram	**Receiving Instructions (REC)** Receiving training and help from someone with more expertise in a given area.. Relationship of more expertise in a given area within a particular communication act (CA). This is evidenced by explanations and/or how-to instructions. References to Web sites, reading materials, or copied/pasted instructions that do not address or communicate the specific problem do not qualify. back to Enlarged Diagram
		Asking Questions (QUE) Asking for help and assistance from someone with more expertise. Relationship of less expertise in a given area within a particular communication act (CA). back to Enlarged Diagram
		Question and Answer Exchange (EX) Fast synchronous exchange between members, one of whom is receiving help and assistance. Conversation with follow-up questions from the persons giving or receiving assistance. Differs from practice collaboration (see TIK-P varables) with respect to unequal relationship between those communicating - with respect to expertise. back to Enlarged Diagram
		Acknowledgement of Gained Expertise (ACKN) Expressed acknowledgement among community members of a certain member's or members' increase in an area of expertise. back to Enlarged Diagram
	Boundary Practices (BP) More experienced members are receptive to and encourage new ideas that advance knowledge in the field from boundary members. Simply welcoming new members does not	**Background Questions (BG)** Newcomers and silent members are questioned about their professional background and interests. back to Enlarged Diagram
		Eliciting Background Knowledge (EBK) Special skills possessed by newcomers or silent members are ellicited. back to Enlarged Diagram

	suffice. Interest in boundary members needs to be shown by the more active members. back to Enlarged Diagram	**Use of Community Knowledge (COM)** Silent members are questioned how they apply knowledge that is gained from the community or how these silent members use community knowledge outside of the community. back to Enlarged Diagram
Transfer of Implicit Knowledge (TIK) Evidenced by collaborative work on reference to specific collaboration, as opposed to general announcements. back to Enlarged Diagram	**Practice (P)** Collaboration is learning oriented and activity-based, providing indirect evidence of implicit knowledge transfer. This contrasts to working individually and reporting the results, although reporting results may qualify as a story (see Exchange of Stories). Relationship between individuals is equal - an exchange. back to Enlarged Diagram	**Proposed Collaboration (PROP).** Direct evidence of a selection for collaboration. General announcements of collaborative events do not qualify, rather proposed collaboration with specific individuals or a specific group. back to Enlarged Diagram
		Reported Collaboration (REP) Collaboration is reported as a reponse to a previous message. It is expressed in present tense to give others information on a problem or task, on which one or more members are currently working. back to Enlarged Diagram
		Actual Collaboration (ACT) Direct evidence of collaboration between one or more members is shown back to Enlarged Diagram
	Exchange of Stories (S) Stories as described by Wenger, McDermott, and Snyder (2002) provide indirect evidence of implicit knowledge transfer. Stories contain 3 elements: an activity in skill-learning, problem-solving, or innovating, 2) a new method, relationship, or insight generated by this activity, and 3) how value was created from this resource. back to Enlarged Diagram	**Complete Stories (COMP)** Stories that contain all three elements as described by Wenger, McDermott, and Snyder (2002). back to Enlarged Diagram
		Partial Stories (PART) Stories that contain one or two of the three elements of complete stories. back to Enlarged Diagram
Learning as Principal Goal (LPG) Conversations about the raison d'etre of the community or	**Negotiation/Definition of Knowledge Domain (KD)** Negotiation and suggestions of solving a particular and task-based problem relates to practice (TIK-P), as opposed to this category "Meta"	**Opening Statements (OPEN)** 1) Members begin a discussion on their opinions with respect to a topic. or 2) Members express what their expectations of the community are, that is, why they hope to gain by belonging to the communtiy. back to Enlarged Diagram

community or discussion about what individual members want from the community exemplify this area. back to Enlarged Diagram	this category. "Meta" discussions belong in this category, even if they do not consciously or specifically address learning goals per se. Communication is about hypothetical situations and does not address individual or current tasks or problems. back to Enlarged Diagram	**Declaration of Overall Community Goals (GOAL)** A member states what a purpose or purposes of the community is --not as a statement of personal expectations. back to Enlarged Diagram **Active negotiation and definition of Community Goals (NEG)** Members negotiate goals of the communities with respect to the area of learning or knowledge area that the community seeks to advance. Learning is the main goal of the knowledge domain, in contrast to learning as a by-product of task completion. Again, it does not need to be expicitly expressed as a learning or communtiy goal. back to Enlarged Diagram

Appendix G

Events associated with Webheads in Action

Events associated with Webheads in Action		
Event No.	**Event**	**Allocated Event Time Block**
1	Webheads evonline session 2002	Analysis Period 1
2	CALICO 2002 Annual Symposium - University of California at Davis (26-30 Mar. 2002) Webheads: Online Community Building since 1998 -(30 Mar. 2002) Tesol Arabia 2002: Critical Reflection and Practice - Abu Dhabi, UAE (20-22 Mar. 2002)	March 20, 2002 – March 30, 2002
3	TESOL 2002: Language and the Human Spirit - Salt Lake City, Utah, USA (9-13 Apr. 2002) Theory Meets Practice in CALL, a Colloquium (TESOL 2002 CALL-IS Academic Session: Webcast event with participation of Webheads - 10 Apr. 2002) Webheads at the Internet Fair (12 Apr. 2002):	April 5, 2002 – April 12, 2002
4	Tapped In Summer Carnival 2002 (17 Jul. 2002)	July 10, 2002 – July 17, 2002
5	Cross Cultural Communication Online: perspectives from around the globe - The Webheads Community (21-22 Aug. 2002) NetWorking 2002 (19-30 Aug. 2002)	August 22 – August 30
6	e-Merging e-Learning Conference - Abu Dhabi, UAE (8-9 Sep. 2002)	September 2, 2002 – September 9, 2002
7	Global Learn Day VI - a 24-hour online event covering all time zones (13 Oct. 2002)	October 6, 2002 – October 13, 2002
8	EVonline Training for Moderators Oct 21 - Nov 29, 2002:	Analysis Period 3
9	EgypTesol 2002 Conference - Cairo, Egypt (13-15 Dec. 2002).	December 8, 2002 – December 15, 2002

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