

A Dissertation

Entitled

Peer interaction in university-level distance education

By

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Submitted as partial fulfillment of the requirements for
The Doctor of Philosophy in Curriculum and Instruction

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An Abstract of
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Course management systems (CMS) are widely used in higher education to deliver courses completely at a distance. Although research suggests learning is influenced by social interaction, there is comparatively little research on why and how students enrolled in a CMS-based, fully online course interact with their peers. A review of the literature suggests the history of distance education is primarily constructed of applied practice, largely unchanged throughout periods of technological innovation.

The purpose of this study is to discover students' perceptions of social interaction among peers enrolled in a university-level, fully online, CMS-based course. An online survey provided an objective measure of peer interaction.

The results revealed hierarchical patterns in reasons for interaction, communication methods used, and the perceived value of interaction in academic success. The study also revealed significant demographic differences regarding reasons for interaction and communication methods used. Content review suggests students have a strong interest in how instruction is provided online.

Improvement in learning skills, communication literacy, and information literacy are recommended to increase online learning outcomes. Additional research is suggested to expand the knowledge of distance education.

This dissertation is dedicated to the memory of my loving parents, John Alexander Fink, Sr., and Geraldine (Severn) Fink.

As mentors, their blend of Pennsylvania Dutch and English wisdom modeled honesty, integrity, and compassion toward others. Their belief in diversity at a time when it was unpopular, their humble service to the country, and their volunteering to improve the human condition established a social ethic I strive to emulate.

As teachers, their constant insistence that I inquire, learn, and reflect ignited a passion within me to seek meaning, to explore, and to discover, bringing me to this day.

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alleviated statistics anxiety experienced by so many students, and also sparked my interest in learning about objective measurement. Her book, *Applying the Rasch model: Fundamental measurement in the human sciences*, ” has a permanent place on my bookshelf as a text that will often be referenced.

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Chapter I: Introduction

Problem

Distance education is experiencing tremendous growth through the use of Web-based course management systems (CMS). The practice of distance education has increased course offerings at public and private institutions. However, there is comparatively little research on the reasons students indicated they interact with their peers, or the technological tools used to engage in the communication. Generally, research on student interaction is qualitative in nature, using small, homogeneous groups. Research foci tend to involve discourse analysis of a particular communication tool, focus on a particular group, study a specific form of interaction (e.g., instructor-to-student), or study interaction that occurs in a physical classroom. Social interaction among peers in a CMS course is not fully understood. In this study, distance education refers to the broad application and administration of education where instruction is separated by time or location. Distance learning, when used, refers to the intended outcome, or what was learned from the delivery of instruction. This study uses the term “course management system (CMS)” to identify the use of a server-side software application to deliver university-level instruction through the World Wide Web. Courses using other instructional delivery or media are specifically identified herein.

Although research regarding interaction in a fully online course is relatively rare, a few studies have focused on CMS-based peer communication. Research in this area includes the study of learner-interface interaction (Ballard, Stapleton, & Carroll, 2004; Gibson, Hall, & Callery, 2006; Hillman, Willis, & Gunawardena, 1994), instructor-learner interaction (Bull et al., 1999; Gibson et al., 2006; Moller, 1998; Moore, 1993), asynchronous-synchronous interaction (Bates, 1995; Bull, Kimball, & Stansberry, 1998; Cavallaro & Tan, 2006; Stokoe, 2000), and discourse analysis within a particular tool (Basturkman, 2002; Belanich, Wisher, & Orvis, 2004; Benwell & Stokoe, 2002; Coulthard, 1992; Freeman & Bamford, 2004; Jung, 2002; Mehan, 1985; Pelowski, Frissell, Cabral, & Yu, 2005). The few studies regarding interaction among learners include qualitative studies of discourse analysis (Amy, 2003; Benwell & Stokoe, 2002; Geelan, 2001; Hara, 2000; Mehan, 1985), instructor perception of student discourse (Gallini & Barron, 2001; Pettitt, 2002; Yang, 2001), or student interaction within a special population or discipline (Burke & Greenbowe, 1999; Geelan, 2001; Lia-Hoagberg, Vellenga, Miller, & Li, 1999; Powers & Mitchell, 1997; Tabatabaei, Schrottner, & Reichgelt, 2006; Thompson et al., 1997; Zhai & Liu, 2005).

Research on gender and learning online suggests women are more willing to learn from their peers and more academically engaged than males (Price, 2006). Qualitative interviews in a Canadian study found women used the online environment to test roles and behaviors that conflict with social norms of gender prior to implementing the changes offline (Kelly, Pomerantz, & Currie, 2006). In a study that focused on facilitation, Chang (2001) found females most often seek information on assignments and grades (e.g., sought clarity on assessment criteria), where males mostly request network

access support. A study using a larger sample size and greater diversity is required to more fully understand the difference of interaction based on gender. There is little research across disciplines investigating students' perceptions of interaction with peers enrolled in the same CMS course, although it is understood that social interaction is a significant contribution to learning:

Since much of what a student learns in college takes place outside the classroom (over 70 per cent according to Wilson, 1996), then it seems likely that fellow students will be a major influence (Lazar, 1995) (Knapper & Cropley, 2000, p. 117).

Peer-to-peer influence is significant in learner cognitive development and may have a greater significance in a fully online course than in the traditional classroom (Astin, 1993; Knapper & Cropley, 2000; Pascarella & Terenzini, 1991). Currently, research has not provided a large, heterogeneous sample to more fully understand why and how students communicate with their online counterparts.

There is little in-class interaction research, and the study of interaction that occurs "outside" the online course is unknown. Institutions often realize the benefits obtained in learner engagement provided by support systems for students like online tutoring, online student centers, online orientation, and technical support. However, there is little research on the interactions that occur apart from the designed classroom interaction and support systems provided (Kerr, 2006). Institutions may have excellent formal support systems, but there is no knowledge of informal, alternative routes students may use to interact with their peers. Since interaction is a significant contribution to the cognitive development of

students, it is important to understand what the nature of that interaction is, and how the interaction is perceived by students to influence their academic success.

Background

The evolution of distance education from correspondence delivery to a multimedia environment is significant. The fusion of technological innovation, learning theory, and instructional design provides new methods of delivering instruction and increasing potential for quality learning outcomes. Transferring knowledge from previous generations to the current generation is known as cultural reproduction (Kerr, 1996). In order to effectively engage in cultural reproduction, an understanding of historical and theoretical perspectives and current research is necessary. Growth in the pace of technological innovation used by distance education is on the rise and distance education enrollment and programs continue to increase. The two primary shifts in educational technology contribute to cultural reproduction.

The first primary shift in educational technology occurred due to significant innovations from 1900 to 2000. During this period, the impact, quality, and speed of innovation greatly advanced educational technology as it contributes to the enculturation of society (Kellner, 2002, n. d.; Poster, 1994). Theorists define “quality” of virtual reality as a virtual event that closely represents a real event. An event that vaguely represents reality (e. g., the video game Pong) is defined as a low quality, in contrast to a clear representation of reality (e. g., digitized motion picture effects). The highest quality, or ideal, would be to an extent that the mind could not discriminate the virtual from the real. Kellner’s examination of the past century shows innovations from 1900 to 1950 are far

less in number than those from 1950 to 2000. Virtual theorists suggest that the speed, quality, and use of technology as well as the rate of innovation increase exponentially (Baudrillard, 1994b).

The pace of innovation will advance distance education, including innovation associated with hyperreality. Virtual reality is a sub-set of Hyperreality, or HR. Hyperreality is a technological capability that makes possible the seamless integration of physical reality and virtual reality, human intelligence and artificial intelligence HR makes it possible for the physically real inhabitants of one place to purposively coact with the inhabitants of remote locations as well as with computer-generated imaginary or artificial life forms in a HyperWorld (Terashima, 2001, p. 8).

Hyperreality theorists have formal knowledge situated in various disciplines (much like social informatics), including philosophy, engineering, cultural studies, education, and sociology (Baudrillard, 1975, 1994a, 1994b; Best, 1994, 1995; Kellner, 2002; Poster, 1994). The continuing increase in technology tools for learning and their potential for greater learning outcomes are significant. However, the appropriate use of instructional design, instructor/student motivation, and student interaction are necessary components, regardless of technological sophistication used to make the learning environment seem real. Virtual reality will powerfully create contexts that can be exploited by learners in an HR environment, and technology will increase the need for translating educational theory into practice through instructional design in order to achieve desired outcomes (Pea, 1993; Terashima, 2001).

The second primary shift in the acquisition of knowledge is in the exponential growth of distance education enrollments in higher education. Distance education enrollment from the 1997-1998 academic year to the 2000-2001 academic year nearly doubled. Approximately half of these enrollments were at public institutions (Rooney et al., 2006). Based on a report from the Sloan Consortium, it appears that distance education no longer resides on the margin of the academe. The Allen, Joyce, & Seaman report (2005) notes:

- The online enrollment growth rate is over [sic] ten times that projected by the National Center for Education Statistics for the general postsecondary student population.
- Overall online enrollment increased from 1.98 million in 2003 to 2.35 million in 2004.
- Sixty-five percent of higher education institutions report that they are using primarily core faculty to teach their online courses, compared to 62% that report they are using primarily core faculty to teach their face-to-face courses.
- Seventy-four percent of public colleges report that their online courses are taught by core faculty, as opposed to only 61% for their face-to-face courses.
- Sixty-five percent of schools offering graduate face-to face courses also offer graduate courses online.
- Sixty-three percent of schools offering undergraduate face-to face courses also offer undergraduate courses online.

- Among all schools offering face-to-face master's degree programs, 44% also offer master's programs online.
- Among all schools offering face-to-face Business degree programs, 43% also offer online Business programs.

The speed and quality of innovations in educational technology, and the enrollment growth of courses offered online, indicate that more research in distance education is needed. An investigation of peer interactions for students enrolled in fully online courses would be a significant contribution to current knowledge in this area.

Purpose

Research suggests learning is influenced by social interaction, including in Web-based courses. However no cross-discipline, empirical evidence is available to describe student perceptions of social interactions. Therefore, the purpose of this study is to discover students' perceptions of social interaction among peers enrolled in a university-level, fully online, CMS-based course. Since no instrument or items are available to address the problem, it is necessary to develop a valid instrument to more fully understand the nature of why and how students interact with their peers. It is necessary to conduct a pilot study to evaluate and calibrate the items, since they have not been tested prior to this study. Data collected from the pilot will reveal the instrument's psychometric properties. Data collected from the full study will use the psychometric properties to contribute to our understanding of social interaction through the analysis of the responses provided.

Operational Definitions

Although terms used in this study may be defined differently in other contexts or studies, the terms listed below are defined as stated for the purposes of this study.

Article – a message posted for a group of readers on a bulletin board, discussion board, or discussion room.

Asynchronous – A method of communication where interaction between the sender and receiver does not take place at the same time. Asynchronous communication within the course management system used in this study is generally conducted via email, discussion board, presentations, audio email, audio discussion board, or instant messaging.

Bulletin Board or Discussion Board/Room – A message center regarding a particular topic to post, reply, and read articles, or messages. For this study, the term bulletin board, discussion board, or discussion room are synonymous and refer to the tool available within the course management system (CMS).

Chat room – A virtual “room” (transmission path or channel) where real time, synchronous communication takes place between two or more users. The communication can be text, audio, video, or any combination thereof.

Communication literacy – In this study, the term is operationalized to define the ability, skill, and appropriate behavior when interacting with others in an asynchronous or synchronous environment using various tools in a variety of contexts.

Course management system (CMS) – A secured, server-side software application used to deliver instruction. CMSs contain tools and internal, seamless applications within

one site (e.g., email, discussion tool, quiz tool, chat room, presentation tool). Examples of CMS applications include WebCT, Blackboard, TopClass, Sakai, and eCollege.

Cultural reproduction – The transfer of culture from one generation to the next.

The transfer contains knowledge built upon from previous generations and is reproduced for future generations (Kerr, 1996).

Distance education – The phenomenon that occurs when an instructor and student(s) are separated by physical space or time, using technology to engage in the instructional process (Willis, 1994). In the context of this study, distance education will refer to university-level instruction that is delivered through a course management system.

Distance learning – The intended instructional outcome of distance education, or the learning that occurs from instruction delivered at a difference place or time (Willis, 1994).

Educational Technology – The systematic, systemic, and social science discipline that integrates technology into educational psychology theories to provide instruction based on desired objectives and results using the scientific method. The Encyclopedia of Educational Technology positions the theory and practice of educational technology into discrete categories of cognition and learning, analysis, design, development, implementation, and evaluation (Hoffman, 2006). However, these categories are archetypal for the practice of the discipline, whereas the actual engagement of the discipline extends beyond cognitive psychology and instructional design.

Electronic mail (email) – An asynchronous, electronic system using text, audio, or video to read, send, or manage a message. In the context of this study, an email can be

generated from within the course management system, the University system, or a personal email messaging service (e.g., Yahoo, Hotmail, Gmail, etc.).

Hyperreality (HR) – The seamless interaction among physical reality, virtual reality, human intelligence, and artificial intelligence (Terashima, 2001).

Information literacy – In this study, the term is operationalized to define the ability and skill to search, access, and evaluate information through a CMS-based environment using various tools in a variety of contexts.

Instant Messaging (IM) – a type of communication enabling two individuals to communicate over the Internet “online” in real time (synchronous). IM can be text, audio, or video and alerts a user when a member of their list is online. The technology is rare in higher education CMS applications. IM messages sent by an online user to an offline user can be viewed at a different time when the user opens the IM application (asynchronous). Sophisticated IM systems also allow users to share files, play games, invite many into a customized chat room, and synchronously collaborate on a document while at a distance.

Internet – The Internet is a global network of large and small computer networks around the world (Moore & Kearsley, 2005).

Item/Person fit – The degree of fit of an instrument/test items or persons meeting the expectation of the Rasch Model. An item fit examines a pattern of a particular item for all persons, where a person fit examines a pattern of a particular person for all items. The expectation of the Rasch Model is that items that are difficult (harder to agree with) will be less frequent, while easy (or easier to agree with) items will be more frequent. Persons who identify more with the latent trait studied will agree with the difficult items

and those who do not identify with the latent trait will agree with the easy items (Bond & Fox, 2001; Stone, 2006; Wright & Douglas, 1975).

Learning style – “A relatively stable and developed way in which a person perceives, behaves, and interacts in a learning environment” (Moore & Kearsley, 2005, p. 326).

Newsgroup – an online discussion group on the Internet covering thousands of topics and interests. To view newsgroup postings, a newsreader application connecting to a news server is required.

Posting – The act of authoring a discussion board message, called an article.

Protocol – A format standard to transmit data between two devices. A protocol identifies the type of error scrutiny used, any data compression method, and indicators acknowledging that a transmission has completed sending or receiving data. Protocols can be based in software application or hardware devices. Examples include HTTP, HTTPS, and Telnet.

Server – A computer or machine that manages network resources. For example, a server can store files (file server), manage printers (print server), manage network traffic (network server), store audio or video on demand (streaming server), or store database information and resolve queries (database server).

Server-side software – Software applications that reside on a server, not on an individual computer. These applications typically use a Web browser to access the tools and features of the application.

Synchronous – The method of communication where interaction between the sender and receiver takes place at the same time (i.e., no time delay; in real time).

Synchronous communication in the CMS is typically conducted via chat room, white board, audio or video conferencing, or audio chat room.

Usenet – A global bulletin board system containing on-line discussions held through newsgroups.

Virtual – Something that is not real, but simulates the physical reality typically through technological automation in order to provide a conceptual reality. “A technology that provides computer-generated realities that are an alternative to physical reality” (Tiffin, 2001, p. 30)

Web-based instruction (WBI) – Instruction that is primarily delivered using the World Wide Web.

World Wide Web (WWW or the Web) – A system of Internet servers that exchange information using specially formatted documents. The WWW allows information to be shared using the connectivity of the Internet and is one of several methods to exchange information using the Internet. Others include email, Usenet news groups, instant messaging, and FTP. The Web requires users to exchange the information using a software application known as a browser.

Delimitations and Limitations

This research is confined to university students who enroll in fully online courses. Therefore, findings should not be applied to students enrolled in courses that are Web enabled (interact in a face-to-face instructional environment), to other populations (e.g., K-12 education), or for technology tools not specified (e.g., video conferencing). The

study does not attempt to establish cause-and-effect relationships and is bound by descriptive and inferential research.

Significance of Study

Using the literature on the history, theory, and design of instruction of distance education, a study of social interaction among peers enrolled in a university course that is delivered through a CMS is essential for many reasons. First, a greater understanding of the communication between peers in an online course will allow online courses to be designed to increase the likelihood of higher learning outcomes. Second, the instrument tested and used as a measure can be applied to future related research. Third, administrative decisions based on the results will effectuate enhanced learning environments for distant learners in a more efficient and effective manner during a period of immense growth.

Research Questions

Based on the purposes stated, the research questions posed are:

1. Why do students interact with their peers enrolled in the same CMS course?
2. What communication tools do students use to interact with other students who are enrolled in the same CMS course?
3. Are there relationships between why students interact and their perceptions of academic success?

4. Are there relationships between why students interact and demographic characteristics?
5. Are there relationships between communication tools used and demographic characteristics?

Chapter II: Review of the Literature

This literature review contains three sections. The first section includes a review of literature regarding the history of distance education. Researchers suggest the history of distance education is often ignored, yet vital to understanding the discipline (Berge, 1999; Gunawardena, Wilson, & Nolla, 2003; Moore & Kearsley, 2005; Peters, 2003; Picciano, 2001). The section is chronological, exploring correspondence study, telecommunications, computers, networking, and course management systems (CMSs).

The second section is a review of the literature concerning the theoretical perspectives used in the systematic design of instruction. The section addresses the philosophies of empiricism, constructivism, and pragmatism as foundations for educational theories. Primary education theories used in instructional design include behaviorism and cognitivism. In addition, cultural reproduction and social learning theory are reviewed in the context of online interaction.

The third section is a review of the literature relating to interaction in Web-based instruction. The section begins by reviewing the various approaches to defining and studying interaction found in the literature. The section concludes with a review of the literature regarding the design of interaction. Each of the sections in the review of the literature are examined in context to the specific inquiry for this study.

History of Distance Education

A review of the literature on the history of distance education is necessary in understanding the contexts of interaction. Significant milestones of distance education are presented in this section including: correspondence study, audio telecommunications, educational television, interactive television, computer-assisted instruction, the Internet, the World Wide Web, and secured course management systems.

While the history of distance education is important to our understanding of instructional delivery and design, it is largely ignored. According to Pittman (2003), the discipline rarely reflects on the past, focusing instead on the pragmatic issues involved in distance education and the results that can be obtained from professional practice in the field. “Distance education is developing in a hurry at the postsecondary level. As its pace of innovation and adoption accelerates, many practitioners and advocates seem anxious to leave its past behind” (Pittman, 2003, p. 21).

Correspondence study.

For centuries, distance education evolved from face-to-face interaction to the invention of the printing press, and thereafter, electronic media (Brown & Brown, 1994; Picciano, 2001; Schlosser & Simonson, 2005; Simonson, Smaldino, Albright, & Zvack, 2000). “Evolution is an appropriate descriptor because distance education describes learning occurring within the constraint of Holmberg’s (1981) essential elements and appears to have infiltrated the process of education by reverse osmosis” (Brown & Brown, 1994, p. 5).

In 1840, Isaac Pitman began a “Penny Post” correspondence program for Great Britain that guaranteed the delivery of a letter for a penny where students learned

shorthand. During this period, formalized correspondence language instruction was popularized in Berlin, Germany by Charles Toussaint and Gustav Langenscheidt (Schlosser & Simonson, 2005). In European higher education, formal university courses began at Oxford University in 1870 (Sherow & Wedemeyer, 1990), followed by Skerry's College in Edinburgh in 1878 and the University Correspondence College in London in 1887 (Picciano, 2001). In 1886, H. S. Hermod began teaching English in Sweden. Hermod's correspondence program became "one of the largest distance learning organizations in the world" (Picciano, 2001, p. 8).

In 1873, Anna Eliot Ticknor introduced the United States to correspondence education. Ticknor's Boston-based organization, The Society to Encourage Studies at Home, is credited with instructing some 10,000 students in 24 years. Ticknor's instruction included assigned readings, tests, and interaction with a teacher (Schlosser & Simonson, 2005). In 1883, the State of New York began sanctioning academic degrees for correspondence courses delivered by the Chautauqua College of Liberal Arts. The first graduating class, known as the Chautauqua Literary and Scientific Circle (CLSC), continues as an international book club and home study group today (Sherman, n. d.). The degrees conferred were among the first hybrid degrees offered, as correspondence delivery was used in conjunction with required attendance at summer institutes. Yale professor William Rainey Harper created and led the Chautauqua program and was an early advocate of distance education (Picciano, 2001; Schlosser & Simonson, 2005; Simonson et al., 2000).

Not all correspondence programs were designed for affluent individuals in society. One of the largest correspondence schools in the United States began in

Pennsylvania. In 1891, founder and publisher Thomas J. Foster created the International Correspondence School (ICS). Courses offered were originally directed toward mining methods and safety. By 1900, the ICS had an enrollment of 225,000 students and by 1920 more than two million students were enrolled (Simonson et al., 2000). Today, ICS is the large publishing empire known as Thompson Publishing (Moore & Kearsley, 2005). One year before Foster's ICS operation began, the University of Chicago was founded, creating the first university extension program for an American university. The university extension division was one of only five divisions in the university and was responsible for lecture study, class study, correspondence teaching, library, and training (Simonson et al., 2000). In 1892, Harper traveled from his Western New York home at Chautauqua to head the Chicago extension division (Picciano, 2001). Although Chicago's program had 125 instructors teaching more than 3,000 students at a distance, faculty interest dissipated and by 1899 the program halted for seven years (Simonson et al., 2000). During this time, the University of Wisconsin offered short courses and extension services for farmers via correspondence establishing programs in use today (Simonson et al., 2000).

Throughout his career from Chautauqua to Chicago, Harper believed correspondence was a primary method of instructional delivery for the future (Picciano, 2001), writing:

The student who has prepared a certain number of lessons in the correspondence school knows more of the subject treated in those lessons, and knows it better, than the student who has convened the same ground in the classroom. The day is coming when the work done by correspondence will be greater in amount than that done in the classrooms of our

academies and colleges, when the students who shall recite by correspondence will out number those who make oral recitations (Schlosser & Simonson, 2005, p. 9).

If “correspondence” is defined to include today’s electronic presentations, term papers, projects, portfolios, email, and discussion boards, then Harper may have correctly predicted the future of instructional delivery. However, it is possible that learner characteristics played a role in shaping Harper’s position. Education in the 1800’s was largely offered to affluent, Caucasian males. Specifically, the Chautauqua Institute was (and continues to be) known as a “think tank” for knowledge acquisition among members of a high socio-economic stratum. Presidents, CEOs, and many of the affluent and influential continue to be learners and presenters at Chautauqua events. While a historical investigation of learner characteristics in relationship to distance education is important and should be conducted, it is not a primary focus of this study.

The review of literature suggests that distance education history may provide evidence of an “analog divide” that has evolved with distance education and technology into today’s “digital divide.” Research should be conducted in this area to determine any possible influence or relationship between the technology, the field, and the limitations of access to learning resources. The acquisition of resources in relationship to distance education populations has an influence on engagement and interaction within any instructional delivery, regardless of distance. Today’s learners are more heterogeneous than their correspondence school predecessors. Still, homogeneity remains in student technical, cognitive, social, and economic situations for participating in higher education.

