INSTRUCTOR INTERACTION AND IMMEDIACY BEHAVIORS IN A MULTI-POINT VIDEOCONFERENCED INSTRUCTIONAL ENVIRONMENT: A DESCRIPTIVE CASE STUDY

by

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DEDICATION

This is dedicated to Laura whose love and support made my doctoral program and this dissertation possible, and to my parents Carol and Max for their encouragement and unwavering faith in me.

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Teachers open the door, but you must enter by yourself
- Chinese proverb

I have had many teachers along the way in my doctoral studies, and many people to thank for their time, patience, and encouragement. Writing a dissertation is a solitary and often lonely experience. But the people I have met along the way and relied on for guidance, support, and encouragement helped me to climb what at times seemed like a very steep mountain.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

INSTRUCTOR INTERACTION AND IMMEDIACY BEHAVIORS IN A MULTI-POINT VIDEOCONFERENCED INSTRUCTIONAL ENVIRONMENT: A DESCRIPTIVE CASE STUDY

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The purpose of this study was to examine the experiences of professors teaching in a multi-point videoconferencing instructional environment and how they interacted with students in proximate and remote classrooms. Qualitative and quantitative data were analyzed to gain an understanding of the teaching experience and to examine differences between instructor interaction and immediacy behaviors based on student location. Results indicate that no clear difference exists in instructor interaction behaviors with local and remote populations, but that they engaged in more immediacy behaviors with the remote population in their classes. Additionally, instructor interaction behaviors were more closely tied to student interaction behavior than to student location.

I. INTRODUCTION

The special education field faces acute shortages of trained personnel (Ludlow, 2003). The shortage has resulted from a number of causes, among them high attrition rates among special education teachers due to certification status and special education teacher preparation courses not keeping up with the demand for teachers (Brownell, Smith, McNellis, & Miller, 1997; Miller, Brownell, & Smith, 1999). The lack of sufficient numbers of trained special education teachers has been most keenly felt in the area of severe disabilities (Lang & Fox, 2003). An insufficient number of teachers trained to work with students who have severe disabilities has been related to the highly specialized skills required to work with these students, and university programs in severe disabilities producing small numbers of trained teachers each year (Ryndak, & Kennedy, 2000; Snell & Brown, 2006).

Distance education technologies have emerged as significant instructional delivery methods. Higher education institutions responsible for training special educators have recognized their value and are expanding their training in special education by including a variety of distance education technologies (Ludlow, 2003; Spooner, Jordan, Algozzine, & Spooner, 1999). The number of distance education-based special education teacher training programs has increased significantly, with many of these programs designed to provide training in an array of specializations (Allen & Seaman, 2008).

Like many states, the Mid-Atlantic state in this study has experienced a consistent need for licensed special education teachers trained in working with students with severe disabilities. In order to address the state's need for teachers trained in severe disabilities, and in keeping with the trend toward providing this kind of training via distance education, a teacher preparation in severe disabilities consortium was formed. The consortium is comprised of state-approved teacher preparation programs in severe disabilities at five state universities. The consortium's primary goal is to prepare teachers across the state to be highly skilled in working with learners who have severe disabilities and to increase the state's number of fully endorsed teachers in severe disabilities. The consortium provides training via interactive, synchronous distance education technologies to new full-time pre-service personnel as well as accelerates the training of those already teaching on conditional licenses. The class sessions originate from one of the participating universities and are broadcast to other locations. Students in the program attend classes either on campus at one of the five member universities, or connect to the distance education system from their homes. Using distance education technology, the instructor sees and interacts with each remote classroom and each at-home student as a separate window on his or her screen in what has been termed a "Brady Bunch" display.

Statement of the Problem

Introducing robust distance education technologies has brought a focus on how these instructional delivery methods compare to more traditional face-to-face classroom environments (Massingill, 2002). The face-to-face instructional milieu is used as the

standard not only because it has been the norm, but also because it is viewed as allowing participants to experience the widest array of communication and interaction patterns in the teaching and learning process. Of the current distance education technologies, videoconferencing most closely approximates the face-to-face instructional experience because students and teachers can see and hear each other in real time. It is therefore regarded as the most interactive of these technologies. But as McDavid (2003) points out, interaction in distance education is complicated. While there may be many similarities between face-to-face and videoconferenced classrooms, introducing technology between the teacher and the student may restrict or alter interaction (Jung, 2006). Aspects of videoconferencing such as transmission quality, acoustics, lighting, room configuration, and the presence of the technology itself may either complement or detract from the distance learning experience. As a result, educators cannot simply assume that interaction in the videoconferenced classroom will be comparable to that of the more traditional setting.