Historians generally agree that correspondence study is an extension of the American tradition of voluntary self-improvement, but there is disagreement in regards to motive. Historian Joseph Kett believes higher education institutions beleagueredly accommodated instructional delivery by correspondence for revenue (Kett, 1994). However, historian Charles Wedemeyer believes the use of correspondence instruction was a cognizant act by institutions to shift from pervasive elitism found in the tradition of face-to-face classroom instructional delivery (Wedemeyer, 1981). Like the contextualization of the discipline of distance education itself, both perspectives are found to have evidence in varying institutional operations. While the Chautauqua program was directed to affluent adults, the International Correspondence Schools started to educate working class miners. In the university setting, extension efforts were not a central part of the campus community, and were typically operated as a small business within the public university system (Kett, 1994).

Historically, higher education institutions continued to evolve and increase the already dominant face-to-face instructional classroom as the primary delivery method for degree relative instruction. This in-group/out-group dichotomy resulted in formulating a perception among many academicians that distance education was not as rigorous, resulting in the marginalizing of correspondence as an instructional delivery medium. Correspondence programs offering higher education degrees were generally folded into continuing education operations or closed. Myths about correspondence and attempts at using the delivery method for every type of lesson without a focus on pedagogy diminished the learning outcome and assisted in creating non-accredited programs (Moore & Kearsley, 2005). Technology improvements eroded the significance of using

correspondence as an instructional delivery method. By the early 1960s, educators removed correspondence study from mainstream higher education. To differentiate from the face-to-face classroom environment, academic jargon was modified to define correspondence study as “home study” and later as “independent study” (Pittman, 2003).

In continuing education, correspondence instruction continued to provide revenue for experimentation in telecommunication endeavors, generating revenue essentially from adult education students (Pittman, 2003). From the beginning, formalized distance education was directed toward adults with work and family commitments – a demographic found in distance education students today. Adult learning and training through correspondence instruction, continuing education, and telecommunication delivery provided significant contributions to progress in the United States. Factory workers learned new measures for safety, health care professionals learned of new illnesses and treatments, and farmers learned best practices for agricultural and livestock production.

Telecommunications.

During the 1920s and 1930s, broadcast radio became the instructional media and delivery tool preferred by educators in distance education (Picciano, 2001). For the first time, instruction could be delivered en masse. However, in order to obtain instructional materials for the new medium, educators made serious errors in learning theory by loosely recording textual content to the new audio-based technology, without regard to the pedagogical differences in the delivery change. The theoretical flaw made was in assuming instruction intended for one medium (correspondence) could be directly applied to another (radio). This dilemma reinforced resistance in teaching via radio. Instructors

who used the medium were often marginalized in the academe. Differences that are beneficial and limiting in using radio were not discovered until later (Atkinson, 1941).

Carroll Atkinson criticized those resistant to change:

Most surely if such a project is ever to be successful, there must be a sensible compromise between radio and traditional methods. So long as professional educators continue to maintain a holier-than-thou conception that they possess exclusively the secret patented formula on how to improve the intellectual welfare of the human race without recognizing the necessity of changing from time-honored method of the past to meet the highly increased tempo of modern times, just that long will they fail to see and utilize the true educational possibilities of radio communication (Atkinson, 1941, p. 12).

The attempts to change pedagogy were slow although learners continued to take courses by broadcast radio that were designed solely as a print delivery method (Simonson et al., 2000). To repair the design flaw, educators sent information and materials to students by mail. For example, audio recordings of written material were sent to visually impaired students, audio recordings of broadcast sessions were mailed to students who would not be listening to a particular broadcast, and laboratory test kits were sent to students for experimentation at home (Simonson et al., 2000).

Pittman finds irony in today's distance education leaders, believing their pragmatism and rush to produce results allowed historical knowledge to be disregarded. He suggests those who ignore the lessons learned in previous technologies repeat the errors made in a different delivery method (Pittman, 2003). For example, instructional

materials created for one medium (i.e., correspondence) applied to another medium (i.e., radio), without regard to the differences in delivery can limit opportunities for high quality learning outcomes.

Changing instructional delivery without revising methods or content can be subtle or noticeable. An apparent change is noticed when a lesson tells students to “see figure a” for a radio broadcast course; students listening on the radio cannot “see” the figure referenced by the instructor. However, subtle instructional differences exist when teaching content across media. The pedagogy – not technological tools – should drive media selection and use (Heinich, Molenda, Russell, & Smaldino, 2002). However, in every delivery method and technological tool invented, the lack of historical knowledge has repeated the same errors warned by Pittman. Any conversion of course content should contain a redesign of the instruction, including an analysis to establish any change from the media utilized. Pittman’s work also suggests that distance educators who ignore the historical significance of the field often claim innovation in the application of a method, technique, or practice that existed in medium popularized in other eras. Through the conversion of text-based content to aural, educators began to realize the need for instruction that was systematically designed; bringing radio broadcast instruction to higher education.

The application and strength of radio broadcast became popular at the University of Wisconsin, the Ohio State University, and at the State University of Iowa. These institutions were leaders in delivering instruction via airwaves although educational radio rapidly expanded to more than 176 other broadcasting stations located on higher education campuses across the United States (Picciano, 2001). While radio broadcasting

continues to be used in the United States (principally in remote locations), the use of the medium for instruction was generally replaced by television in the 1940s and 1950s (Picciano, 2001).

The first instance of educational television occurred at the State University of Iowa. The program began in 1934, and by 1939 more than 400 educational programs were on the air (Unwin & McAleese, 1988 cited in Moore & Kearsley, 2005). The initial thrust for educational television began after World War II when 242 broadcast frequencies were allocated exclusively for educational programming. NBC and CBS offered two successful educational television productions in conjunction with major universities. The ability of the medium to reach mass society created a ratings system to sell advertising. Since educational programs did not receive a high audience share, educational television as a major focus of commercial programming diminished. In 1950, the Ford Foundation provided millions of dollars in grants to maintain the life of educational programs and educational broadcasting stations (Moore & Kearsley, 2005; Picciano, 2001). In 1951, the first continuous series of credit courses offered using broadcast educational television was at the Western Reserve University (Simonson et al., 2000). A year later, cable television (CATV) was implemented in a town nestled amongst frequency-interfering mountains (Moore & Kearsley, 2005).

In the early 1960s, the use of educational television was promoted in the United States and abroad with governmental legal and financial support. In 1962, the Educational Television Facilities Act (ETFA) created public funds for educational television shows (Simonson et al., 2000). That year also brought rise to the exclusivity of distance education institutions when the University of South Africa declared it would

operate entirely as a distance teaching university, offering correspondence, audio, and television instruction (Moore & Kearsley, 2005). While South Africa started this trend, a project two years later brought distance education worldwide.

In 1964, Charles Wedemeyer of the University of Wisconsin-Madison led a project by the Carnegie Corporation combining various types of instructional media. The project, titled the Articulated Instructional Media project (AIM) lasted four years and closed in 1968 (Moore & Kearsley, 2005). In 1965, Wedemeyer met with individuals in the academe and in British government while lecturing on the failure of AIM.

Wedemeyer was critical of AIM for three reasons: AIM had no control over project curriculum or faculty; AIM had no control over project funds; and AIM had no have control over granting credit or in conferring degrees (Moore & Kearsley, 2005). In 1967, the same year the Public Broadcasting Act created the Corporation for Public Broadcasting (CPB), the British government responded to Wedemeyer's concerns with AIM and began creating a new institution exclusive to distance education. Disregarding complaints made by established higher education institutions, the British government's Open University was opened in 1971. The government, influenced by Wedemeyer's criticism of AIM, ensured that OU was not connected to any existing physical campus, was free to award degrees, and selected their own faculty and curriculum (Moore & Kearsley, 2005; Oliver, 1994). The United Kingdom's Open University is now international in scope, enrolling more than 200,000 adult students with 20,000 students graduating each year. OU is one of the leading teaching and research universities in the country and tuition is 40% of the cost of a physical campus in the UK (Moore & Kearsley, 2005). The contribution of the UK's Open University organizational

autonomous philosophy is significant: more than 22 countries have open universities with annual enrollments ranging from 110,000 to 577,000 (Moore & Kearsley, 2005).

During the time the British were focused on establishing the Open University, the use of low power broadcast stations and satellites for instructional delivery was on the rise in the United States. In 1969, Stanford University created the Stanford Instructional Television Network (SITN). This network was designed to broadcast 120 engineering courses to 900 engineers at 16 participating companies within the 25-mile broadcast area (DiPaolo, 1993). Due to the small broadcast radius of Instructional Television Fixed Service (ITFS), most successful applications involved offering corporate training courses to organizations in economic development zones (Savage, 1995). Partly due to this limitation, the delivery tool faded out of service by 1984, with a final large-scale project on the west coast. California State University-Chico taught computer science courses to Hewlett-Packard company using ITFS (Moore & Kearsley, 2005).

Unlike ITFS, satellite communications as an instructional delivery tool fared much better and continues today. In 1971, the University of Hawaii's Pan-Pacific Education and Communication Experiments by Satellite (PEACESAT) was created (Moore & Kearsley, 2005; PEACESAT, 2006). PEACESAT continues to provide instruction to the region, now adding public and private copper, fiber, and microwave technologies in an attempt to close the digital divide of the Pacific Islands (PEACESAT, 2006). In 1974, the Appalachian Education Satellite Project (AESP) was created to provide adult basic education and college courses for underserved populations in rural Appalachia. The program later provided graduate courses to rural teachers (Simonson et al., 2000).

A rarely recognized pioneer in instructional television and leader in the AESP was William M. Brish. Brish was fundamental in reaching underserved populations in rural America and India as a consultant with the Ford Foundation (Ban, 1999). Brish's work with AESP was successful in bringing education to a rural, remote region of the United States. Years later, the satellite foundation built by Brish and the Ford Foundation evolved into partnerships with the Ohio Supercomputer Center (OSC). The OSC and partnering organizations create wireless neighborhoods using satellite transmission to provide credit courses, training, and development to residents of Appalachia (OSC, 2006).

Throughout the latter half of the century, satellite transmissions were used, often in conjunction with other media. By 1972, the Federal Communications Commission (FCC) required all cable operators to provide an educational channel, used mostly for telecourses. CATV telecourses and satellite instruction were combined with print media, telephone conferencing and audio recordings. In 1980, the state of Alaska created the first state-sponsored educational satellite system providing "six hours of instruction to 100 villages" (Simonson et al., 2000). This was expanded two years later when Learn Alaska was launched (Unalaska, 2006). Broadcast, satellite, and CATV brought hundreds of hours of educational and instructional programming using media that typically offered a one-way, synchronous transmission. Instructors using the technology in the early years were limited in their engagement because they had to wait for delayed, asynchronous feedback from the learner. The invention and use of interactive television removed this limitation, introducing new benefits and limitations.

British Open University is not only a leader in creating a new institutional structure for higher education, it is also credited as a leader in interactive television (Garrison, 1990; Oliver, 1994). The push for interactive television for the Open University began in 1971 (Oliver, 1994) developing one of the most successful interactive television operations (Picciano, 2001). Soon, other countries followed suit. By 1980, some 200 college-level ITV courses were offered in the United States (Moore & Kearsley, 2005). Canada experimented heavily with telecommunications, having almost half of the instruction in the country using some form of telecommunication (Oliver, 1994).

In the 1980s, ITV maintained a presence in particularized settings, as educational television and recorded instructional television grew. In 1981, the Corporation for Public Broadcasting's Adult Learning Service supplied some 600,000 adult students instruction in more than one thousand schools (Moore & Kearsley, 2005). In addition to the famous K-12 programming like Sesame Street, educational television for adults continued with programs like Nova, Wall Street Week, and Masterpiece Theatre (Heinich et al., 2002). Educational television was primarily used in combination with other media, and instructional television provided one of the first delivery tools to eliminate the time and distance barrier. Instructional television allowed branch campuses to offer specialized courses, and allowed students to engage in the learning process through inter-institution team work, discussion, and project development (Savage, 1995). Like all instructional delivery tools, ITV has limitations in addition to the benefits noted by Savage. With ITV, students do not have personal contact with their instructor, transmission and other technological difficulties can occur beyond the control of the instructor, collaborating

institutions must resolve scheduling conflicts, and movement is spatially limited (Morehouse, 1987).

During the 1980s and 1990s, consortia from academe, government and private industry were created to offset costs associated with distance education. The Southern California Consortium created the award winning program, *The Mechanical Universe* (Moore & Kearsley, 2005). As technology increased the ways of knowing and learning, consortia were used to support satellite, cable, fiber optics, and later computer-based instruction. In the 1990s, the State of Iowa produced the largest fiber optic system at that time by linking every educational and library building in the state (Simonson et al., 2000).

Broadcast, satellite, microwave, closed-circuit systems, cable television and interactive television changed, supplementing the face-to-face classroom. This hybridization, or multiple delivery methods, occurred when it was necessary to explain a complex subject, to supplement limited resources, and to help increase learner motivation (Rockman, 1976, cited in Heinich, Molenda, Russell, & Smaldino, 2002). In the late 1970s and 1980s, the focus on delivering instruction included the use of a new tool: the personal computer.

Prior to personal computers in the homes of learners during the late 1980s, many institutions were shifting information technology from administrative and research applications to instructional delivery. Higher education institutions purchased Cathode Ray Tube (CRT) terminals for connection to mainframe databases. Research databases in higher education were later connected to military computers, which set the stage for today's email communication. In libraries and learning labs, the personal computer was

purchased. Students were provided 5¼” floppy discs (and later 3½” discs) to store information. This on-campus engagement supplementing in-class sessions promoted a transfer of this delivery method to distance education students. Computer discs were mailed to learners in course packages, much like the historical predecessors of texts, audiotape, and video recordings.

Wayne State University in Detroit, Michigan is one of the oldest institutions offering an instructional technology program in the United States (*50 years*, 1998). Although WSU was in the forefront of instructional technology, the progress in using computers as learning tools at the university is a microcosm of the progress in computer use – and instructional technology – in higher education in the United States throughout this period. In 1948, WSU began teaching and researching educational technology, and remained in a leader in providing technology-enhanced labs to mediate instruction (*50 years*, 1998). Like other institutions during the era, WSU began shifting their instruction to meet the new era of educational technology. From the 1970s, the university began to integrate the use of instructional technology with academic coursework in systems theory, instructional design, resource management, distance education delivery, and research. Prominent educators in the discipline, like Rita Richey and Gary Morrison, were hired and contributed significantly to the WSU program and in the shaping of the discipline worldwide. Using a combination of media, the WSU program participated in major Department of Defense projects and later partnered with “Frank Westervelt of the [WSU] College of Engineering to design and deliver an Engineering Master’s Degree by distance to employees of the Ford Motor Company” (*50 years*, 1998, p. 29).

The networking of computers.

Although the history of linking computers to communicate can be traced to Charles Babbage's "difference engine" of 1843 (Moschovitis, 1999), the focus for this study is on the developments of the 1970s to today. The innovations allowing the communication between computers through a network dramatically changed the way in which distance education is delivered. During the 1980s, computers began joining discrete media into a single instructional platform (Heinich et al., 2002). Audiocassette tapes that were historically separate from text instruction were merged into an audio/data CD-ROM. Video recordings that were once delivered by television or magnetic tape became streamed as a clip within a course site or delivered as an interactive DVD. The utilization of networked and non-networked computers for credit and non-credit courses occurred throughout the 1980s (Ackerman, 1995).

After networking technologies enabled computers to communicate with each other, Local Area Networks (LANs) and Wide Area Networks (WANs) were developed. Both closed systems, LANs were typically used to connect computers in a single building, while WANs were used to connect several buildings across a wide area, typically within one organization. As globalization increased, organizations linked their systems using an intranet, sometimes combining the closed networks to create an extranet (Heinich et al., 2002). The collection of open networked systems is known as the Internet. The Internet contains publicly assessable LANs and WANs from the government, higher education and K-12 schools, corporations, organizations, Internet service providers, and Internet hosting companies (Heinich et al., 2002).

In the 1970s, a concern over systems failure for Nuclear missile silos led the Department of Defense (DoD) to connect 30 locations through an organization named the Advanced Research Projects Agency (ARPA) (Roblyer & Edwards, 2000). The organization was responsible for the management of the first networked system called ARPAnet. It is widely and incorrectly assumed that the DoD's first involvement with distance education began with ARPAnet (Duncan, 2005). Early on, the military was involved in distance education, providing "large correspondence course programs teaching new skills to service members and civilians, both in the United States and overseas" (Duncan, 2005, p. 397).

By the 1980s, the focus on connection speed led the National Science Foundation (NSF) to fund a project providing high-speed connection among universities. The system used the knowledge acquired from the ARPAnet system (Roblyer & Edwards, 2000), but provided access for universities not connected to ARPAnet (Kristula, 1997). The NSF System, known as NSFNet, connected universities and research institutions with five supercomputer centers (Moore & Kearsley, 2005). NSFNet enabled users to interact using email, exchange documents, communicate on bulletin boards, and use library services (Inglis, Ling, & Joosten, 199, cited in Moore & Kearsley, 2005). The network was the first to allow users to connect from their home (Roblyer & Edwards, 2000). Two events shaped the future of today's Internet in 1983. First, the machine language used to communicate with other machines on ARPAnet had to use a protocol known as TCP/IP (Kristula, 1997). The decision evolved into today's IP addresses assigned to each computer when communicating online. Second, the University of Wisconsin developed

the Domain Name System (DNS) that allowed users to remember a Web page's name, not IP number or address (Kristula, 1997).

The ability to compute from home using NSFNet evolved into a public platform through an organization known as CREN. CREN was fully funded through member dues and launched the World Wide Web (also known as WWW or the Web) (Kristula, 1997). The Web is a series of communication protocols that allows communication among users. Heinrich, Molenda, Russell, & Smaldino (2002) use a metaphor to compare the WWW to a software application. The Web "is not separate from the Internet. Instead it rides on top of it, in the same way that an application such as *PowerPoint* runs on top of an operating system such as *Windows*" (Heinrich et al., 2002, p. 265).

In order to use the WWW, Web languages needed to be created and an application allowing the user to read Web pages was necessary. The most common communication protocol is the hypertext transfer protocol, or HTTP (Simonson et al., 2000). Protocols allow computers to send and receive data over networks, and languages allow information to be displayed using Web browsers. The most common language created was the Hyper Text Markup Language, or HTML. Soon, other languages and specifications emerged including DHTML, XML, PHP, Virtual Reality Modeling Language (VRML), and a Common Gateway Interface (CGI) for dynamic PERL documents. In 1993, Mosaic was launched as the first browser (Roblyer & Edwards, 2000). Soon, Netscape Communicator and Internet Explorer were available to view the dynamic pages on the WWW. As the increase in Web sites and Web pages grew, a method of finding information on the Web was necessary. The first search system was developed by the University of Minnesota and named after their school mascot, a

Gopher. Two search resources for Gopher that enabled searching the Internet were named Veronica and Jughead (Roblyer & Edwards, 2000). Later, sophisticated search engines were incorporated seamlessly into Web browsers and applications to create Web pages without knowing a Web language were readily available.

The creation of the WWW, a search method, a domain naming convention, and software to create Web pages led to an influx of faculty creating course materials online (Simonson et al., 2000). Early academic adopters used the WWW to create Web-based instructional content on a public domain, typically a personal or public site provided by the institution. While the early adoption of instructional content with global access provided easy access for students and instructors, it provided a risk of violating fair use if faculty “published” copyrighted materials on the Web that would be considered fair use documents in the physical classroom. In conjunction with course materials, some instructors took advantage of new interaction opportunities afforded by the Web. Many faculty members began using a combination of email, listservs, discussion boards, chat rooms, and desktop video conferencing (Simonson et al., 2000). The abundance of new interaction opportunities were mostly separate software applications, instead of a single, course management system.

Although the advantages of having discrete delivery tools connected through one computer in an asynchronous or synchronous format was significant, it still required using various applications, causing students and instructors to access separate applications on their computer. The constant switching between instructional tools (e.g., Website, listservs, chat, email) was frustrating for students attempting to learn, and for instructors attempting to teach. To create a seamless and secure instructional delivery

area, gateways or portals were created. These “one-stop” server-side applications became known as Course Management Systems (CMS). The CMS provided users one login access point accessing a variety of Web applications for instruction including email, chat rooms, discussion boards, white boards student page tracking, online assessment, and statistical analysis of assignments (Heinich et al., 2002; Roblyer & Edwards, 2000).

Course management systems were launched in the mid 1990s, about the same time the United States government began working to create a seamless communicating path that influenced the success of distance education online. In 1994, President Clinton passed the Emerging Telecommunications Technology Act directing the Secretary of Commerce: to administer aggressive transfer of federal frequencies to the private sector, to establish an electronic government, to invest in technology and technology infrastructure, and to make government information more available to citizens (Lyons, 2006).

The Department of Defense continued their involvement in online learning in creating the Advanced Distributed Learning (ADL) organization. The ADL is most recently known for creating a learning object standard called the Sharable Content Object Reference Model, or SCORM (SCORM, 2006). SCORM uses Extensible Markup Language (XML) to deliver and track course content. In creating learning modules, objects, or complete courses in SCORM, the content becomes portable across platforms, required for DoD contracts (Cover, 2003). SCORM ensures government evaluators the same content is delivered to each soldier in the same manner. In some DoD grants, higher education institutions are required to transmit students’ progress to the DoD.

Beyond the work of ADL, the government increasingly became both a provider and a consumer of distance education through the National Research and Education Network (NREN). NREN is a collaborative effort of the National Aeronautics and Space Administration (NASA), the Department of Energy, and the Department of Defense. In addition to the legislation to create these initiatives, two specific laws had an immediate and long-term impact on distance education for higher education.

First, the government passed the Internet Equity and Education Act (IEEA) (Harper, 2004). This law allows attempts to lessen the digital divide in college by allowing federal grants and loans to be used by students for distance education courses. The IEEA also removes the requirement for the location of instruction to be a physical classroom. Prior to passage, 12 instructional hours were considered a week for programs not using a semester, trimester, or quarter system. Upon passage of the IEEA, a week of instruction is defined as at least one day of instruction per week regardless of online or physical classroom delivery (Harper, 2004).

The IEEA was designed to provide access to distance education for students receiving financial aid. The Technology, Education, and Copyright Harmonization Act (TEACH Act) enabled faculty to use fair use in their electronic classroom. The TEACH Act grants the transmission of performances and copyrighted material online following fair use guidelines. The TEACH Act does not supersede copyright law and stipulates the instructional item in question can only be provided to students in the course, creating the legal rationale for using a CMS. Typically, a secured CMS allows only those enrolled in the specified course access to course materials, providing adherence to this specification of copyright law. The use of instructional materials on the Web that are not the original

works of the individual “publishing” creates a violation of copyright law. Both the IEAA and the TEACH Act contributed to the demand for distance education delivery by CMS, and by 2002, courses delivered online completely at a distance “ . . . expand daily” (Heinich et al., 2002, p. 264). In addition, some 75% of the 2002 courses offered in the United States resided within a CMS (Green, 2002, cited in Molenda & Bichelmeyer, 2005).

By 2005, the two primary CMS products used in higher education – Blackboard and WebCT – had merged, leaving only a marginal market share for alternative applications. Research by collaborating institutions developed an alternative, open source CMS product called Sakai. The goal of the Sakai Project is to allow transportable learning objects across institutions while allowing each institution to retain their identity through an open source platform. As Sakai notes, the CMS is “free to use, free to develop, and freedom for education” (Sakai, 2006, banner). Today, the project has more than 100 higher education institutions and consortia as project members throughout the world. US members include Harvard University, Yale University, Stanford University, the University of Michigan, and the Massachusetts Institute of Technology (MIT). The organization has 13 commercial affiliates including Apple Computer, Inc., IBM, Oracle, Pearson, and Sunguard, and Sun Microsystems.

CMS platforms are more sophisticated than anything used by distance education in the past, but some tools still reside outside of the platform. For example, desktop video conferencing is a technology that allows students and instructors to interact using a Web-enabled camera (Web cam), a microphone and speakers (Heinich et al., 2002). The synchronic tool is a user-to-user conferencing system. In education the tool is used for

projects, to hold virtual office hours, and to discuss and share documents. At the institution used in this study, this technology is not available within the course management system or supported as a separate tool and therefore is not included in the measurement instrument. Although the Sakai CMS offers many cutting-edge tools in an intuitive, user-friendly manner, the shared development of each tool by varying institutions has concerned administrators who rely on vendor support of application issues. The rise of CMS applications is significant. Users can engage in seamless interaction and virtual activities securely, and without needing to learn several unrelated components. If lessons are learned from the ancestors of distance education, then systematic and systemic design of instruction can allow a vast number of students to be engaged in higher order thinking on an individualized basis. This is not to say that CMS should replace any form of delivery en masse, but that any instruction should be evaluated based on an instructional design that includes a needs assessment focusing on the results desired for the instructional outcome (Kaufman, 1996; Rothwell & Kazanas, 1998).

The exponential growth of distance education in the past decade is immense. In 1998, some 1.6 million adult students were enrolled in various levels of distance education courses (Boettcher, 2000, cited in Harper, 2004, p. 585). By 2001, 3,077,000 students were enrolled in distance education course at two and four year regionally accredited institutions (Waits & Lewis, 2003). Using distance education to deliver higher education courses to students is increasing competition with for-profit companies entering the instructional delivery business. In 1999, higher education realized annual revenues of \$225 billion (Oblinger & J, 2000, cited in Harper, 2004, p. 585). “The

Internet has created a new level of competition to higher education with the entry of for-profit online universities that are competing with traditional educational institutions offering alternatives to classroom-based instruction” (Tracey & Richey, 2005, p. 19).

Understanding the history of how technological tools are used in education transforms our ideas of how media can support instruction. “Media are an essential element of distance education and it cannot happen without it, transmitting the instruction to, and/or from the learner. However, because each medium influences and changes the pedagogical structure, the question as to which carrier media to use for distance education is not only a practical or technical issue but also a pedagogical issue” (Peters, 2003). Distance education is influenced by the application of new technologies for teaching postsecondary coursework, by increased competition, and by a shifting population of students with experience using the Web. This shift is “a reflection of changing educational values and philosophies” (Tracey & Richey, 2005, p. 17).

Instructional Design & Theoretical Perspectives

Learning theories used in educational technology and instructional design stem from educational psychology, which originates from the field of psychology. The three primary perspectives used in instructional design are behaviorism, cognitivism, and constructivism. While these perspectives have served the discipline, a call to view educational technology with a sociological perspective continues to be made. The research questions considered in this study are grounded in theory from education and sociology. This section will present the application of theory on instructional design as it relates to interaction; it will briefly explain the three primary psychological perspectives

used in educational technology today and discuss current theoretical approaches by educational technologists studying interaction of college students using Web tools. While research in this area is generally rare, there is currently no specific study that considers student perception on their engagement of social interaction in a fully online course. Therefore, available research that typically focuses on an individual tool, course content, or learner characteristics are discussed. This section concludes by addressing sociological perspectives in the context of their relationship to this study.

Empiricism.

The systematic design of instruction was developed as a result of World War II. In order to mobilize qualified soldiers, the United States military engaged researchers in the design of instruction, often producing films that would be distributed to various facilities for training (Seels & Glasgow, 1998). The primary goal of military training during WWII was to change the behavior of a soldier's ability to *perform* a particular function. The theory used in developing this performance-related instruction was behaviorism. Behaviorism's key founding theorists are Ivan Pavlov, E. L. Thorndike and J. B. Watson. Pavlov (1927) was responsible for looking at the cerebral cortex and how animal behavior can be changed, known as classical conditioning. Thorndike (1921) was particularly interested in human learning, adult learning, individuality and mental and social measurements. Thorndike's *Law of Effect* stated that any action producing satisfaction would be repeated in a similar situation. Watson (1929) believed social scientists should study the observable change in behavior. According to Watson, the observable change in behavior is the learning outcome. Watson further postulated that unobserved characteristics, what he named "mentalisms" (thinking, intentions), could not

be observed and therefore could not be studied. Perhaps the most prominent behaviorist is B. F. Skinner. While Thorndike and Skinner both contributed to operant conditioning, Skinner (1953) more fully developed the construct: introducing the control of consequences including reinforcement and punishment. The philosophy behind the theory of behaviorism is empiricism, which states that knowledge is acquired through an experience that is sensory in nature. Empiricists tend to believe that there is only one reality, and that reality is objective. A counter to empiricism is constructivism.

Constructivism.

Constructivism is an extension of an umbrella philosophy of rationalism. Rationalists believe “that reason is the primary source of knowledge and that reality is constructed rather than discovered” (P. L. Smith & Ragan, 1999, p. 14). Jean Piaget is often considered the founder of constructivism, and was among the first to postulate that knowledge is constructed, not transmitted or genetic (Piaget, 2006). Constructivism is divided into three areas: Individual Constructivism, Social Constructivism, and Contextualism (Merrill, 1992, cited by Smith & Ragan, 1999, p.15).

Educators who follow Individual Constructivism believe that we actively develop meaning based on our experiences and that learning occurs based on our personal interpretation of knowledge. Social constructivists believe that learning is a social and collaborative process and believe in the negotiation of meaning. A contextualist believes learning is situated and based on the context of a real setting. They also believe that assessments should be integrated into the learning task (Merrill, 1992, cited by Smith & Ragan, 1999, p.16). It is important to note here that these are generalizations of guiding philosophies. In both empiricism and constructivism there are extreme and moderate

interpretations. A philosophy that acquires attributes from both empiricism and constructivism is pragmatism (Driscoll, 1994, cited by Smith & Ragan, 1999, p. 17).

Pragmatism.

Pragmatists “believe that knowledge is acquired through experience . . . that knowledge is interpreted through reason and is temporary and tentative . . . (and) that knowledge in a particular field is negotiated upon an agreement of experts as to a common interpretation of experience” (P. L. Smith & Ragan, 1999, p. 17-18). Education philosopher and theorist John Dewey would be situated within the pragmatism realm. Dewey believed that knowledge is provided through our experiences and proposed a *context effect* which states that nothing an individual can do is in a vacuum and the significance of any behavior must be considered in context, not in isolation (Dewey, 1966; Sarben, 1977). As a pragmatist, Dewey emphasized the significance of context on any interpretation of a phenomenon. Pragmatists believe theoretical constructs can only have meaning within context and they obtain this meaning not by ignoring empirical study, but rather by considering the context relationship in a deductive system of research with empirically testable consequences. Pragmatism is relevant to the study and practice of designing instruction, as an understanding of the context is imperative for successful learning outcomes. Most instructional design models include context and nearly all models used in relation to technology include context of learner, content, environment, and other areas by way of analysis.

Cognitivism.

Generally, major learning theories that follow the philosophy of constructivism or pragmatism are cognitive in nature. The primary components of instructional design are

influenced by cognitive psychology (P. L. Smith & Ragan, 1999). Cognitive theories seek to explain cognitive structures and processes. The learner is an active, involved participant in the learning process in order for meaning to be constructed. A subset of cognitive theories is a group of theories known as information-processing theories including Gagné's Model of Learning and Memory (Gagné, 1985).

Generally, in Gagné's model learners collect information into a working memory; under specific conditions add this information into long-term memory and issue a response. Gagné's work advanced knowledge in instructional psychology, particular through the Gagné-Briggs instructional theory (Gagné & Dick, 1983). Other theorists extended work by Frederic Charles Bartlett in the discovery of schemata. According to theorists, schemata are structured areas of knowledge held in memory that is activated in the comprehension of text and in supplying references to build a mental construct of a textual world (Bartlett, 1923, 1958; Marshall, 1995; Rummelhart, 1980, cited in Smith & Ragan, 1999, p. 21). For example, the term "computer" is filled with a vast configuration of information, or schemata. As new information is gathered regarding "computer," the data are stored in relationship to the concept. Modern cognitive theorists have reasoned that images are processed like Bartlett's (1923) "text" (e.g., an image of a picture versus an image representing text). Modern theorists also believe that procedural knowledge is stored differently and use "IF/THEN" statements to connect the conditions (Anderson, 1995, cited in Smith & Ragan, 1999, p. 21).

Major influences from cognitive theories on instructional design can be seen when conducting the stages of analysis, design and evaluation. In conducting an analysis, instructional designers must analyze learner characteristics (including prior knowledge,

aptitude, attitudes, and interests). By considering the mental tasks required, cognitivists contribute to the behavioral outcome. In building the design for the instruction, cognitive theories are applied. This seems apparent when gestalt theory is considered and applied to the visual design of instructional content in a course management system. As a cognitive theory, gestalt theory considers the form, configuration, shape and essence in relation to learning. Gestalt theorists Max Wertheimer, Wolfgang Köhler, and Kurt Koffka enhanced the maxim that the whole is different from the sum of its parts; (Ellis, 1997; B. King & Wertheimer, Michael, 2005; Köhler, 1992, c 1947; Wertheimer, Max, 1959). For Web design, the visual components follow gestalt theory in that each component fits into a holistic form that identifies the course screen as a singular essence, and yet have differences to identify the use (i.e., a “mail” icon versus a “discussion” icon). Additionally, modern Web design features use hypermedia, where researchers are exploring the hyperreality involved in the virtual world (Tiffin & Terashima, 2001). The ability to employ the World Wide Web as a platform for secured, course management systems with dynamic tools grew in conjunction with a learner-centered movement (Bonk & Reynolds, 1997).

Learning as a social phenomenon.

The learner-centered movement revised the argument that learning is a social event, situated within social learning theory. Originally, Miller & Dollard (1941) presented a strict behaviorist interpretation of social learning theory. Alfred Bandura (1977) reasoned that social learning theory includes attention, memory, and motivation. Both cognitive and behavioral domains use social learning theory in research. Lev Vygotsky theorized that social interaction is fundamental in cognitive development and

created a “zone of proximal development” (ZPD) (Vygotsky, 1978; Wertsch, 1985).

Vygotsky explained ZPD as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers” (Vygotsky, 1978, p. 86). Another major contributor to social learning theory is Jean Lave. Lave (Lave, 1988) contends that learning is situated within the context, culture and activity where it occurs. Lave’s “community of practice” suggests that learners who are new to the social learning situation (i.e., class, subject area, etc.) reside in the margins of the learning environment moving toward the center as they become more engaged learners.

Extending the research of learning as a sociological concern within the context of educational technology is rare, yet important to advance our understanding of educational technology (Kerr, 1996). In a 1996 longitudinal study, Chong (cited in Bonk & Reynolds, 1997) discovered that interactions through electronic discussion were “more extended and engaging for students beyond their traditional lecture-based instruction” (p. 170). Chong’s used asynchronous tools of computer conferencing that does not include the capabilities of today’s more modern Web-based instruction (WBI).

According to Bonk & Reynolds (1997), WBI learning and the learning-centered movement converged as Vygotsky’s (1978) view of learning as a social phenomena gained popularity among education practioners and researchers. In 1995, the American Psychological Association recognized that social and cultural factors significantly impact learning and called for reform toward learner-centered schools (American Psychological Association, 1995). In investigating learning as a social phenomena, the construction of

meaning is negotiated (Bonk & Reynolds, 1997) by the social parameters provided by experience (Dewey, 1966). For sociologists, any attempt to explain social phenomena must move beyond an exclusivity of the individual (Kerr, 1996). “Rather, we must examine how people interact in group settings, and how those settings create, shape, and constrain individual action” (Kerr, 1996 p. 114).

Kerr (1996) suggests cultural reproduction is a central concern for educational technologists. In cultural reproduction, knowledge from previous generations is transmitted to the current generation, who adds to this knowledge and provides the transmission of previous and new knowledge to future generations. In doing so, Kerr notes three areas of significance in the sociology of education (and educational technology): interactions among parents, educators, students, and others in defining what education is (current context) and what education should be in our society (ideal context); perceived problems or inequalities in education; and the investigation of the social system of education, how it operates, and how it contributes to social improvement (Kerr, 1996). “The questions about educational technology’s social effects . . . are principally those relating (or potentially relating) to what sociologists call collectivism – groups of individuals (teachers, students, administrators, parents), organizations, and social movements” (Kerr, 1996, p. 114).

In investigating the social interactions of students, this study will examine how student interactions are created and the communication tools used in the WBI instructional delivery method. Although educational technology is often viewed as a change agent for the larger social system of education, the study of social interactions of students enrolled in a fully online distance education course is rare.

The Study of Interaction in Web-based Instruction

Interaction is not a primary area of study for educational research in the context of Web-based instruction (WBI) courses. This section will discuss how online interaction is interpreted by leading educational theorists; explore primary studies that contributed to our knowledge of face-to-face classroom discourse; and conclude with current trends in the investigations of WBI interaction research.

Interaction, Web-based instruction, and theory.

Web-based interaction affords educators a range of dynamic possibilities for interacting with learners (Heinich et al., 2002; Moore & Kearsley, 2005). WBI influenced the shift toward using instructional design models that support an environment with rich communication. The shift toward learner-centered instruction provided the need for instructional design models that were cognizant and responsive to interaction.

“Interaction does not simply occur but must be intentionally designed into the instructional program” (Berge, 1999). According to Rogers & Wells (1997), the strength of engaging learning through interaction differentiates the university experience from independent learning or in using one-way media. Interaction within the context of WBI is multi-dimensional. Table 1 provides an overview of the perspectives applied to interaction in the discipline. The salient nature of “interaction” led to a professional panel convened to define “interaction” for the field (Moore, 1993). From his representation on the panel, Moore (1993) developed three types of interaction: learner-to-content, learner-to-instructor, and learner-to-learner. A year after Moore’s contribution, the dynamic between learner and interface was added by Hillman and others (Hillman et al., 1994).

The learner-to-content segment explores the interaction between the learner and the content. In this segment, the learner's interaction with instructional content and how the learner interacts cognitively, behaviorally, or constructively with the materials is considered. The learner-to-interface segment added by Hillman would focus on the interaction the learner experiences with the technology. For example, if a hypertext page is presented as part of the instruction, does the student know how to access this page? Does the student know how to play an instructional game provided for simulation? The learner-to-instructor interaction includes all interaction among student and instructor, regardless of content. A discussion that is off topic would be included in this segment. Likewise, the learner-to-learner interactions could include off topic discourse that shapes the classroom environment regardless if that classroom is physical or virtual. The learner-to-learner area of interaction is of specific interest in this study.

In another three-tiered dimension, Bates (1995) provided the perspective of interaction based on time or context, synchronous or asynchronous, and personal or social. For Bates, segmenting interaction by time or context was an important factor to distinguish where a chronological, sequential order was used in an interaction, or if the interaction was designed using context-based instruction. Context-based instruction allows the learner to approach a learning element of their choice based on the context applied in the instruction. The Jigsaw technique is one method of providing context-based instruction. In using the Jigsaw technique, students are individually responsible for an essential piece of a larger product (e.g., case study, presentation, project).

Table 1

Interpretations and leading primary approaches of interaction

Year	Theorist	Concept
1993	Moore	Learner-to-content Learner-to-instructor Learner-to-learner
1994	Hillman Willis Gunawardena	Learner-to-interface (Added to Moore's three types of interaction)
1995	Bates	Time or context Synchronous or asynchronous Personal or social
1995	Paulsen	One-to-alone One-to-one One-to-many Many-to-many
1998	Moller	Academic community (learners & instructors) Intellectual community (interaction and collaboration) Interpersonal community (interaction involving interpersonal encouragement or assistance)
2002	Jung	Academic interaction (task feedback provided) Collaborative interaction (learner discuss learning issues) Interpersonal/social interaction (social feedback, encouragement and motivation)

The work of each student is essential to the final result of the project, but is contextualized by the experiences and investigations of each learner. The second interaction segment Bates determines is synchronous or asynchronous. Here, Bates discriminates between interactions that occur at the same time (synchronous), like those found in a chat room, and interactions that occur at a different time (asynchronous), like those found on discussion boards or email. The third dimension of Bates' interaction model is personal or social interaction. Personal interactions are those that are within the focus of the learner (i.e., What is my grade?), versus social interactions that include a group of learners and/or instructors producing or "socializing in" on-topic or off-topic interactions. Bates argued that different learning objectives required different forms of interaction. The number of participants involved in the communication was explored with four variables (Paulsen, 1995): one-to-alone, one-to-one, one-to-many, and many-to-many.

Moller (Moller, 1998) divided interaction among three communities. First, the academic community consisted of learners and instructors. Second, Moller considered peer interaction and collaboration to be the intellectual community. Third, the interpersonal community involved interpersonal encouragement or assistance (Moller, 1998).

In considering the work of previous researchers, Jung (2002) explored interaction using academic interaction, collaborative interaction, and interpersonal/social interaction (Jung, 2002). According to Jung, academic interaction consists of online materials where task-orientated feedback is provided. Academic interaction is content-centered. Collaborative interaction, Jung suggests, is the process where learners discuss learning

issues and collaborate with others. Jung states that this dynamic is situated amidst both content and social realms. Interpersonal/social interaction is considered by Jung to consist of social feedback, encouragement, and motivation from others (Jung, 2002). These studies indicate that interaction plays a vital role in learning and should be considered in the design of instruction.

The design of interaction.

Literature regarding the design of interaction provides evidence toward a rationale for continuing research in this area. The literature also contributes to understanding the social nature of online interaction. The study of interaction in a face-to-face classroom setting has contributed to our understanding of how classroom discourse is organized (Basturkman, 2002; Berrill, 1991; Coulthard, 1992; Gibson et al., 2006; Mehan, 1985). Topic development is specifically useful in understanding online discourse. The study of how a class engages in social negotiation to discuss topics is largely disregarded as a research interest in education – regardless of the delivery method of the topic’s discourse (Gibson et al., 2006).

Three primary studies contribute to our understanding of discourse. The results of these studies have implications for technology-enabled discourse. The three studies examined students’ perceptions of discourse creation (Stokoe, 2000); explored patterns of task setting sequences (Benwell & Stokoe, 2002); and investigated the structure of how topic conversations move and transform in the classroom setting (Gibson et al., 2006).

Stokoe’s (2000) student perception study found “off topic” discourse was prevalent, and is significant in the organization of communication. According to Stoke, the “off topic” discourse is necessary in order to move toward “on topic” conversation. In

a face-to-face environment, it is common for instructors to engage classroom participants in conversational discourse unrelated to the lecture topic. This element, according to the research study, is a significant contribution to the instruction. It is common to use “ice breakers,” and establish common ground and affinity with students, and Stokoe’s research proved it is also significant in contributing to the overall learning experience of the lecture topic.

In 2002, Benwell and Stokoe examined task setting sequences of university students and found a three-part sequence of control university instructors typically use in defining the parameters of classroom discourse (Benwell & Stokoe, 2002). First, the researchers found that instructors define the task related to the discussion. For example, when a university instructor directs students to work in groups in order to solve a particular problem, the instructor is defining what Benwell and Stokoe call the discussion task. Second, the researchers found instructors can determine the time allocated to a line of discourse. Third, the instructor has the ability to re-direct the discussion back to the task or away from the task if necessary or if uncontrolled.

The design of instruction is an important factor for a satisfactory learning outcome. In this context, the quantity and quality of interaction are dependent upon the control of the instructor. If the instructor creates a lesson using effective instructional design practices, students will be more likely to complete the lesson’s objectives. Benwell and Stokoe’s work suggests that the instructor define the task, the time allocated to the task, and allowance for discourse variance. Their work provides evidence to suggest that interaction planned in this manner has a higher likelihood of success.

In the Gibson, Hall, and Callery (2004) study, a discourse analysis was conducted consisting of 12 lecture recordings. A set of two recordings were analyzed from six groups of five to eight students enrolled in a postgraduate research methods university course in northern England. The purpose of the study was to find commonalities among topic negotiation in a face-to-face classroom environment. The researchers found several topic interjections in the discourse and several cases of overlapping conversations. The authors suggest their findings have implications for the development of alternative distributed media for hosting interactive seminars. This use illustrates the implications of the interactional “affordances” of learning environments for the achievement of interactive talk (Gibson et al., 2006).

In all three studies, the authors indicate that the limited research available in the face-to-face environment be expanded. New studies involving the change of delivery method to online discourse are imperative to provide an understanding of these new discussion environments.

Throughout the history of distance education, interaction remains a vital component in meeting learning objectives and their success or failure. The literature suggests the practice of designing instruction based on research was necessary before the arrival of instructional design during World War II. The philosophical perspectives of empiricism, constructivism, and pragmatism were instrumental in underpinning ideology for theories such as behaviorism, cognitivism, and a social learning theory. The use of theory to assess the needs and learning gaps of students and to gain new knowledge in understanding the peer social interaction is at a critical time in history.

The “cultural reproduction” (Kerr, 1996) educators transfer to new generations is no longer assisted by analog technological devices. These devices often required rote memory to recall incidental details that are later rehashed for instructional distribution. Educational researchers who contribute toward cultural reproduction in research, teaching, or service are passing along a culture that is largely digital. The digitalization of information, and in particular knowledge, will continue to create an increasing quality of virtual communities. These communities will demand new knowledge in order to analyze, access, and socialize online interaction regardless of the tool that may be presented.

Chapter III: Methodology

This study investigated peer interactions of students enrolled in university courses delivered fully online through a course management system (CMS). Specifically, the study sought to understand why students interact with their peers, how they engage in peer interaction, and whether students perceive academic benefits from interacting with their peers. The study also sought to more fully understand interaction differences related to gender and class rank reported in previous qualitative studies.

This chapter is divided into two sections. The first section focuses on a pilot study. The purpose of the pilot study was to assess the performance of the uniquely developed instrument intended for use in the primary study. Currently, there are no available instruments that specifically address the research questions used in this study. The pilot study allowed the newly developed instrument to be reviewed and modified in order that data collected during the primary study was useful. The rationale for the instrument design, researcher's role, scope of the study, data collection, and analysis within the pilot study are discussed.

The second section of this chapter focuses on the primary study. This section explains the steps taken to refine the instrument during the pilot study. The rationale for use of a quantitative design in the project, researcher's role, scope of the primary study, data collection, and data analysis methods are addressed.

Initial Explication of Peer Interaction among Distance Education Students

Creating an instrument to measure peer interaction among university students enrolled in a fully online CMS course began with an investigation into possible factors assessed in previous, generally qualitative, studies. The instruments used in those investigations did not appear to be useful here because either they did not evaluate peer interactions or were only marginally related to the proposed research questions of this study. However, to provide a framework for the development of a new instrument, analyses of interview questions and participant responses from the previous qualitative studies were analyzed for common themes. The described themes corresponded well with the general literature regarding practice in the field. The proposed pilot instrument included 20 items that address peer-to-peer student interactions. Additionally, the three student demographic characteristics of gender, age, and class rank were included. The demographic questions were included in order that a gross assessment of differential item functioning might be conducted. The discovery of items that function differently for demographic groups would not be unexpected based upon previous literature, and may not be considered a problem within the instrumentation development. However such differential functioning should be reviewed to ensure that the items themselves are not written in such a way to promote the difference based on problematic instrument design.

To better understand why students interact with their peers enrolled in a CMS course, five items were constructed based on the work of Moller (1998) and Jung (2002). Moller and Jung vary in how they connect an academic involvement domain to student interaction. Moller's work defines academic discourse in terms of a community of

learners and instructors, whereas Jung defines academic interaction as more material and practical, including the availability of online materials and feedback from instructional tasks (or content-centered). Moller and Jung consider a second domain of interaction as collaboration, in which learners collaborate with one another regarding learning issues (e.g., in small groups for projects, studying, etc.). Moller and Jung both include interpersonal and social interaction as a third domain of student interaction. The interpersonal and social domain can include encouragement, assistance, and motivation. The domain can also include non-academic aspects of social discourse. To understand why students interact, items on the pilot instrument were constructed that address the domains presented by Moller and Jung, and are used for items that specify reasons students are most likely to interact with their peers. The specific interactions defined include those of obtaining syllabus information, seeking help with course content, seeking help with quiz and/or exam answers, working together on projects, working as a group, and interacting for non-academic (e.g., social) reasons.

The determination of how students interact with their peers online arises from themes found in the literature regarding the electronic tools selected for use by students enrolled in fully online courses. Students have a multitude of tools to use in interacting with others (Heinich et al., 2002; Moore & Kearsley, 2005). The communication tools are both formal and informal, and students may often use informal tools that do not reside in the CMS, such as a personal cell phone, a face-to-face meeting, or an external email address (Kerr, 2006). Items identifying how students communicate with their peers are included in the instrument. An open-ended item that allows students to describe other communication tools not specified in the list of options was added to investigate the

presence of any unforeseen models of communication. Additional tools will be considered for inclusion to the primary study's instrument.

Research suggests that student interaction in fully online courses occurs only if it is designed in the delivery, or encouraged by the instructor (Benwell & Stokoe, 2002; Gibson et al., 2006; Stokoe, 2000). Although research findings were limited by sample size and breadth of tool assessment, all three studies note the limited research available and stressed a need for additional research in understanding new communication tools for interaction. An item on the instrument questioned the extent to which students agree that their instructor advised them to communicate with their peers. This item resides within the Moller (1998) and Jung (2002) academic domain.

One of the present study's research questions seeks to better understand student perceptions regarding academic success gained through peer interaction. Within a pragmatist theoretical perspective, the question arises from the notion that knowledge is obtained through experience (Dewey, 1966), and that learning is a social phenomenon (Vygotsky, 1978). Peer-to-peer influence is significant in learner cognitive development and has been shown to have greater significance in a fully online course than in the traditional classroom lecture (Astin, 1993; Knapper & Cropley, 2000; Pascarella & Terenzini, 1991). To examine this question in a larger, more heterogeneous, study, three items were included on the instrument to examine the relationship between students' perception of their peer interaction and academic success.

Research on gender and learning online suggests there is a difference regarding why men and women engage in interaction (Kelly et al., 2006; Menchaca, Resta, & Awalt, 2002), and in the tools they are likely to use (Chang, 2001; Price, 2006). Research

also suggests there are interaction differences between undergraduate and graduate class levels (Bonk & Dennen, 1999; Chang, 2001), and age (J. C. King & Doerfert, 2006; Richardson, 2006; Sellers, 2003). Items inquiring about the participants' gender, class rank, and age are included on the instrument. Although the sample selected to participate in the pilot study were stratified by class rank, the responses are confidential and anonymous. Participants were asked to identify their class rank when submitting the instrument in order to assess the heterogeneity of the final sample used in the pilot study.

Rationale for instrument design.

The purposes of using the design in this study are two-fold. First, unlike the smaller, homogeneous groups used in previous studies, a quantified study with a larger, more heterogeneous sample may allow for greater inferential power. Second, the use of an online instrument is well suited for the population studied. Students who have taken a university course through a CMS will have mastered technical skill beyond the perquisite knowledge and technical skills required to complete the instrument. An online instrument is used for data collection in this study because it is most reasonable; online instruments can be administered to a larger sample more economically, have greater convenience, and are time efficient (Creswell, 1994).

Researcher's role.

The researcher sought approval to conduct the pilot study from the institutions' Human Subjects Research & Review Committee (HSRRC) prior to presenting the instrument to participants. The instrument was delivered via the Web on a University server using a data collection software application. The application is used in major research institutions of higher education and allowed a mass mailing of the electronic

consent letter and a hyperlink to the instrument. Participants received an electronic letter of consent delivered with the instrument explaining that their participation is voluntary, confidential, anonymous, and has no effect on their relationship with the University (see Appendix A). The confidentiality and anonymity of their responses were reinforced in the instrument's instructions (see Appendix B).

Several procedures were used to ensure participants' responses are confidential and anonymous (see Figure 1). First, all data provided by the institution follows public information guidelines of the institution and is in accordance with the Family Educational Rights and Privacy Act of 1974 (FERPA). The public information requested includes the student name, email, and class rank. FERPA and the institution consider these items public, directory information. Although this is public information, the requested information will remain with the researcher and a University staff member (with no relationship to the study or participants). Students were informed that duplications in a \$200 incentive drawing and the submission were eliminated.

Second, a university staff member removed duplicates due to possible alias university email addresses and removed any identifying information from self-disclosure. The staff member separated the collected data into two tables: an item response table and a second table containing only the identifying email address to be used for the incentive drawing. The staff member provided the tables to the researcher after the separation. The item response table was used to aggregate data for analysis. The table used for the incentive drawing was destroyed upon the completion of the primary study. A random selection computer program was used to select the participant for the incentive.

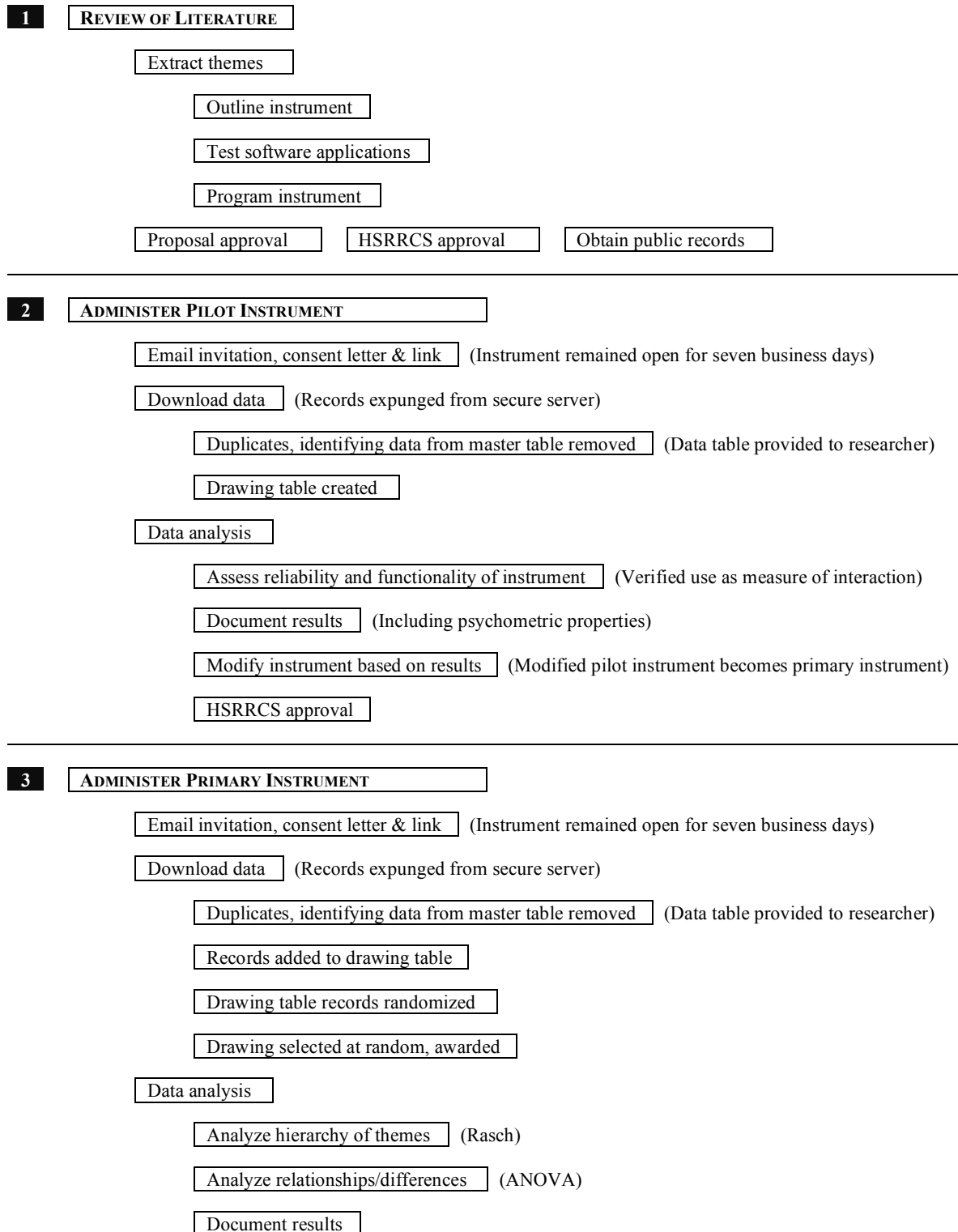


Figure 1. Methodological process

The staff member verified there were no duplicate entries and ensured no entries existed for respondents who opted out of the drawing or did not complete the form (making it impossible to contact the awardee).

Scope of study.

This study was conducted at a major, Midwestern, metropolitan, research university. The institution uses WebCT as the course management system (CMS) for fully online and Web-assisted courses. Participants in this study were undergraduate and graduate students who have taken a fully online course between the spring 2005 semester and the fall 2006 semester. The participants in this study, representing nearly every college on campus, were enrolled in at least one of the 1,569 fully online courses.

The total enrollment for the six terms included in the study period was approximately 22,632, however many students were enrolled in multiple courses and for more than a single term. After eliminating duplication, the total unique participant population for the period is 13,247. Students were asked to reflect on their most recent fully online course taken.

Data collection.

Email distribution of the instrument and corresponding letters of consent were sent to the specified sample in the spring 2007 semester. Students had seven days to complete the instrument and enter the incentive drawing. Respondents were asked to maintain their anonymity when writing comments and returning the instrument. A computer screen capture of the instrument and items is found in Appendix B. A computer screen capture of the drawing is found in Appendix C.

Data analysis.

For this study, a Rasch measurement model reference was used. The ability of the Rasch model to estimate item difficulties and plot those measures along a linear representation of social interaction defined by the instrument items is beneficial to understanding whether the instrument was an effective means for data collection. Results on the instrument's precision, accuracy, and sensitivity are provided, thereby allowing the researcher to better modify the instrument. Questions guiding the analysis of the online peer student interaction instruments include:

1. Do the 25 items describe the construct "peer interaction" for students enrolled in CMS-based courses?
2. Are the 25 items reliable and useful measures of satisfaction?

A one-way analysis of variance (ANOVA) was used for general inspection of possible differential item functioning based upon demographic characteristics.

The remainder of this chapter includes an overview of Rasch measurement; a synopsis of major Rasch statistics used to analyze the instrument, and responses provided; and a comparison of Rasch with classical test theory. The chapter concludes with the further refinement of peer interaction among distance education students and describes the processes and methods associated with the primary instrument.

Overview of Rasch measurement.

Rasch measurement models are probabilistic models that fall under objective measurement. "Objective measurement operates within the research traditions of fundamental measurement theory, item response theory (IRT), and latent trait theory (LTT)" (IOM, 2000, n.p.). IRT/LTT describes respondent ability and item or test

performance and predicts results from the abilities measured by the items in the test (Cook & Eignor, 1991; Hambleton & Jones, 1993). The outcome of any finding between a person and item (e.g., communication tool) is determined by the difference between respondent ability and item difficulty on the same latent trait dimension (Snyder & Sheehan, 1992). In the case of the present study peer interaction among online students is considered the latent trait dimension. Rasch stated this principle, known as “invariant comparison,” as such:

The comparison between two stimuli should be independent of which particular individuals were instrumental for the comparison: and it should also be independent of which other stimuli within the considered class were or might also have been compared.

Symmetrically, a comparison between two individuals should be independent of which particular stimuli within the class considered were instrumental for the comparison; and it should also be independent of which other individuals were also compared, on the same or some other occasion (Rasch, 1961, p. 332.).

Since its initial elaboration in 1960, Rasch models have proved effective in a variety of social science applications, bringing specificity and clarity most associated with the natural sciences through rigorous data analysis (Bond & Fox, 2001). Primary characteristics of the Rasch Measurement Model include:

- Observations made linear, placed on continuum for mapping persons (Andrich, 1990).

- Unanticipated responses considered in measurement construction (Linacre, 1996).
- Raw scores should not be misused as though they are measures to avoid bias against extreme scores; a factor analysis of raw scores does not construct measures (R. M. Smith, 1996).
- Raw scores are a sufficient statistic for item difficulty and person ability estimation (Wright, 1999).
- Probability of correct response to an item (p) is controlled by participant's ability (b) and item difficulty (d) so $b-d = \log (p/1-p)$ (Wright & Masters, 1982).
- Logits are the mathematical units for person and item parameters (Wright & Stone, 1979).

The Rasch Measurement Model is used by organizations throughout the world including the National Board of Medical Examiners certification (Kelley & Schumacher, 1984), the National Council of State Boards of Nursing licensure (O'Neill, Marks, & Reynolds, 2005), and widely in program evaluation (Ingebo, 1989).

The model is used to analyze the Likert-type scale data from the instrument to create measures for statistical analysis. The Rasch model transforms raw scores into linear measures, as shown in Figure 2 (Wright & Linacre, 1989). Respondents have the opportunity to respond to two open-ended questions to provide the researcher with greater understanding in lieu of misfitting items.

$$P \{X_{vt} = 1 | (B_v), (D_1)\} = \exp (B_v - D_1) / [1 + \exp (B_v - D_1)]$$

Figure 2. Rasch mathematical model: B_v is person ability and D_1 is item difficulty.

The linear transformation allows for an explication of how well each item functions to measure the desired latent trait through the use of traditional and Rasch-based statistics.

Synopsis of major Rasch statistics.

Rasch converts raw scores into meaningful linear estimates of person ability and item difficulty. Estimating item difficulty is known as the process of calibration. Estimating person ability is known as measurement. In this study, a software program known as WINSTEPS® is used. The program uses the same statistics for persons and items: log-odd units, or logits, for item and person measures, infit mean square (infit mnsq), outfit mean square (outfit mnsq), and separation.

Difficulty. The measures of item difficulty and person ability are specified in log-odd units commonly referred to as logits. While person ability is a commonly used term in Rasch presentations, because this study evaluates the attitude of satisfaction, the term “propensity” is used in this text. A student’s propensity to respond with greater satisfaction to items should be considered as akin to greater person ability. Item difficulty refers to the likelihood that an item will elicit a favorable response. Items that are more difficult to agree with will elicit fewer favorable responses than items that are easier to respond in a favorable manner. Items that are more difficult and persons with greater propensity to be satisfied are generally reported as positive logits. Easier items or persons with a lesser propensity to be satisfied are generally reported as negative logits. The distribution will be centered at a mean item difficulty of zero unless otherwise noted.

Fit. An infit information weighted mean square fit (mnsq) statistic is provided by WINSTEPS® to determine whether items and persons conform to the specifications of

undimensionality, construct validity or clarity of the scale. While both infit and outfit mnsq have expected values of 1.0, outfit mnsq is influenced by any unexpected behavior in person or item outliers.

Separation. Separation is a measure of the spread of estimates such that the larger the separation, the more the instrument is able to differentiate persons and items. Person and item separations are found by obtaining the ratio of the adjusted standard deviation (SDadj) to the root mean square standard error (RMSE). The separation reliability is a ratio of adjusted variance, or true variance to the observed variance, like Cronbach's alpha statistic used in classical test theory (Fox & Jones, 1998).

Compare and contrast with classical test theory.

The argument against using classical test theory in constructing instruments relates to sufficiency and meaningfulness of score interpretations (Gable, Ludlow, & Wolf, 1990). Estimates of item difficulty, item discrimination, item quality, and participant's ability levels associated with raw scores are confounded mathematically (Snyder & Sheehan, 1992). Although classical use of factor analysis, correlations, and alpha reliability assist in developing an instrument, they are not sufficient and can lead to inadequate variable definition (Gable et al., 1990).

This section compares classical test theory (CTT) and Rasch in regards to item difficulty, item quality, person ability, reliability, and validity estimations.

Item difficulty. CTT determines item difficulty based upon a percentage of respondents in a standardizing sample answering items correctly. A non-linear p-value or the proportion of persons in a sample who answer an item correctly is a typical statistic used (Snyder & Sheehan, 1992). However, in using Rasch, the non-linear p-value of an

item is converted into a linear value by using a logit function. This linear value plots item difficulty on an equal interval scale that is free from observed ability mean and variance of the standardized sample (Wright & Stone, 1979). The position of the item on the latent dimension represents the location where half of the respondents with ability equal to the item's difficulty answered the item (Snyder & Sheehan, 1992).

Item quality. In CTT, a point-biserial correlation is typically used to determine the strength of an item or its ability to discriminate between high and low ability respondents. The point-biserial correlation is a correlation between sampled persons' responses to an item and the summation therein. The statistic requires the researcher to assume the appropriateness of the standardizing sample of persons (Wright & Stone, 1979).

However, the mean square residual used in Rasch is somewhat less influenced by the ability distribution of the calibrating sample, providing a test of item fit only on the sample and item characteristics that remain when the model's values for item and persons are removed (Wright & Stone, 1979). Stating that an item "fits the model" communicates the level of clarity and precision of the specified measurement. In Rasch, if an item is misfitting, then it means that the item did not contribute information about the construct studied (Gable et al., 1990). The item quality of the pilot instrument in this study will be evaluated to ensure items fit the model. If any large misfit is observed, it would suggest that the measure is not precise and misfitting items are removed or reworked (Linacre, 1996). Mean square values between 0.6 and 1.4 were used to indicate fit; anything outside this parameter is considered misfits.

Person ability. A percentile standing in the sample based on overall score is used by CTT for person ability. In Rasch, however, the total raw score is converted into logit

values with standard errors near 50% correct. Rasch predicts the more able a person, the greater their chances for success with any item; and the easier the item, the more likely any person will answer it correctly (Wright & Stone, 1979). Item response theory, a categorical area where Rasch resides, allows instrument developers greater ability to determine the probability of how a person will answer an item (Hambleton & Jones, 1993). Like CTT, Rasch analyses item validity, but unlike CTT, it also considers the validity of the pattern of responses of persons (Wright & Stone, 1979). Rasch provides information on misfitting persons or patterns that should not be considered valid. This allows for greater quality control of data considered in measurement.

Reliability. Although it is sometimes thought that reliability relates to the quality of a measure, reliability actually determines how well the stability of the instrument remains intact when replicated (Linacre, 1996). The stability of persons or scores under a hypothetical replication is modeled as: $\text{trait variance} / \text{observed score} = \text{reliability}$. In CTT, the test reliability blends distribution of sample and measure characteristics of the test into one correlation (Wright, 1998). Test fit, average test error variance, and sample's true score variance are considered separately with Rasch, but joined in the classical test reliability coefficient. Rasch is not influenced by sample variance and thus provides a sample-free test characteristic reporting the precision of ability of any person whose response pattern fits the model. Rasch considers the reliability of any measurement as the proportion of true variance. True variance is the variance that remains after deducting measurement error. In Rasch, error variance is the mean-square error from a model misfit. Reliability is expressed as a separation of statistically different strata found in the sample.

Validity. In Rasch, content and construct validity are both provided for in enhanced construct interpretations, providing a clear identification of high and low scoring respondents. With Rasch, a person can be located on the trait beyond merely indicating the reliability of the measure. Among several fit statistics reported in Rasch is the infit mean square (MNSQ). If the statistic's value is near one, it is considered acceptable and the calibration of the item is valid. If the internal consistency of each person's performance pattern fits the model then the measure is valid (Wright & Masters, 1982). If items are too easy to agree with in this study, then those who select "strongly agree" most often may lack measurement discrimination, limiting the validity of the measures. Researchers who use classical test theory use factor analysis to ascertain construct validity of the instrument. Factor analysis, per se, cannot fully determine ordinal variables and high correlations, positioning an item's relativity to the underlying variable. Rasch, however, establishes a linear construct of ordinal variables with a location of the item on the variable, providing a higher quality process in construct development (Schumacker & Linacre, 1996).

Further Refinement of Peer Interaction Among Distance Education Students

Rationale of quantitative design in primary study.

This instrument will add to the knowledge base of student perceptions of communicating online with peers. This instrument will also provide evidence of reliability, content validity, and construct validity for measuring peer social interaction. The methodological processes for this study can be found in Figure 1.

Researcher's role.

The researcher sought approval to conduct the primary study from the institutions' Human Subjects Research & Review Committee (HSRRC) prior to conducting the instrument and after making any changes to the pilot instrument for use in the primary study. The researcher followed established protocols, including information regarding consent (Appendix A). The researcher followed the same procedures for the distribution, data collection, and drawing used in the pilot study.

Scope of study.

This portion of the study was conducted using the same institution and same course management system. The same population used in the pilot study was used in the primary study, less the 1,200 participants selected at random for the pilot study. This study did not include students who declined to be listed in the campus directory.

Data collection.

Like the pilot study, email distribution of the instrument and corresponding letters of consent were sent to the specified sample in the Spring 2007 semester. Students had seven business days to complete the instrument and enter the incentive drawing. Respondents were asked to maintain their anonymity when writing comments and returning the instrument. A computer screen capture of the instrument and items is found in Appendix B. A computer screen capture of the drawing is found in Appendix C.

Data analysis.

Sample descriptions and descriptive statistics are provided in an analysis of the instrument results. Questions defining the analysis include:

1. Why do students interact with their peers enrolled in the same CMS course?

2. What communication tools do students use to interact with other students who are enrolled in the same CMS course?
3. Are there relationships between why students interact and their perceptions of academic success?
4. Are there relationships between why students interact and demographic characteristics?
5. Are there relationships between communication tools used and demographic characteristics?

A one-way analysis of variance (ANOVA) will be used for general inspection of possible differential item functioning based upon demographic characteristics.

Chapter IV: Results

Pilot instrument

All participant records were randomized. Initially, 200 participants were selected for the pilot instrument, stratified by class rank. Wright & Linacre (1989) suggest that 50 responses are sufficient to provide a generally stable assessment of the instrument performance. Only 17 responses were received from the initial 200 participants selected, so the process was repeated with a sample of 1,000 students. Resampling resulted in 100 additional submissions for analysis. In both phases, students had seven business days to complete the instrument, and were reminded three days prior to the expiration of the availability period.

In order to assess the ability of instrument items to measure social interaction, Rasch statistics of separation, reliability, and step calibrations for the rating scale categories were reviewed as described in Chapter III. Step calibrations were used to evaluate whether or not respondents were able to consistently distinguish between levels of the variable expressed within the rating scale. A step difference of 1.4 or greater indicates that respondents were able to effectively use the rating scale. For estimating internal consistency, person/item separation and reliability indices were used. Beyond consistency, separation assists in helping to evaluate whether or not the items on the

instrument help to elaborate a hierarchically arranged variable. A separation value of 2 is considered a minimal requirement.

For convenience, within Chapter IV, the terms “why,” “tools used,” and “academic success” were used to label each subgroup of items corresponding to research questions one, two, and three, respectively. Research questions four and five were not included in the analysis, as the pilot’s purpose was to assess the ability of instrument items in measuring social interaction.

Research question one: “Why”

Items corresponding to research question one were analyzed to determine if they allowed respondents to sufficiently describe why they interacted with their peers in the same CMS course. The analysis of this question revealed a new construct – not initially identified – relating to motivation and social interaction. While the majority of items related to intrinsic motivation, two items were extrinsic in nature, because they inquired about the instructor’s role in requiring or emphasizing respondents’ peer interaction (see Appendix B). The two items were over fitting, and after a review of content and student comments, it was determined that the two questions were redundant. After removing the extrinsic item, step calibrations for “why” were reasonable, suggesting that respondents were able to effectively use the rating scale (see Table 2).

The question “I communicated with my peers because the instructor told students to do so,” was equated with “I would not have communicated with my peer(s) if the instructor did not require it” (see Appendix B). The latter question was removed to avoid problems with redundancy and because the item contained two forms of negative wording, thus adding further confusion.

The item, ““I communicated with my peer(s) because the instructor *told* students to do so,” was changed to read, “I communicated with my peer(s) because the instructor *required* students to do so.” As shown in Table 2, removing the two items from the “why” analysis and using only “intrinsic” items improved the measure, reflecting unidimensionality. The removal of the extrinsic items increased the person/item indices, and the step calibration moved into an acceptable range (requiring a minimum difference of 1.4 between steps).

Table 2

Pilot summary statistics for research question one (“why”).

Rating Scale	Step Calibration	Person Separation	Person Reliability	Item Separation	Item Reliability
With extrinsic items		1.39	.66	3.14	.91
Strongly Disagree	None				
Disagree	-.98				
Agree	-.35				
Strongly Agree	1.33				
Without extrinsic items		1.90	.78	3.76	.93
Strongly Disagree	None				
Disagree	-1.86				
Agree	-.36				
Strongly Agree	2.22				

Research question two: “Tools used”

Step calibrations for “tools used” were reasonable, suggesting that respondents were able to effectively use the rating scale (see Table 3). Although functional, content

review and student feedback indicated that a rating scale based on frequency would be clearer than a scale based on agreement. A new, four-step category was developed as:

- Never.
- Rarely (only a few times during the course).
- Sometimes (less than once a week).
- Often (daily or more than once a week).

Table 3

Pilot summary statistics for research question two (“tools used”).

Rating Scale	Step Calibration	Person Separation	Person Reliability	Item Separation	Item Reliability
		2.10	.81	8.08	.98
Strongly Disagree	None				
Disagree	-1.70				
Agree	.11				
Strongly Agree	1.60				

Research question three: “Academic success”

Step calibrations for “academic success” were reasonable, suggesting that respondents were able to effectively use the rating scale (see Table 4). After content review and a review of item fit statistics, one item was rephrased for clarity. The item, “Communicating with my peer(s) *helped* my grade in the course,” was changed to “Communicating with my peer(s) *improved* my grade in the course” (see Appendix B).

The Office of Research, Department for Human Research Protections at the University of Toledo confirmed that the modifications were considered minor and did not

constitute a deviation or amendment to the protocol. Upon the approval to move forward, the instrument was delivered to the population who were not sampled for the pilot.

Table 4

Pilot summary statistics for research question three (“academic success”).

Rating Scale	Step Calibration	Person Separation	Person Reliability	Item Separation	Item Reliability
		2.66	.88	2.45	.87
Strongly Disagree	None				
Disagree	-5.84				
Agree	-.62				
Strongly Agree	6.45				

Primary instrument

Two of the three subgroups (*Why* and *Academic Success*) on the final instrument functioned as expected. During the piloting of the instrument, content analysis and participant feedback suggested that rating scale categories be changed from agreeability to frequency of use for “*Tools Used*”. The four redefined categories used in the instrument (never, rarely, sometimes, often) remained ineffective. Several attempts to collapse the rating scale categories for “*Tools Used*” were undertaken to determine whether the measure could be improved. Because of the skewed nature of the responses (e.g., more than half of the respondents stated that they never used communication tools in their online course) a dichotomous category collapse of “never used tool and used tools” represented the best understanding of respondent intention. An increase in person separation and reliability was observed while the item performance did not change dramatically (see Table 5).

Table 5

Comparison of categories used in primary instrument before and after collapse.

Rating Scale Category	Step Calibration	Step %	Person Separation	Person Reliability	Item Separation	Item Reliability
(1) Never	None	54%	1.67	.74	22.97	1.00
(2) Rarely	-.08	16%				
(3) Sometimes	-.44	16%				
(4) Often	.51	14%				
(1) Never used	-2.26	58%	1.88	.78	22.36	1.00
(2,3,4) Used	1.77	42%				

Participant characteristics.

A total of 13,247 students were enrolled in fully online courses during a two-year period. The entire population of distance learners at the institution used in the study, less 1,200 participants selected for the pilot instrument, was offered the opportunity to participate in the research study. Of the 12,047 email invitations sent, 428 were returned as failed addresses and 16 were returned as “out of office.” The email failure rate just below 3.5% was better than expected, given that university email addresses are terminated when a student is no longer affiliated with the institution. Due to the anonymity of the study, there was no way to indicate whether the 16 “out of office” email replies actually participated.

The demographic data collected included gender, age, and class rank. The data from respondents were compared to the institution’s distance education population, to the entire student population at the institution, and to three national data sets. The three national data sets were necessary in order to provide a comprehensive representation of distance learners in the United States. While the United States Department of Education’s

National Center for Education Statistics (NCES) is beginning to collect data on students who enroll in distance education courses, the information currently available was collected from voluntary submissions by institutions. Given the global competitiveness of distance education, the contribution of information is limited to those who submit data.

The data sets used are described by their column titles below:

- Study – The research study for this report.
- Population – The institution’s distance education population.
- Institution – The institutions’ population for all courses.
- NOLPR – National Online Learners Priorities Report (NOLPR).
- NCES US – National Center for Educational Statistics (NCES) data for all US institutions.
- NCES Peer – National Center for Educational Statistics (NCES) Peer Analysis System. Data about peer institutions similar to the study’s institution was provided.

Gender.

The participant gender data from the present study closely matched the percentage reported in the NOLPR (Noel-Levitz, 2005), and generally follow the percentages found in NCES data (National Center for Education Statistics, 2007; Waits & Lewis, 2003). Gender representations in NCES peer institutions were matched more closely than general US population, as expected (see Table 6). In all studies shown in Table 6, females represent more than half of distance education enrollments.

Table 6

Gender demographics (percentage).

Gender	Study	Population ^a	Institution ^a	NOLPR ^b	NCES US ^c	NCES Peer ^d
Female	68	57	51	68	56	66
Male	32	43	49	32	44	34

Note: Study and population data include merged institutional data for Fall 2007. Data in institution column does not include merger data.

^aData adapted from University office of Institutional Research. ^bData adapted from Noel-Levitz (2005), *The 2005 national online learners report*, p. 4. ^cData adapted from Waits, T., & Lewis, L. (2003). *Distance education at degree-granting postsecondary institutions: 2000–2001*, p. 2-3. ^dData adapted from National Center for Education Statistics. (2007). The integrated postsecondary education data system (IPEDS): National Center for Education Statistics.

Age.

The researcher combined participant age categories to match those of national data. Table 7 compares this study to the National Online Learners Priorities Report (NOLPR). The NOLPR collected student ages in three groups: under 24, 25-54, and 55 and over. NCES collects data in three different categories: 18-29, 30-39, and 40 and over, as shown in Table 8. Respondents at the study's institution were generally aligned with NCES data, but two categories are inverted when compared with NOLPR data. Some of this difference can be attributed to the age groupings between the data sets. While the institutional age groups can be summarized to match NCES data, the NOLPR groups (25-54 and 55 and over) can only be an estimated comparison with the institutional groups that split at 40-49 and 50-64. As Table 7 shows, the NOLPR population includes only 21 percent of students under age 24, while this study reports 71 percent of students are under 21 years of age. Similarly, this study reports a quarter of the students are between 25 and 54 years old, while NOLPR data show three quarters of the 60 institutions' online students are between 25-54.

Table 7

NOLP comparison: Age demographics (percentage.)

Category	Study	Population ^a	Institution ^a	NOLR ^b
Under 24	71	72	60	21 ^c
25-54	24	25	25	75 ^d
55 and over	05	03	03	04 ^e

Note: Study and population data include merged institutional data for Fall 2007. Data in institution column does not include merger data.

^aData adapted from University office of Institutional Research. ^bD

ata adapted from Noel-Levitz (2005), *The 2005 national online learners priorities report*, p. 4. . ^cNOLR may include minors.

^cData compared to category for study, population, and institution ending at age 49. ^bData compared to category for study, population, and institution includes 50-64 and 65+.

Table 8

NCES US and Peer comparison: Age demographics (percentage).

Category	Study	Population ^a	Institution ^a	NCES US ^b	NCES Peer ^c
18-29	81	81	86	78	80
30-39	08	11	08	10	09
40 and over	11	08	06	12	11

Note: Study and population data include merged institutional data for Fall 2007. Data in institution column does not include merger data.

^aData adapted from University office of Institutional Research. ^bData adapted from Waits, T., & Lewis, L. (2003). *Distance*

education at degree-granting postsecondary institutions: 2000–2001, p. 2-3. ^cData adapted from National Center for Education Statistics. (2007). The integrated postsecondary education data system (IPEDS): National Center for Education Statistics.

While age categories are expressed differently, the NCES peer institutions report nearly identical ages. The difference is found in the institutions that participated in the Noel-Levitz organization. NOLPR-participating institutions provide the report with a wide range of institutional types (e.g., private, public, 2-year, 4-year, and professional). NOLPR data were derived from 16,551 students from participating institutions, compared to millions of students in the NCES database. As shown in Table 8, the age of respondents in this study, most closely resembles NCES peer institutions.

Class rank.

The study's class rank categories of "graduate" and "professional" were combined to match categories in national data sets. Class rank is the least stable demographic presented. Institutions vary significantly in delivery of instruction, programs of study, and how (or if) courses are offered fully online. Unlike the large distance education enrollment at this institution's study, NCES data show that 22 percent of institutions in the United States had a distance education enrollment of 100 or fewer students and 30 percent between 101 and 500 enrollments (Waits & Lewis, 2003).

Table 9

Class rank demographics (percentage)

Rank	Study	Population ^a	Institution ^a	NOLR ^b	NCES US ^c	NCES Peer ^d
Undergrad	82	83	80	65	76	54
Grad/Prof	17	15	16	30	23	43
Other	01	02	04	04	01	03

Note: Study and population data include merged institutional data for Fall 2007. Data in institution column does not include merger data.

^aData adapted from University office of Institutional Research. ^bData adapted from Noel-Levitz (2005), *The 2005 national online learners report*, p. 4. ^cData adapted from Waits, T., & Lewis, L. (2003). *Distance education at degree-granting postsecondary institutions: 2000–2001*, p. 2-3. ^dData adapted from National Center for Education Statistics. (2007). *The integrated postsecondary education data system (IPEDS)*: National Center for Education Statistics.

The class rank of respondents in this study more closely resemble the population of the institution and NCES US institutions and resemble NOLPR and NCES peer institutions less (see Table 9).

Research Questions.

As specified in Chapter III, major Rasch-based statistics (e.g., difficulty, fit, and separation) are analytical tools used to address research questions one, two, and three. One-way ANOVAs were used in the analyses to address research questions four and five. Figures D1, D2, and D3 can be found in Appendix D.

Research question 1: Why do students interact with their peers enrolled in the same CMS course?

The “why” items for research question one appeared to work well in the elaboration of the variable (see Table 10). Placing items according to agreeability and classification on a map provides an intuitive way to understand the variable (see Figure D1). Logits function as a ruler, and thus by placing items according to their measure along a line representing the variable, we can gain insight into the structure of that variable more effectively. Smith and Young (1995) argue, “The clear superiority of the map over conventional tabular displays is evident....The item map communicates the findings of the paper concisely and powerfully in a way that no table of numbers could ever do.” The map shown in Figure D1 specifies why students interact with their peers enrolled in the same CMS course. Each item associated with question one is located on the ruler.

Table 10

Primary summary statistics for research question one (“why”).

Rating Scale Category	Step Calibration	Person Separation	Person Reliability	Item Separation	Item Reliability
		2.09	.81	11.40	.99
Strongly Disagree	None				
Disagree	-2.16				
Agree	-.20				
Strongly Agree	2.37				

The map in Figure D1 suggests that respondents are more likely to engage in peer interaction when the discourse is based on content and is non-voluntary. Operationally, non-voluntary interaction is interaction that is influenced by course requirements, grades,

or instructor recommendations. Typically, if respondents do not engage in the interaction specified, there are consequences, whether via grades, extra-credit, or a socialized “other.”

While interacting with peers about a course syllabus or quiz is content based in a similar manner to course content and projects, they are voluntary interactions. Peers who choose not to interact regarding a syllabus or a quiz do not experience negative consequences such as grade reduction associated with course requirements. In fact, an argument could be made that negative consequences *could* be experienced when peers interact about items such as quizzes.

Respondents found the non-academic social item the most difficult with which to agree. Non-academic social interactions like those about syllabi and quizzes are voluntary, but they are not based in content. This is expected, as the types of students most likely to enroll in an online course are those who are geographically-bound or time-bound, and cannot attend on-campus courses at specified times. Many students work full-time and have limited time to engage in social interaction. A comparison of the results provided and the work of Jung (2002) found in Chapter II and Table 1 is discussed in Chapter V.

Research question 2: What communication tools do students use to interact with other students who are enrolled in the same CMS course?

Items related to “tools used” were used to answer research question two. The person separation of 1.88 improved from 1.67 when the four categories were collapsed into a dichotomy (see Table 5), but remained below the two-logit specification. More than half the respondents stated they never used the tools to interact with their peers.

Table 11

Comparison of pilot and primary categories for research question two ("tools used").

PILOT			PRIMARY		
Rating Scale Category	Step Calibration	Count %	Rating Scale Category	Step Calibration	Count %
Strongly Disagree	None	26	(1) Never	None	54
Disagree	-1.70	37	(2) Rarely	-.08	16
Agree	.11	24	(3) Sometimes	-.44	16
Strongly Agree	1.60	13	(4) Often	.51	14
			(1) Never used	-2.26	58
			(2,3,4) Used	1.77	42

A discussion of student comments strongly in favor of and strongly opposed to interaction online may be found in Chapter V. Table 11 represents step differences between the same items in the pilot and in the primary instrument.

The person measures are vague in specifying person location with confidence. However, the item separation of those who do interact indicate they are more likely to use asynchronous tools within the CMS than they are to use synchronous tools external to the CMS (see Figure D2). Overall, asynchronous tools are more often used than synchronous. In addition to the time and geographic restraints mentioned previously, distance education instructors at the institution are encouraged to use the internal course email and course discussion board to engage in academic discourse. Some faculty members prefer to use an external email address, often to categorize student email within all university mail.

The selection and use of the technological tool used can also be influenced by the users' competency or the tool's ease of use. As shown in Figure D2, the course email and course discussion board are most often used and also those that are among the most intuitive. Both tools are similar in their use, and both replicate popular Web-based email available free through the World Wide Web. The location of cell phone and face-to-face interaction was not expected to be more frequent than other external interaction tools. Content review and student comments suggest that the relationships are established outside of the online classroom. Tools that are used the least are items that are the least easy to use, manage, and are more diverse in their interface with the exception of the "land phone" item. Student use of cellular telephones is outpacing that of land based telephones regardless of course delivery. Courses offered through a course management system are also Web-based, which could account for a skew due to respondents using a dial-up Internet Service Provider (ISP).

Research question 3: Are there relationships between why students interact and their perceptions of academic success?

Items related to "academic success" were used to answer research question three. The items in this instrument performed well (see Table 12). Results indicated that it was easier for respondents to agree that interaction improved their grade or that they learned more from the interaction (see Figure D3). In both instances, the items were specific to the course taken online by the respondent. Respondents had a more difficult time agreeing that peer interaction in the course would lead to their academic success. This item was the only item on the instrument related to success beyond the classroom.

Table 12

Primary summary statistics for research question three (“academic success”).

Rating Scale Category	Step Calibration	Person Separation	Person Reliability	Item Separation	Item Reliability
		2.70	.88	10.33	.99
Strongly Disagree	None				
Disagree	-6.98				
Agree	-.40				
Strongly Agree	7.38				

Research question 4: Are there relationships between why students interact and demographic characteristics?

As specified in Chapter III, a one-way analysis of variance (ANOVA) was employed to determine if differences in perceptions across gender, age, and class rank existed with regard to why students interact. The analysis for gender was significant: $F(1, 1265) = 4.192$, $p. < .05$, as shown in Table 13. Female respondents ($M = -.691$, $SD = 2.20$) were somewhat less likely to agree with “why” items (see Figure D1) than males ($M = -.417$, $SD = 2.27$). The results suggest that females in a fully online course interact less with their peers than their male counterparts. This result is in contrast to research discussed in Chapter III regarding gender difference and student interaction (Kelly et al., 2006; Menchaca et al., 2002).

The analysis for age demonstrated a significance difference between age categories: $F(8, 1258) = 2.209$, $p. < .05$, as shown in Table 13. Generally, the results suggest that younger students are more likely to interact for social, non-academic reasons. Students between 40-64 are least like to interact socially (see Figure 3). The results

support research regarding interaction differences between age groups discussed in Chapter III (J. C. King & Doerfert, 2006; Richardson, 2006; Sellers, 2003).

Table 13

<i>Analysis of variance between “why” question and demographic information provided</i>						
		Sum of Squares	df	Mean Square	F	Sig.
Gender	Between Groups	20.733	1	13.130	4.192*	.041
	Within Groups	6256.770	1265	4.939		
	Total	6277.503	1266			
Age	Between Groups	86.974	8	10.872	2.209*	.024
	Within Groups	6190.528	1258	4.921		
	Total	6277.503	1266			
Class	Between Groups	39.389	3	12.130	2.658*	.047
Rank	Within Groups	6238.114	1263	4.939		
	Total	6277.503	1266			

*p < .05

The analysis of class rank was significant prior to rounding ($p = .047$): $F(3,1263) = 2.658$, $p < .05$, as shown in Table 13. Generally, students seeking a degree are more likely to interact with their peers than students not seeking a degree. Graduate student measures were the highest ($M = -.409$, $SD = 2.039$), followed by undergraduate measures ($M = -.612$, $SD = 2.264$). Measures for professional students ranked third ($M = -.826$, $SD = 1.65$). Measures for students who self-selected “non-degree seeking/other” reported the lowest mean ($M = -2.039$, $SD = 2.353$). The results tend to agree with research regarding the interaction differences between undergraduate and graduate class levels as discussed in Chapter III (Bonk & Dennen, 1999; Chang, 2001).

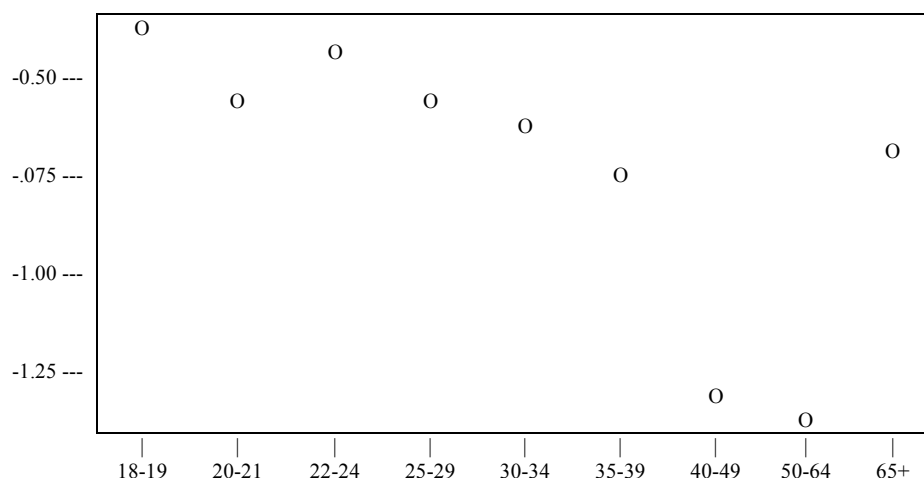


Figure 3. Location of means by age category.

Research question 5: Are there relationships between communication tools used and demographic characteristics?

As specified in Chapter III, a one-way analysis of variance (ANOVA) was employed to determine if differences in perceptions across gender, age, and class rank existed with regard the use of communication tools. The analysis for gender was significant: $F(1, 1265) = 11.183$, $p. < .01$, as shown in Table 14. Female respondents ($M = -.552$, $SD = 2.23$) were less likely to agree with “tools used” items (see Figure D2) than males ($M = -.0729$, $SD = 2.54$). The results suggest males use more types of communication tools than their female counterparts.

The analysis for age was not significant: $F(8, 1258) = 1.175$, $p. = .310$, as shown in Table 14.

The analysis of class rank was significant: $F(3, 1263) = 36.034$, $p. < .01$, as shown in Table 14. A pattern for class rank is shown in Figure 4. This pattern suggests students not seeking a degree are the least likely to use synchronous communication tools found

on Figure D2. Graduate students are more likely than undergraduates to use synchronous communication tools, but not more than professional students.

Table 14

Analysis of variance between “tools used” question and demographic information provided

		Sum of Squares	df	Mean Square	F	Sig.
Gender	Between Groups	63.185	1	63.185	11.183**	.001
	Within Groups	7147.322	1265	5.650		
	Total	7210.507	1266			
Age	Between Groups	53.500	8	6.687	1.175	.310
	Within Groups	7157.007	1258	5.689		
	Total	7210.507	1266			
Class	Between Groups	108.102	3	36.034	6.408**	.000
Rank	Within Groups	7102.404	1263	5.623		
	Total	7210.507	1266			

p < .01

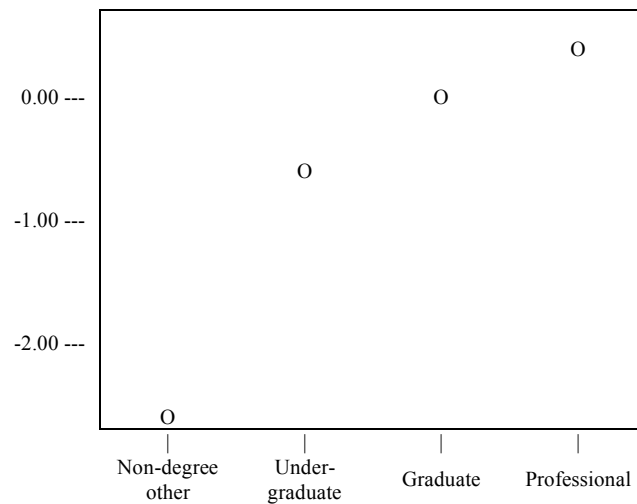


Figure 4. Location of means by class rank.

The measures with the lowest mean are from respondents who self-selected “non-degree seeking/other” ($M = -2.327$, $SD = 2.407$). Students with degrees were far more likely to agree with difficult items. The higher the class rank, the greater the mean: Undergraduates ($M = -.464$, $SD = 2.442$), graduates ($M = .005$, $SD = 1.929$), followed by professional students ($M = .408$, $SD = 2.347$). The results suggests the more advanced the class rank, the more likely the students are to use communication tools for interaction. This result supports research regarding the interaction differences between undergraduate and graduate class levels as discussed in Chapter III (Bonk & Dennen, 1999; Chang, 2001).

Chapter V: Conclusions, implications, and recommendations for future research

This study investigated social interactions among peers enrolled in a fully online course delivered through a course management system (CMS). This chapter provides conclusions to the research questions, implications of results, and recommendations for future research. The five research questions used in this study arose from central themes found in a review of the literature. The literature includes qualitative research regarding discourse analysis, instructor-focused studies on student interaction, and studies on student interaction within a special population or discipline.

The review of literature also provided an important historical context and varied definitions of social interaction used to discuss communication in learning contexts (see Table 1). The work of Moller (1998) and Jung (2002) influenced how social interaction was operationalized in this study. Moller divided social interaction into three areas: academic community, intellectual community, and interpersonal community. Jung divided social interaction into three areas: academic interaction, collaborative interaction, and interpersonal interaction. This study is a synthesis of Moller and Jung's work. For this study, social interaction is divided into three areas: content assistance interaction, collaborative interaction, and social non-academic interaction.

Conclusions to the research questions are discussed in various tiers. The tiers are labeled on each figure used to accompany the conclusion of each research question.

Figures for research questions one, two, and three can be found in Appendix D. Figures for research question four can be found in Appendix E. Figures for research question five can be found in Appendix F.

Conclusions

Research question 1: Why do students interact with their peers enrolled in the same CMS course?

The interactions among students enrolled in the same CMS course are divided into three Tiers as shown in Figure D1. The first tier contains items relating to projects and course content. The tier suggests peer interaction is largely driven by non-voluntary, content-based interaction. Instructors often require students to interact with peers on projects, respond to content, or collaboration activities. This tier is reasonably expected at the institution as instructors are encouraged by instructional designers to engage learners through peer interaction.

The second tier in Figure D1 includes items such as discussing the syllabus or a quiz. Students are less likely to interact in this tier than they are in the first tier (collaboration), but more likely to do so than for social, non-academic reasons (Tier 3). Tier 2 is also content based, but contain voluntary items (items without instructor influence). Many students do not voluntarily interact with their peers to obtain or provide help with the syllabus or quiz. As one student noted, “Sometimes students may think that contacting another peer for help may be seen as a way for cheating so they just don’t do it.”

Students who are located at or above Tier 3 would also interact with “why” items found in Tiers 1 and 2 (see Figure D1). About a third of the respondents are identified as students who interact with their peers for social reasons.

Student comments in open-ended items on the pilot instrument and in emails suggested that some students were not required to interact and therefore did not communicate with peers. Some students interacted to assist other students, citing an “absent” instructor, while others interacted to discuss technology or connectivity issues.

Analysis of data related to research question one yielded the following conclusions:

1. Students are most likely to engage in peer interaction because they are influenced to do so by their instructor (non-voluntary) and when the interaction is content based.
2. Students who interact with peers to obtain or provide help with quizzes are also likely to engage in non-voluntary, content based, interaction.
3. Students are least likely to engage in social, non-academic interaction. However, students who do are also likely to obtain or provide help with quizzes and to engage in non-voluntary, content based, interaction.

Research question 2: What communication tools do students use to interact with other students who are enrolled in the same CMS course?

The types of tools students reported using, as discussed in Chapter IV, are represented in five tiers (see Figure D2). Generally, students used asynchronous tools far

more than synchronous tools to interact with their course peers, as shown in Figure D2.

As discussed in Chapter II, students who engage in online learning do not usually attend a physical campus for all or part of their coursework due to time or geographical restraints. The primary tools used by the instructors to engage in interaction are of an asynchronous nature, as shown in Figure D3. Most of the students strongly agree or agree that they used specific tools because their instructor required them to use the tool.

Tier 1 includes course email and course discussion board tools used by students. Some students reported using email in their course more than once a week, but more students reported using the discussion board more than once a week. These tools are the two most typically used by instructors at the institution. Research noted in Chapter II suggests students achieve higher learning outcomes through asynchronous collaborative tools, however, student perception is mixed. Open-ended pilot questions and personal emails to the researcher suggest students feel strongly using the discussion tool. As one student wrote, “Working with other students on the discussion board to build the [title] project for class was the best. I wish all my classes had this.” The impact of the discussion board on student learning was considered by respondents to be one of the most powerful features of learning online:

The discussion board was the most useful tool in the class. It was mostly use [sic] for administrative purposes. Anyone could ask questions about upcoming tests or course policies, and they would get a fairly prompt answer from either the professor or another student. In this way, the lines of communication were very open. However, in my opinion, the discussion board should foremost be a forum for discussion on course

topics, especially for the types of courses I have taken online (world religions and intro psychology) [sic]. Such discussion takes the place of homework as it is used in classes such as math and sciences; it requires the use of learned concepts and facts and would aid tremendously in learning them and comprehending their depth. I believe the discussion of course topics should be promoted by the professor for these reasons. Especially in cases where this discussion may spark interest in students and be carried further, free from pressure by the professor.

Another student's comments suggest it may be discipline-specific: "I am an engineering major and in our classes we don't have to use the discussion board, and I'm glad. I think it would be a waste of time."

During the study, the University began to encourage students to obtain their email through an institutional portal. The instrument asked students to specify the degree to which they used email system on the course site, and the degree to which they used an external email system. The item, "When communicating with my peer(s), I used an email system external to the course email system," may have unintentionally implied the course portal. As one student suggests:

When I took the survey, it was unclear to me what exactly was meant by 'email system'. The two things I thought this could describe is mailing lists for a course and also the University Web page where students can retrieve University emails.

However, for the purposes of this study, anything external to the actual CMS-based course site, including the institutional portal, would be considered “external email,” as it is not a tool within the CMS-based course.

Tier 2 contains the external email tool. Instructors sometimes require this tool as an alternate email tool, or to communicate course achievement through their university-provided email address. Through discussions with instructors, the researcher discovered that some instructors required the use of an external email. All mail from students in the course could be delivered to a specified folder in the instructor’s email application, so the instructor did not need to login to the course management system. Students who reported using external mail were also likely to use tools found in Tier 1.

Tier 3 contains the cellular phone tool and meeting in person. Students commented that they met in person through student organizations, or learned they were geographically close and decided to meet (specifying restaurants, coffeehouses, and the student union). Students also said they decided to meet after realizing they were enrolled in other online courses together. Students explained they used cellular phones to obtain or provide help to a classmate, or for social interaction with classmates. A student wrote, “I contacted my peers to discuss different subject matter concerning a lesson or topic. Sometimes I find it a good ideal [sic] to discuss what is required by a professor and details of interpretations of assignments.” Students who used tools in Tier 3 are more likely to use tools found in Tier 1 and 2.

Tier 4 consists of the CMS chat tool. Most students never used the chat tool in their course. According to the literature noted in Chapter II, chat room use is typically specific to the selection and use of the instructional outcome desired. Generally, chat

rooms are used for virtual office hours or for lessons that require immediate feedback (like those from small brainstorming sessions). The instructor influences the tier location for the chat room tool. The instructor has to make the CMS tool available, has to provide criteria for use, and if used for office hours, be available during the specified times. Students who are likely to use the CMS chat tool are also likely to use tools found in Tiers 1, 2, and 3.

Tier 5 contains tools that are least likely to be used by students. With the exception of the external discussion board, all of the tools found in the fifth tier are synchronous. The land phone is idiosyncratic here, in that any communication through a land line phone does not usually occur simultaneously when using the Web through a dial-up service configuration. The location in this tier suggests that there may be a relationship between the time a student decides to interact with a peer and the ability to do so. If students think of a reason to interact when they are online and choose to do so immediately, they could not use a land line phone if they were accessing the Internet through the dial-up configuration.

All of the tools in the fifth tier (except for the land phone) are more difficult to set up, manage, and operate than similar tools based within a course management system. As described in Chapter I, the strength and benefits of using a CMS include tools that are pre-established, are similar across the institution, and provide immediate use for the class when activated. With external tools, students and instructors must learn how they function. This is typically not the case with external email as it is widely used prior to any online course, as shown by its location in the second tier. Other external tools are not necessarily similar in scope, design, and function, requiring the instructor to set up each

tool, often a significant contribution of time (e.g., enter each student's name, email address, and other information manually). The external tools are also similar in respect to their diffusion of innovation. External blogs, for example, are widely used by students in a social environment, but not for academic purposes. As the speed of innovation increases in producing new educational media, instructors may not adopt the new technology. Instructors could choose to continue using out-dated tools they believe to be the best selection and use. Students who used tools found in the Tier 5 are also likely to have used tools found in the Tiers 1 through 4.

Analysis of data related to research question two yielded the following conclusions:

1. Students use asynchronous tools more than synchronous tools.
2. CMS-based discussion boards and emails are used most often.
3. Some instructors require external email to be used.
4. Students meet in person with peers in their online course.

Research question 3: Are there relationships between why students interact and their perceptions of academic success?

Students' perceptions of their academic success in regards to why they interact are divided into two tiers as shown in Figure D3. Items that were specific to the students' online course are contained in Tier 1. Students were more able to perceive an immediate benefit to interacting with their peers in Tier 1, than they were able to perceive a benefit for more general, overall academic success found in Tier 2. Students who perceived that peer interaction led to general, overall academic success (Tier 2) were more likely to

agree that it also improved their grade and that they learned more by interacting with their peers (Tier 1).

Analysis of data related to research question three yielded the following conclusions:

1. Students perceived that interacting with peers improved their grade in the course.
2. Students perceived that they learned more by interacting with peers.
3. Students who perceived that peer interaction in the course led to their overall academic success also tended to perceive that they learned more in the course and that peer interaction improved their grade.

Research question 4: Are there relationships between why students interact and demographic characteristics?

The demographic factors of gender, age, and class rank were reviewed in exploring why students interact with their peers online. Although Females in the study were less likely to interact on projects than males (see Figure E1), both genders are located within Tier 1, suggesting they are both most likely to engage in Tier 1 interactions than Tier 2 or 3. Both genders are not likely to interact for quiz, syllabus, or social purposes.

Students between 18-39 are most likely to interact for projects and course content, and students between 40-64 are the least likely to interact with “why” items on any tier (see Figure E2). Students age 65 or older are about the same as 30-39 year olds in regards

to their interaction. Students in the 65 or older category could be interacting more than 40-64 year olds because they are retired and have different life commitments than those in the 40-64 year-old age category. Students of all ages are not likely to interact for quiz, syllabus, or social purposes.

Students who self-identified as degree-seeking students are more likely to interact with their peers on projects and course content than non-degree seeking students (see Figure E3). Graduate students were the most likely to engage in peer interaction for projects. Generally, students seeking a degree have different motivation factors than students not seeking a degree. It is widely understood that intrinsic and extrinsic motivators can be greater for students seeking a degree than those not seeking a degree. Career goals, grades, performance, and instructor influence are generally greater for a degree-seeking student than for a student not seeking a degree. No students from any class rank are likely to interact for quiz, syllabus, or social purposes.

Analysis of data related to research question four yielded the following conclusions:

1. Males are more likely to interact for projects and course content, while females are more likely to interact for course content.
2. Students 18-19 years old are more likely to interact for projects and course content. Younger students and students' age 65 and older are likely to interact for course content. Students between the ages of 40-64 are not likely to interact.
3. Graduate students are likely to interact for projects and course content. Undergraduate and professional students are likely to

interact for course content. Non-degree seeking students are not likely to interact.

Research question 5: Are there relationships between communication tools used and demographic characteristics

The demographic factors of gender, age, and class rank were reviewed in exploring the tools used by students when interacting. Although the difference reported in Chapter IV is statistically significant, students of both genders were likely to use tools found in Tier 1 and 2 (see Figure F1). Neither gender is likely to use tools found in Tier 3, 4, or 5. Although there was no significant difference in a student's age and the tools they used, the mean for each group is shown on Figure F2. Professional students are likely to use tools found in Tier 1, 2, and 3 (see Figure F3). Graduate students are likely to use a cell phone for interacting, and use tools found in Tier 1, and 2. Undergraduate students are likely to use tools found in Tier 1 and 2. Students not seeking a degree are the least likely to use tools for peer interaction. Professional and graduate students often have field-specific, Internet-based collaborative applications that are required in their courses. Students not seeking a degree are not likely to be enrolled in courses requiring this level of interaction.

Analysis of data related to research question five yielded the following conclusions:

1. Although a statistically significant difference was found between genders, males and females are likely to use external email, course email and the course discussion board to interact.

2. There is no significant difference in a student's age and the tools used to interact with peers in the same CMS course. Students of all ages are likely to interact using external email, course email, and course discussion board.
3. Professional students are likely to use the following tools to interact: meet face-to-face, cell phone, external email, course email, and course discussion board. Graduate students are likely to use the following tools to interact: cell phone, external email, course email, and course discussion board. Undergraduate students are likely to use the following tools to interact: external email, course email, and course discussion board. Non-degree seeking students are likely to use course email and course discussion board to interact.
4. Professional and graduate students are the most likely to use synchronous tools to interact.
5. No students from any demographic factor studied are likely to use an external chat, an external blog, a land phone, or an external discussion board to interact.

Student Comments

Students made general comments about the instrument, the course management system, and experiences with online learning. Students wrote to the researcher stating the instrument was too broad, too narrow, too short, too long and expressed a concern that no

action would be taken from the results. Some students commented that the online survey itself could be junk mail or an offer to purchase a product or service. The increasing junk mail volume received by students is problematic beyond this study; the university communicates student account information via email. An institution-wide application for the creation and distribution of online instruments available within an institutional portal would assist students in ensuring the request is valid. The application would also assist the university community by providing a standard platform for data collection in research, assessment, and evaluation.

The majority of students who wrote the researcher concerning the course management system pertained to student privacy and perception of instructor access to student interaction. Student perception about privacy within the CMS course included concerns about tracking every keystroke, monitoring emails sent to other students, tracking time spent in the course, and tracking every Web page visited. At the institution used in this study, instructors do not have access to all students' actions within the CMS course site. However, student perception can influence academic performance, so students should be informed of any privacy issues to alleviate concern.

Students provided wide-ranging information about their experiences online. Some students believed a distance education course should be offered for each face-to-face section offered. Other students perceived the courses "getting harder because it is getting more popular." Still other students stated they were concerned about the lack of response, or "absent" instructors, and administrative concerns (e.g., enrollment, fees, changes in instructors or programs without notice). Statements by students demonstrate a wide range of voices regarding instrument design, online survey delivery, and course management

systems. It is clear that students have a strong interest in online instructional media and how instruction is delivered.

Implications and recommendations for practice

Several implications are derived from this study, impacting students, instructors, and higher education institutions. It is derived that implications and recommendations presented here will provide an opportunity for individuals and institutions in higher education to more fully understand the implications of peer interaction for students in fully online, CMS-based courses.

Implications and recommendations for students and instructors.

Implications and recommendations for students and instructors of future online courses are listed below. Students and instructors may consider these implications and recommendations when participating in, or designing, a course for online delivery.

Improving student learning skills.

Today's students could benefit from increased skills to manage their acquisition of knowledge (Weinstein, 1988). In the early stages of Web-based learning, students were mostly self-directed learners, completing assignments, readings, and learning objectives much like their predecessors who enrolled in the correspondence courses described in Chapter II. Increasing societal demands on students, increasing course offerings, and higher online enrollment are shrinking the proportion of students who are self-directed learners in distance education. This includes not only how the information is acquired, but also the technological, social, and logical processes required to obtain, apply, and retain the information. This is particularly the case for students enrolled in the

CMS-based course. The methods, strategies, and skills students will need to use online are different when the delivery method is modified from a face-to-face context to a Web-based environment. The idea that traditional instructional tools (e.g., lecture) are influencing the online environment is a myth: The online environment is influencing traditional methods, strategies, and skills. Today, instructors teaching traditional courses usually require students to use the Web. Traditional classrooms are increasingly media-enriched, and library resources are primarily found online.

Learning skills and study strategies for the online student should be adapted so the information is applied and transferable to other contexts for the student. For example, a time management lesson offered to students explaining effective use of the hours between classes is not applicable to asynchronous, distance education environments. When teaching education students online, the researcher modified this lesson to include relevant examples for students that allowed them the ability to transfer the management skill set to other contexts. Many students engaged socially, some providing study strategies not related to the course taught online. In the first week of one course, several adult students described their “interruptions” by other household members when attempting to study. A term-based “refrigerator” calendar was posted on the CMS-based site for students to print and use, noting their “do not disturb” study periods for all household members to view. This “micro-lesson” allowed students to learn traditional time management practices and immediately apply this information as a study strategy. Students reported their success in time management overall, and higher self-efficacy in their ability to learn, due to their engagement with study strategies. Generally, students do not learn how to learn in secondary school, leaving higher education responsible to fill the void. Students who

understand how they learn best and can apply relative cognitive tools (e.g., concept mapping, KWL) can find meaning from the instruction delivered and will be engaged learners.

Communication literacy.

Students need to understand the benefit of peer interaction and they must have the skills required to engage in academic discourse online. Although students interact with their peers mostly because their instructor requires the interaction, their desire to engage in the course is analogous to recommendations made by regional accrediting agencies.

The importance of engaging students in the online learning experience through interaction and collaboration is recognized as a best practice by the Higher Learning Commission (2007a) and emphasized by all eight regional higher education accrediting agencies (2007b). The International Reading Association and National Council of Teachers of English Joint Task Force on Assessment recommend that instructors help students learn how to debate and challenge peers with respect (2007).

Instructors should create environments where collaboration is valued and students see the benefit of participation beyond, or in addition to, an extrinsic motivator such as a grade. When students realize the benefits of participation, they may be more willing to discuss course content, review peer feedback in an objective, analytical manner, and engage in academic discourse critically, perhaps as a course community. As found in this study, students who interacted perceived that their interactions improved their grade, and that they learned more. If a course environment is designed where students want to participate early on, students are likely to obtain greater benefit in the course, and in peer interactions in the future.

Instructors should ensure that their CMS-based course provides clear directions, intuitive pathways, and meaningful links. An appropriate assessment of the selection and use of visual information and multimedia should be conducted. Like a learning objective that is unclear and not measurable, any digital element that is not meaningful to the context of the course is communication noise and a possible distraction. A course that provides students with a clear understanding of learning objectives, tasks, assessments, and expectations in a measurable, clear, and timely manner alleviates much of the concerns noted by students in this study.

Information literacy.

Students should be required to become familiar with the processes involved in using a course management system and have appropriate skills relating to information literacy prior to starting an online course. Here, the term “information literacy” extends the term used in library science to include the effective use of course management systems and associated tools. Students would greatly benefit from the traditional use of information literacy in library science, but this study specifically concerns their ability to access, share, and evaluate information through course management systems. At the institution used for this study, students have the opportunity to review a practice course three weeks before the first day of classes. The practice course allows students to become familiar with every tool available within the course management system, including several variations of examinations. A non-credit, practice course is offered on a voluntary basis at the institution used in this study. At other institutions, students are required to enroll in a course based on skills necessary for using the CMS platform. Institutions could provide just-in-time learning modules that students can review within the online

course. For example, students taking a quiz online would have access to a non-content practice quiz prior to taking the actual assessment.

Instructors who require students to use new tools for interacting should ensure that students are able to use the tool in a timely manner, so the technology will not interfere with the pedagogy. The pedagogy must take prominence over the technology. As discussed in Chapter II, using new technological tools without primary consideration for student achievement of learning objectives is destructive to student learning. By the same token, resisting the adoption of innovation without regard to achievement could diminish the abilities of delivering instruction that fosters greater motivation and higher learning outcomes. The selection and use of any tool should be based on best practices.

Implications and recommendations for higher education institutions.

Implications and recommendations for higher education institutions are described below. Institutions that offer courses through a course management system should encourage best practices from accrediting agencies, provide functional policies and procedures centered on student learning, and provide faculty training and services to facilitate meaningful learning outcomes.

Best practices.

Institutions need to provide the financial, human, and information resources required to sustain long-term program offerings so students can be assured they can complete a program they begin. Best practices for technologically delivered distance education courses are similar to practices found in traditional course delivery. Regional and professional accrediting agencies have recognized the need to specify distance education best practices that pertain to the institution, the curriculum, faculty and student

support, and evaluation and assessment. Regional agencies recommend the appropriate, fully qualified staffing of distance education personnel. Specifically, agencies like the Higher Learning Commission (HLC) recommend that an instructional designer review curriculum at the program level and often cite the need for instructional designers to have a primary role in course development (Higher Learning Commission, 2007a). As more academic and corporate organizations depend upon learning via the World Wide Web, the demand for instructional design services will increase. This increase creates a paradox in the discipline: as the demand for educational technologists continues, the number of instructors teaching in the field – and the students enrolling – is on the decline.

An apolitical association must be established between the instructor (as subject matter expert), and the instructional designer (as learning expert), in order to provide courses focused on students learning the concepts specified for the course. Areas including utilization of data, strategic thinking, and creativity are beneficial for higher learning outcomes, as defined in the Presky Model (Fink, You, & Mold, 2006). The HLC recommends faculty remain responsible for the curricula and program oversight. Academic qualifications of those managing the program must include an appropriate grounding in the field of educational technology, and preferably, the specific study of distance education. The implications and recommendations stated here directly reflect the recommendations by the HLC (2007a): “The importance of appropriate interaction (synchronous or asynchronous) among instructor and students and among students is reflected in the design of the program and its courses, and in the technical facilities and services provided” (p. 9).

Student and faculty support.

The institutional community should be aware of policies and procedures regarding the level of privacy and the retention of information within a CMS. Students should know what information is recorded, or can be viewed by instructors or any individual not shown in the class. Any team-teaching, graduate assistants, or others who are in the online course should be identified to the students who have the same expectations of privacy as found in face-to-face classrooms.

Institutions should ensure that pedagogy is the first and primary consideration for instructional delivery. The selection and use of technological tools should be appropriate to achieve the learning outcomes desired. Technology already commonplace to students should be considered if the learning outcome would be equal to, or greater than, traditional CMS tools. Examples include cellular phones and university-based student Web sites for academic and social networking.

Institutions should provide information clearly stating the technical competency required to participate in the course and offer students the opportunity to gain those competencies through instruction and practice. Technical competency could be a facet of a larger information literacy program regarding library and learning services, and skills required for academic success. Throughout the course, technical support should be provided to the student in a timely manner. Institutions should ensure that students are aware of instructor and peer interaction requirements for the course.

Institutions should support and encourage instructor development through training, services, and incentives designed to encourage a quality learning experience for students. Institutions must ensure that instructor and student voices are heard regarding

the continuous improvement of the program. Institutions should provide the necessary resources for faculty training beyond technology tools to include learning effectiveness and pedagogy. Instructional services should be provided so instructors can focus their attention on delivering a course that is an appropriately engaged learning environment.

Future research considerations

This study describes why students interact with their peers in a fully online course, the tools students use in the interaction, and their perception of academic gain in interacting. Through this research, recommendations for future research emerged that would add to the body of knowledge pertaining to distance education.

1. *Change context of environment.* The context of interaction through course management systems goes beyond a public university education. In order to understand other contexts, this study should be replicated across business sectors, across non-profit organizations, private academic institutions, K-12 students, and community colleges. The location and diversity of these populations in the United States and throughout the world should be considered. This study should be replicated in relation to human performance technology in the workplace exchanging “academic success,” to performance-related criteria (e.g., ability to perform task, make decision).
2. *CMS-related research.* More research regarding the use of course management systems should be conducted. This research could include the tools available within a CMS, how faculty, students, and support staff uses

the CMS, and how interaction occurs across CMS platforms. Research on the selection process involved in CMS acquisition, those involved in making the selection, and their role at the institution should be studied. More research is needed regarding institutional policies of distance education programs and how programs function within the institution.

3. *Longitudinal research.* The study of peer interaction in course management systems over a specified time should be studied. Although learning via the World Wide Web began several years ago, there is no longitudinal data available to assist in the understanding of online student peer interactions. Longitudinal research could be conducted to examine the impact of peer interaction on a former student's current performance in the workplace. Areas involving technology itself should be considered. A longitudinal study exploring the teaching behaviors of instructors over a period of various innovations would benefit our understanding of instructional delivery and performance. A longitudinal study examining the changes in how peer interaction evolves over time should also be considered. Research regarding the time spent interacting, as well as studies exploring the procedures used to interact with peers would benefit distance education. It is not understood if students read content or postings and respond immediately, if they seek other resources, if they wait until a deadline, or wait until a peer has participated. Researching this process in the context of time would prove valuable to distance education.

4. *Qualitative research.* Themes from qualitative studies provided the instrument items for this research, but were specific to a course, discipline, tool, or demographic characteristic. Several students who responded to the primary instrument in this study emailed the researcher to express their often-strong perception of peer interaction, course development, or instructional influences. Qualitative studies could include an analysis of gender participation across disciplines, what is said during the peer interactions, and an analysis of non-interaction (like the 40-54-year-old group in this study). Students from different cultures taking United States-based higher education courses, and students in the United States taking distance education courses abroad, could be interviewed to gain insight on instructional design in a global environment. For example, the color red has various interpretations across the globe. Understanding the impact on students from various cultures would benefit how color is used in a CMS-based course.
5. *Experimental research.* More experimental research is needed in the field of distance education. Learning theories suggest study strategies and information literacy will benefit distance education students, however little experimental research is available. Research could include a pre- and post-test of students in an experimental and control section taught online by the same instructor. Instructional modules in the experimental group include literacy competencies, and the control group is not provided the competency modules. Experimental research in interaction dynamics, in

discourse debate, and in peer evaluation and assessment are important contributions to research in distance education, and should be encouraged.

6. *Extant data analysis.* An analysis of extant data available should be conducted. On the World Wide Web, millions of log files pertaining to peer interaction external to the CMS are publicly available. Every CMS contains log file information that could be used to more fully understand peer interaction in distance education.

Summary

Students who interact with their peers online largely do so because their instructor required the interaction to occur. Students perceive an immediate benefit to their academic standing in terms of improved grades or through learning more about a course concept. Students who interact most often are generally seeking a degree, younger than 40 years old and use email and discussion tools within the CMS-based course. Students least likely to interact with their peers are not seeking a degree, are between the ages of 40 and 64, are least likely to perceive an academic benefit beyond the course, are least likely to use synchronous tools, and are not likely to engage peers in social, non-academic interactions.

Content review suggests that students have a strong interest in how instruction is provided online. Improving student learning skills, communication literacy, and information literacy are likely to increase student learning outcomes and lower student anxiety. Institutions who offer distance education would benefit from implementing best practices from regional and professional accrediting agencies that recommend support

staff and management have formal degrees and experience in the field. Implementing best practices will allow students to see a benefit from peer interaction, and in turn, increase their learning outcomes. Institutions who follow best practices would provide student and faculty support in policies and procedures that are universal across the institution. Students should know before they enroll in a course what information is private, what is shared, and how that information will be archived or retrieved by the instructor or institution. It is reasonable that a student would be aware of information that is submitted publicly or in confidence. Institutions should encourage – if not require – information literacy before a student's first day of learning at a distance.

This study provided greater understanding of student peer interaction internal and external to the course management system. However, additional research would increase the body of knowledge in distance education. This study should be replicated in different environments beyond public university education to include business sectors, non-profit organizations, private academic institutions, and community colleges. A longitudinal study would provide data of peer interaction changes over time and long-term outcomes of online peer interaction when students are in the workplace. A qualitative investigation would provide greater understanding of what is said in peer interactions. Student perspectives based on discipline and demographic factors and a study of non-interaction would be valuable to the academe. There is little experimental research in distance education available, and even less regarding CMS-based peer interaction. Therefore, many experimental research opportunities exist. For example, qualitative studies and applied learning theories suggest that study strategies and information literacy would benefit the distance education student as it does students taking traditional courses.

Additional experimental research would add valuable empirical data to our understanding.

The role of distance education and the specializations of experts in the field are changing. As distance education enrollment and competition increase, stakeholders will be required to have a formal knowledge in the field, and an immense understanding of using the theoretical approaches to administer distance education programs. Practitioners will need to maintain an awareness of the historical significance of distance education. They will need to provide an environment where learning thrives, is driven by pedagogy, and is fueled by innovative instructional technologies.

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Appendixes

Appendix A: Electronic Letter of Consent.

Dear [student name]:

As a student who has taken a course delivered fully online at [institution name], you are invited to participate in a research project concerning student's interaction with their peers in the online course. As an expression of gratitude, **each participant will be entered into a drawing for \$200.00.**

While a few studies review faculty perspectives online, this study seeks to understand the student's perspective on interacting with their peers in a fully online course.

The online survey is confidential and anonymous. When you submit your responses, your email address is removed so the researcher does not know how you answered any question. Please answer only once, as all duplicates for the survey and drawing must be eliminated.

Your participation in this research is completely voluntary and will have no effect on any relationship you have with [institution's name].

By completing this survey you are providing your consent and acknowledging that you are 18 years of age or older.

If you have any concerns regarding this survey, please contact Dr. Robert Sullivan by email: robert.sullivan@utoledo.edu. **Please complete the survey and drawing by [seventh business day]!**

By clicking on the link below, I am consenting to take the online survey:

[\[Web-based survey address\]](#)

Thank you for your time and consideration,

Mark L. Fink
Doctoral Candidate
The University of Toledo
Judith Herb College of Education
Department of Curriculum and Instruction
mark.fink@utoledo.edu

Appendix B: Instrument.

Instrument font is **12 point, bold, Arial**. It is compressed below to fit page:

Instructions

Dear Student:
As stated in your notice of consent, your answers are confidential and anonymous. Please do not submit the form more than once as duplicates must be eliminated.

The 25 questions ask for your online experience in interacting with your peers. After answering each question, click "continue" at the bottom of the page.

When answering the survey, recall your experiences from the most recent fully online course. A fully online course is where you did not attend a physical classroom for discussion.

Do not forget to include your email address after completing your survey to enter the \$200 thank you drawing!

Please select the gender to which you identify:

☐ Female
☐ Male

Please select your age from the following groups:

<Select>

Age group drop-down menu:
18-19
20-21
22-24
25-29
30-34
35-39
40-49
50-64
65- older

Please select your class rank:

☐ Undergraduate
☐ Graduate
☐ Professional
☐ Non-degree seeking/other

Continue

Each "Continue" button represents a new screen to create the table matrix necessary, for ease of entry, and to reduce the likelihood of selecting a different response than intended. University instructional designers recommend using this method (screen separation) to instructors in their development of WebCT-based quizzes and surveys.

I communicated with my peer(s) . . .

	Strongly Disagree	Disagree	Agree	Strongly Agree
to obtain or provide syllabus information.	☐	☐	☐	☐
to obtain or provide help with course content.	☐	☐	☐	☐
to obtain or provide help with a quiz, or exam.	☐	☐	☐	☐
to work on class projects or study together.	☐	☐	☐	☐
for non-academic, social reasons.	☐	☐	☐	☐
because the instructor told students to do so.	☐	☐	☐	☐
I would NOT have communicated with my peer(s) if the instructor did not require it.	☐	☐	☐	☐

[Go Back](#)
[Continue](#)
Other reasons I communicated with my peer(s) were:

[Go Back](#)
[Continue](#)

	Strongly Disagree	Disagree	Agree	Strongly Agree
Communicating with my peer(s) helped my grade in the course.	☐	☐	☐	☐
I learned more by communicating with my peer(s) in the course.	☐	☐	☐	☐
Communicating with my peer(s) in the course led to my academic success.	☐	☐	☐	☐

[Go Back](#)
[Continue](#)

In communicating with my peer(s) . . .				
	Strongly Disagree	Disagree	Agree	Strongly Agree
I used an email system on the course web site.	☐	☐	☐	☐
I used an email system external to the course email system.	☐	☐	☐	☐
I used a discussion board (or bulletin board) on the course web site.	☐	☐	☐	☐
I used a discussion board (or bulletin board) external to the course web site.	☐	☐	☐	☐
I used a web blog external to the course web site.	☐	☐	☐	☐
I used a chat room on the course web site.	☐	☐	☐	☐
I used a chat room external to the course web site.	☐	☐	☐	☐
I used a cell phone.	☐	☐	☐	☐
I used land phone (home phone, office phone, etc.).	☐	☐	☐	☐
We met in person.	☐	☐	☐	☐

[Go Back](#)
[Continue](#)

Please list any other way you may have communicated with your peer(s) below:

[Go Back](#)
[Continue](#)

Would you like to be entered into the \$200 thank you drawing?

☐ Yes

☐ No

[Go Back](#) [Continue](#)

If “Yes” is selected, the drawing screen appears (Appendix C).

If “No” is selected, the “Submit Your Responses” button appears:

Would you like to be entered into the \$200 thank you drawing?

☐ Yes

☒ No

[Go Back](#) [Submit Your Responses](#)

The participant is redirected to “thank you” screen after clicking “Submit Your Responses” button:

:: Interaction Information page ::

Thank you for participating in this study.

If you have any questions in this regard, please email me at: mark.fink@utoledo.edu.

Mark L Fink
 Doctoral Candidate
 The University of Toledo
 College of Education
 Department of Curriculum and Instruction
 2801 W. Bancroft St.
 Toledo, OH 43606

If the participant attempts to submit responses more than once, the following screen appears:

You have already submitted responses to this questionnaire.

Only your original responses will be included in the results.

Appendix C: Participant Drawing Form.

Please complete the following information to be entered into the thank you drawing. Again, the answers you submitted for the survey are anonymous and confidential. The drawing information you provide below is separated from survey information in order for the researcher to contact the drawing winner.

First Name:

Last Name:

UNIVERSITY email address:

[Go Back](#)

[Submit Your Responses](#)

The participant is redirected to “thank you” screen after clicking “Submit Your Responses” button.

Appendix D: Hierarchal maps of persons and items.

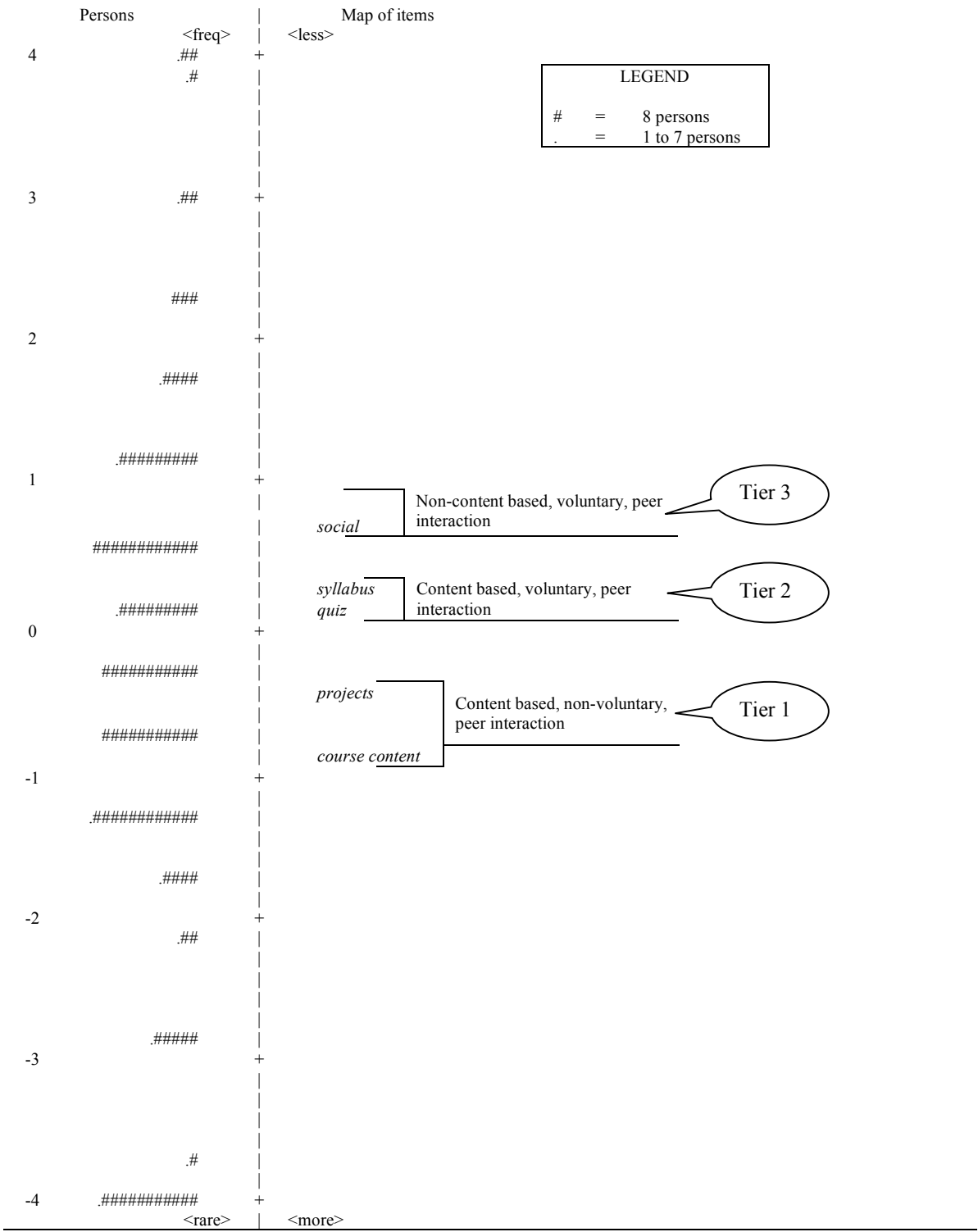


Figure D1. Hierarchal map of persons and items for “why” question. Items separated by type and voluntary nature of interaction. Students interact to discuss course content and projects most

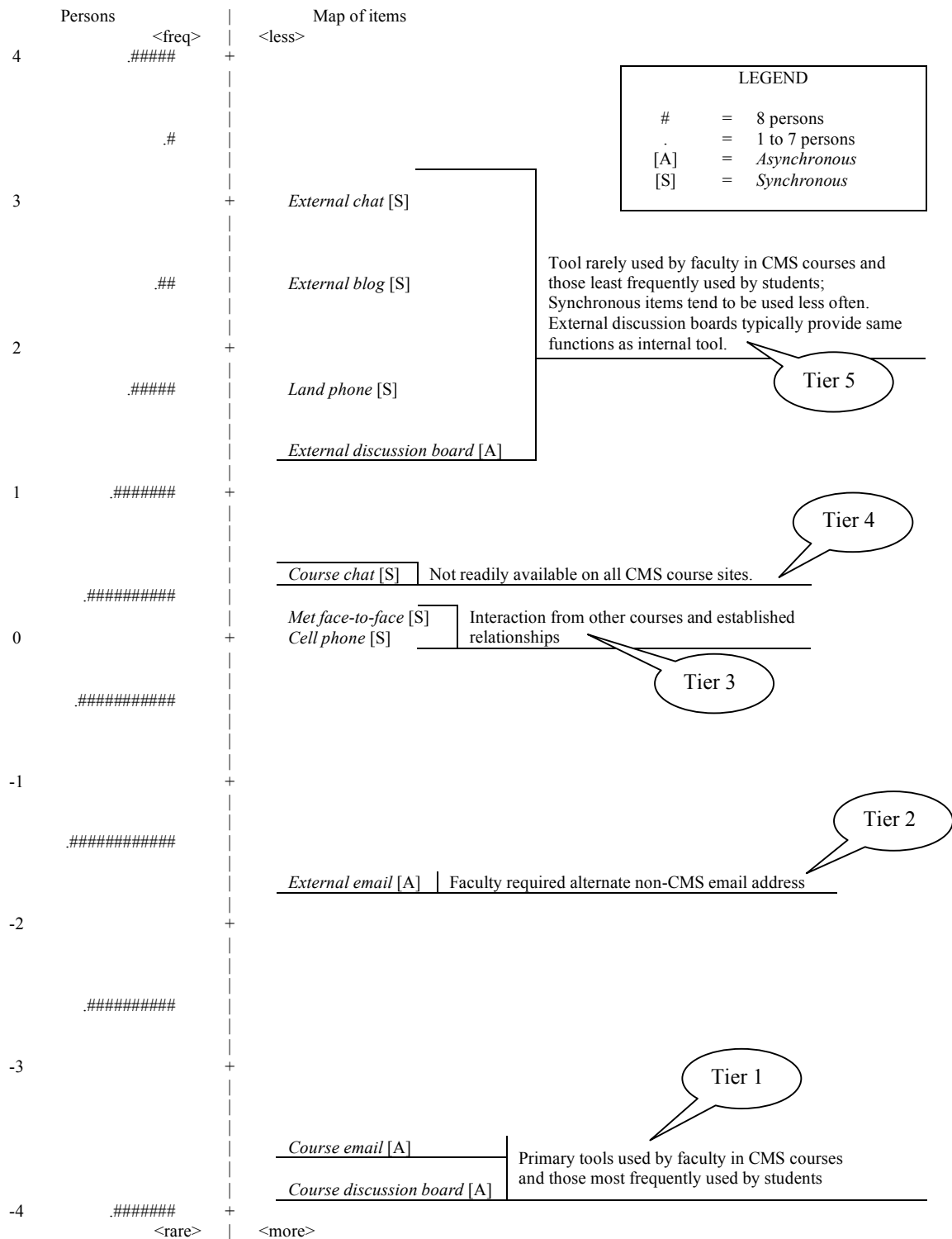


Figure D2. Hierarchal map of persons and items for “tools used” question. Items at the bottom of the map are most often used; items at the top of the map are least frequently used as expressed in logits.

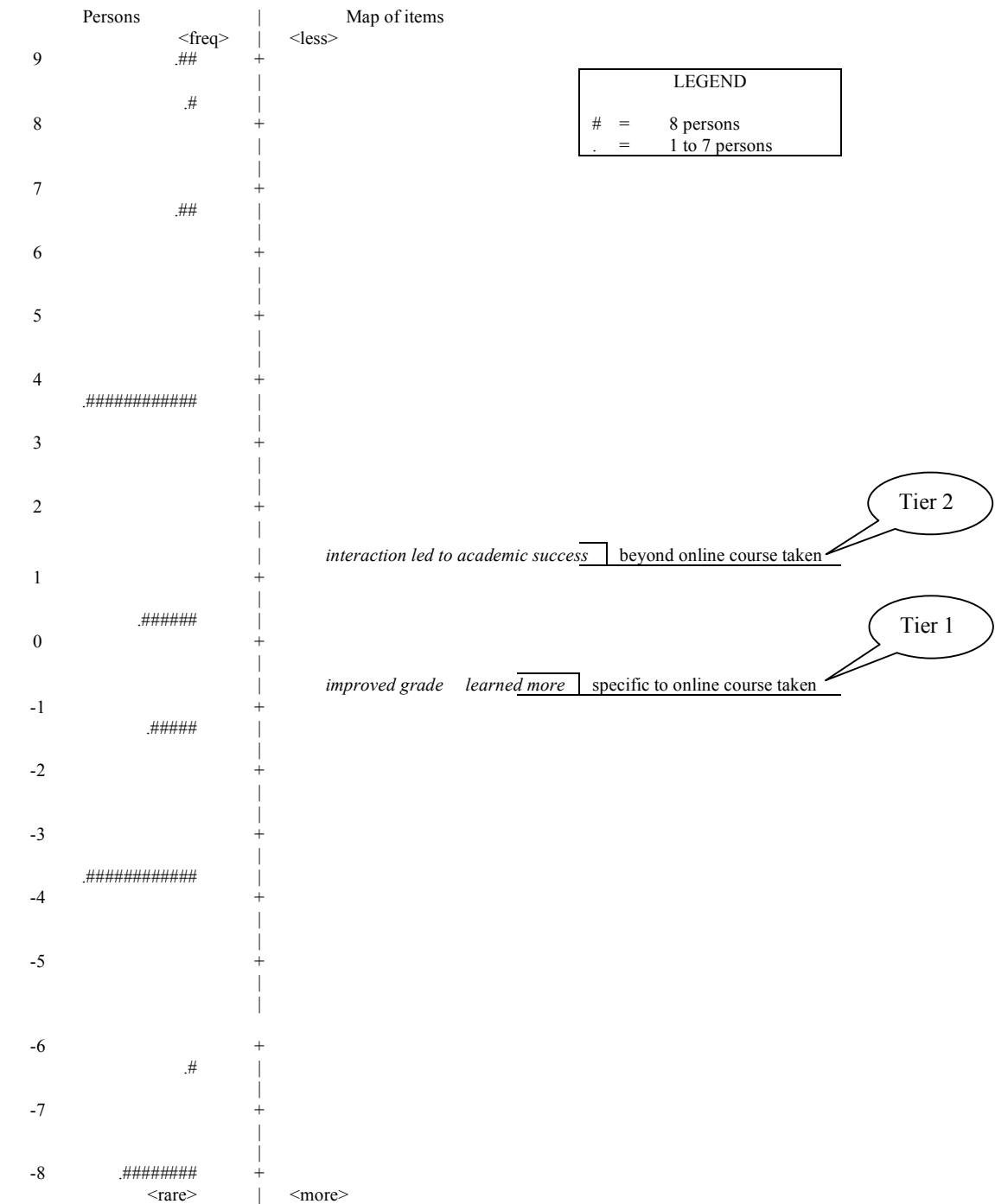


Figure D3. Hierarchal map of persons and items for “success” question. Items labeled *improved grade* and *learned more* are specific to the course of inquiry. Item labeled *interaction led to academic success* is not specific to online course of inquiry. Respondents are more able to agree that interaction has immediate propensity for academic success than a factor beyond the course of inquiry.

Appendix E: Hierarchal maps of demographic data and “why” items.

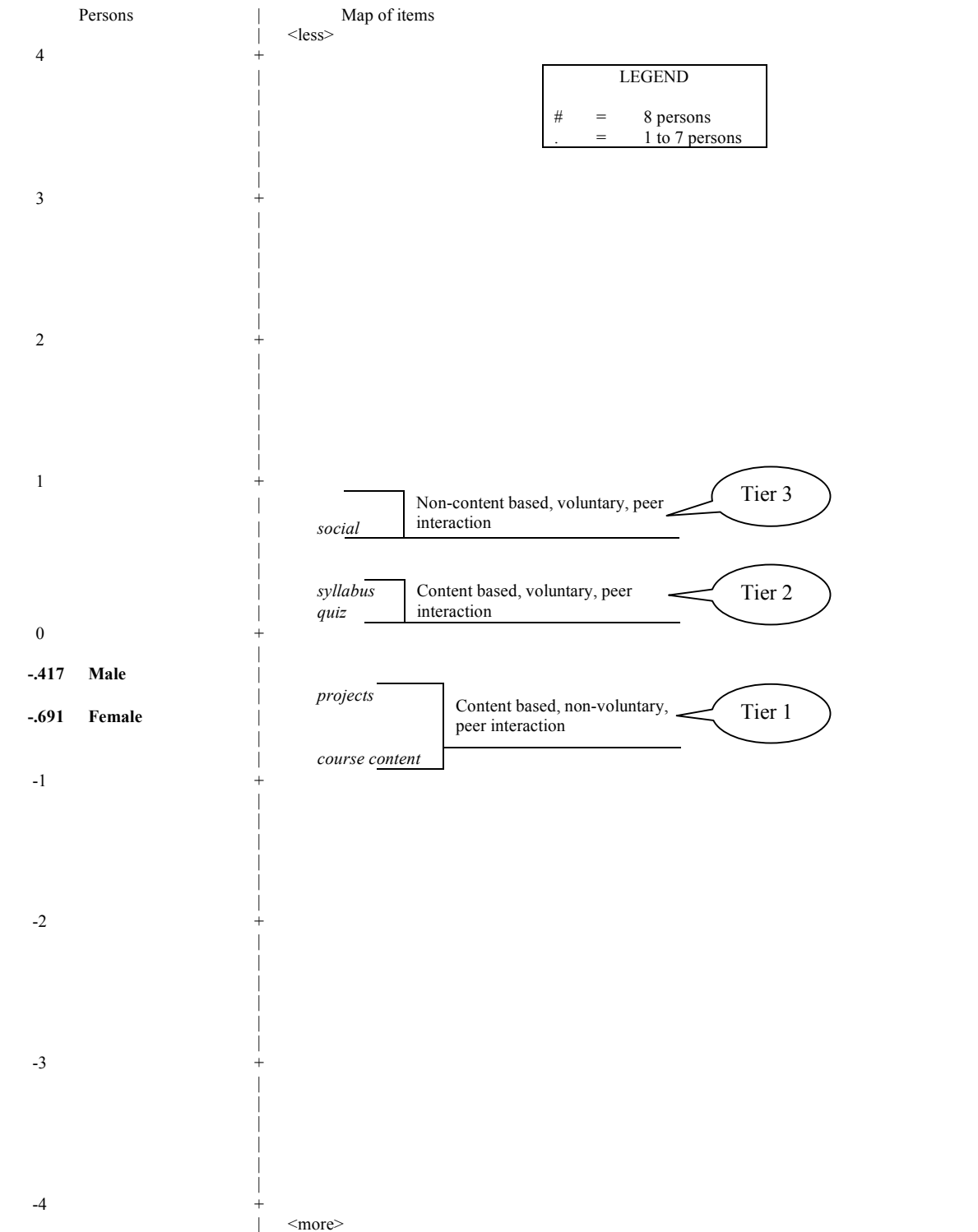


Figure E1. Hierarchal map of gender and items for “why” question. The location of the mean for each gender is found to the left of the map, expressed in logits.

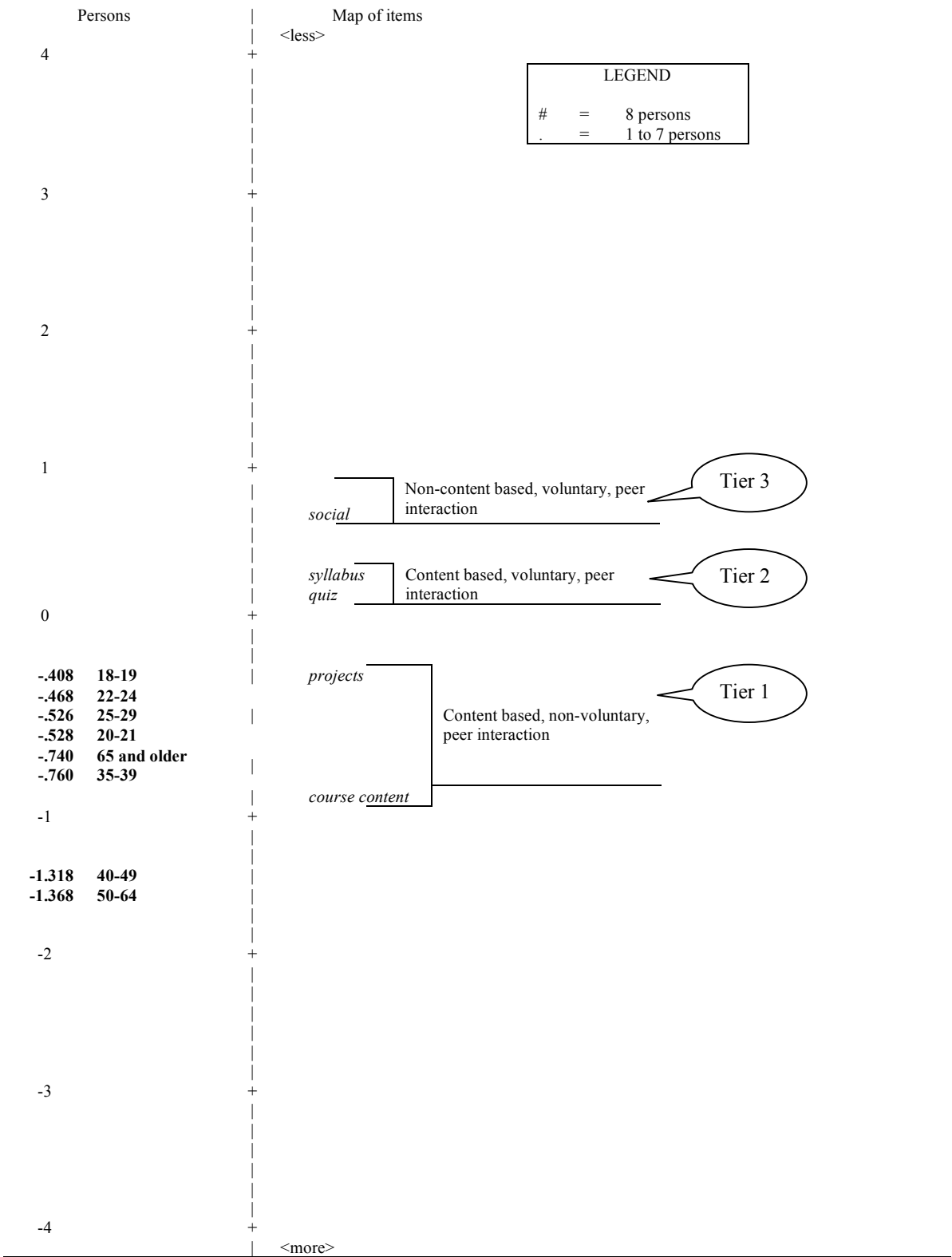


Figure E2. Hierarchal map of age and items for “why” question. The location of the mean for each age group is found to the left of the map, expressed in logits.

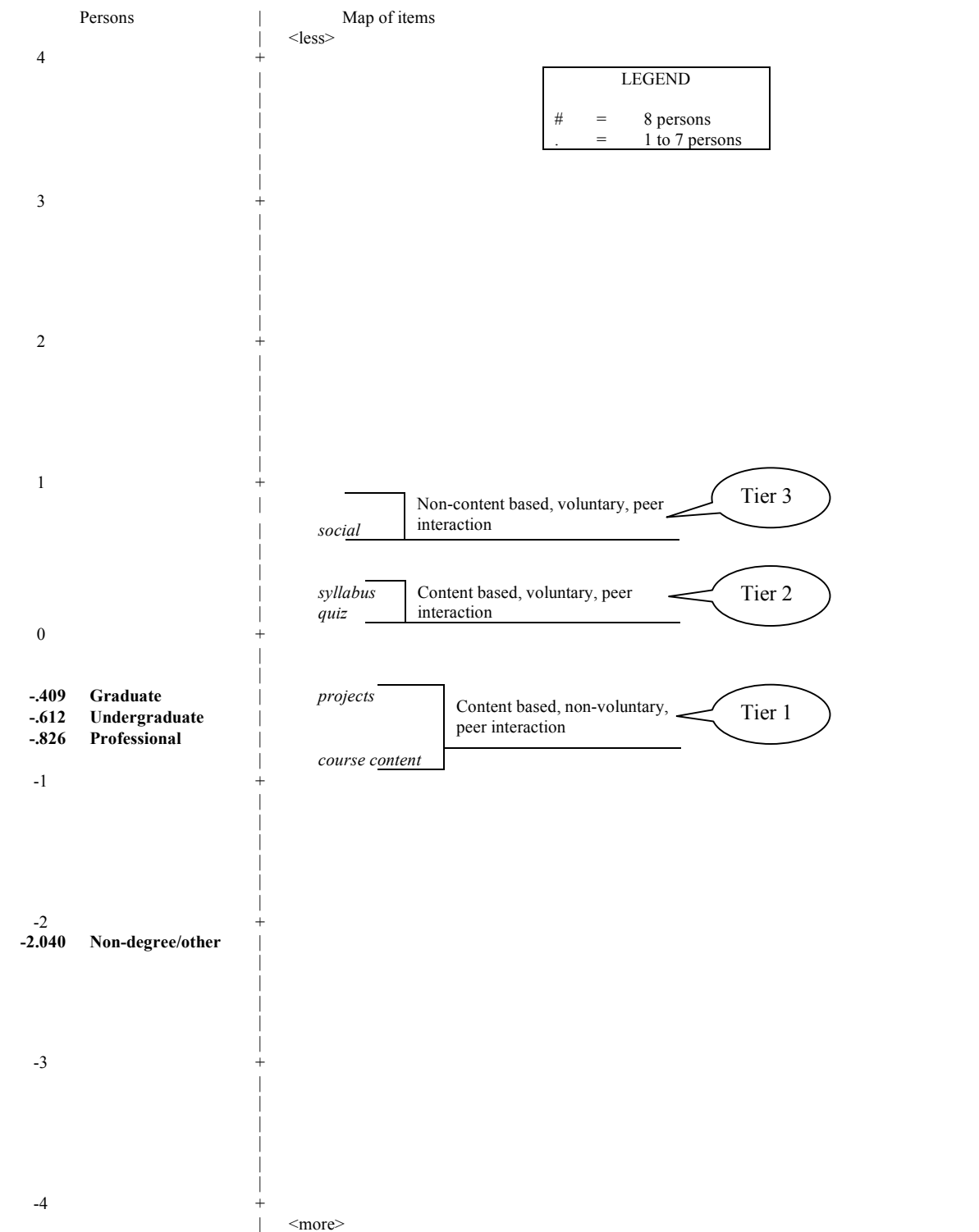


Figure E3. Hierarchal map of class rank in relationship to items for “why” question. The location of the mean for each class rank is found to the left of the map, expressed in logits.

Appendix F: Hierarchal maps of demographic data and “tools used” items.

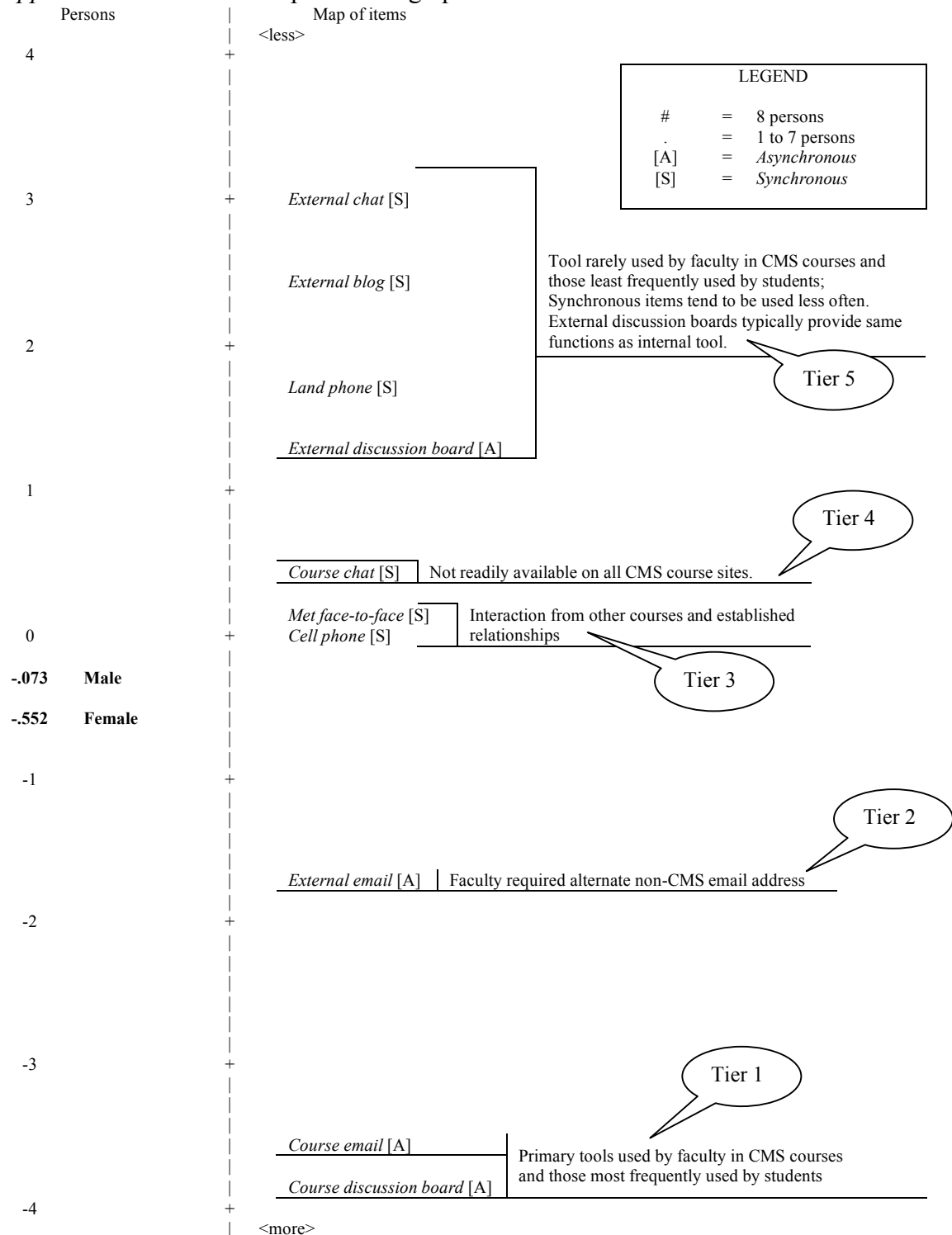


Figure F1. Hierarchal map of gender and items for “tools used” question. The location of the mean for each gender is found to the left of the map, expressed in logits.

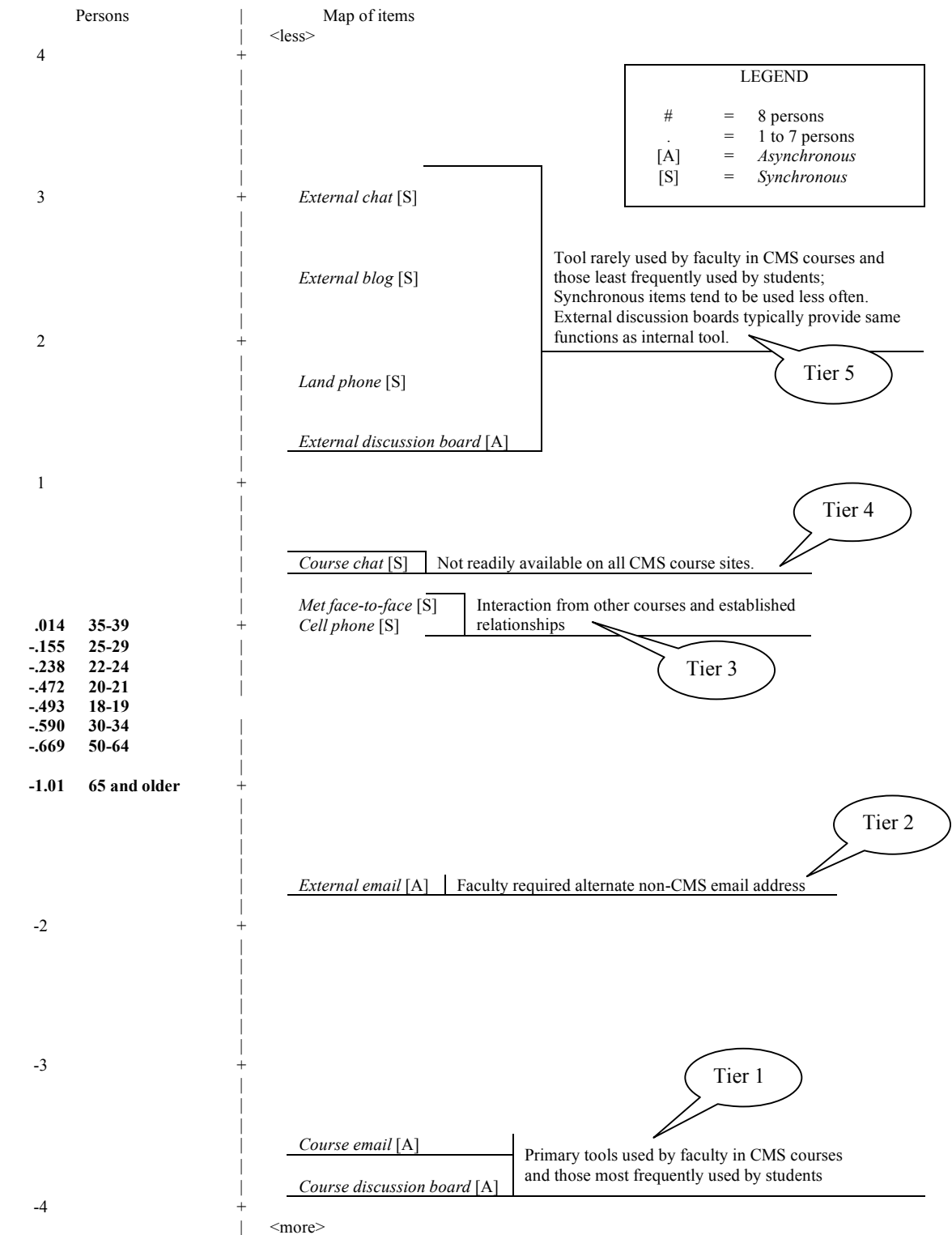


Figure F2. Hierarchal map of age and items for “tools used” question. The location of the mean for each age group is found to the left of the map, expressed in logits.

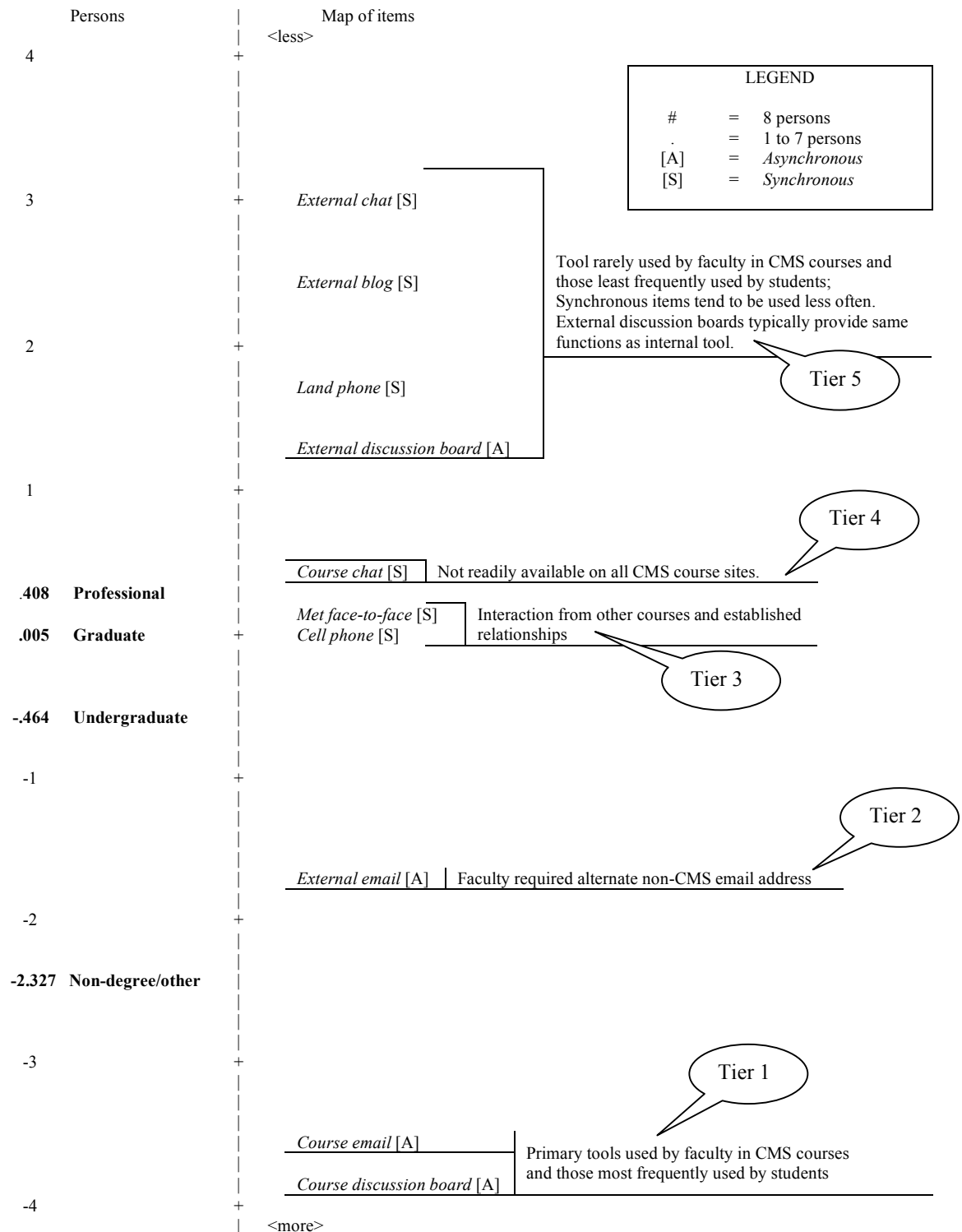


Figure F3. Hierarchal map of class rank and items for “tools used” question. The location of the mean for each class rank is found to the left of the map, expressed in logits.