The body of literature on videoconferencing is less than comprehensive, drawing criticism for a general lack of empirical research and a dominance of descriptive methodologies. The majority of studies conducted to this point focus on student perceptions of the instructional experience in a setting with a single remote location (Cavanaugh, 2001; Fillion, Limayem, & Bouchard, 1999; Knipe & Lee, 2002; Machtmes & Asher, 2000; Russell & International Distance Education Certification Center [IDECC], 2001). Few studies have explored the teaching experience in this environment and as Peacock (2005) notes, those that do look more closely at teachers' activities

outside the classroom walls than at what they are actually doing within them. Fewer still are based on an analysis of observable teacher behaviors. This represents a gap in not only the literature, but also in our understanding of the instructional processes in distance education. As Good and Brophy (2000) note, teachers are often not aware of some of their behavior in the classroom. They go on to suggest that observing and objectively recording teacher behavior may heighten awareness, finding value in case studies that involve reporting observed behaviors. A relative lack of empirical research into what teachers are doing in videoconferencing classrooms, particularly as it pertains to interacting with students at multiple remote locations, hampers the field's ability to adequately evaluate the impact of this form of technology on instruction. An examination of specific behavioral aspects of instructor–student interaction patterns is needed in order to provide a more detailed view of instructional interaction as it exists in multi-point videoconferencing environments and to more thoroughly understand the impact of technology and its design.

Purpose of the Study

In this special education teacher preparation consortium, videoconferencing technology is used to simulate and approximate instruction that would otherwise be delivered in a more traditional, face-to-face classroom setting. The purpose of the study was to examine how professors interact with students in the proximate and remote classrooms. The study analyzed both verbal and nonverbal aspects of instructor interaction behaviors to discover any significant differences that may exist based on student location or the placement of displays for instructor use.

Research Questions

This study investigated instructional interactions in the multi-point videoconferencing environment provided for the consortium by asking the following questions:

1. Is there a difference in instructional interactions between the professor and students based on student location, i.e. proximate or remote location?
2. Is there a difference in instructional interactions between the professor and students based on the configuration of the originating classroom?
3. Is there a difference in instructor immediacy behaviors based on student location, i.e. proximate or remote location?
4. Is there a difference in instructor immediacy behaviors based on the configuration of the originating classroom?

Significance of the Study

Interaction is considered an important element in distance education (McDavid, 2003). Videoconferencing has the potential to create an instructional environment that is rich with opportunities for real-time interaction. As videoconferencing instruction expands to include multiple remote locations it becomes increasingly important to understand the characteristics of interaction in these complex environments, most specifically any differences in how teachers interact with students who are located in the same room with them and those who are located in multiple remote sites. This study focused on observable instructor behaviors rather than student perceptions in order to provide a more specific and detailed view of interactions in the environment studied.

Additionally, Jung (2006) cites a frequently identified limitation of distance education research: It emphasizes individual courses. This study built on existing literature by examining an academic program in a videoconferencing environment that spanned a number of different instructors across five universities, providing a more comprehensive perspective on teacher interaction behaviors in this complex environment.

Limitations of the Study

This study was conducted using archived video recordings of classes taught in the consortium distance education environment managed by an institute at one of the participating universities. As a result, the study was delimited to instructors who taught graduate-level Special Education courses in severe disabilities in that environment. Instructors teaching in other videoconferencing environments, teaching other subject areas, or at other instructional levels were not included.

A primary limitation of this study concerns the necessity of a heavy reliance on the study of verbal interaction behaviors. While nonverbal behaviors are of concern in studying instructional interaction and it would have been preferable to measure a larger variety of behaviors, the diversity of environmental elements such as lighting and using a variety of camera angles in these classrooms did not permit a reliable and consistently replicable collection of data on nonverbal instructor behaviors across the milieu. Nonverbal instructor behaviors can be observed reliably enough to generate gross observations, which were included as an aspect of the case study. But these behaviors cannot be studied in the same depth as verbal instructor behaviors.

In this vein, a further limitation of the study concerns generalizability to larger populations. A descriptive case study approach was selected for this research, with the anticipation of studying the interaction behaviors of what can only be considered to be a small number of professors in a very specific array of videoconferencing technologies. Consequently, it will be difficult to generalize the findings to larger populations, or to teaching behaviors in substantially different technological configurations. However, the study included data collection concerning both gross and more specific observations of instructor behaviors, and as a result should provide a fairly comprehensive view of interactions in these courses.

Finally, the universities included in the consortium do not share common admissions criteria for their programs in this area. As a result, the students taking classes in the consortium are academically more diverse than would be the case in a single university program. While student behaviors were not the focus of this study, the professors interacted with these students during the course of teaching these class sessions. The diversity of student populations may have impacted the interaction behaviors of the instructors to a degree that is unable to be reliably determined.

Definition of Terms

Several key terms are used throughout this study. They are defined here to provide a basis for uniform interpretation,

Asynchronous communication: The delivery of instruction when the students and the instructor are not connected at the same time and/or place (Simonson, Smaldino, Albright, & Zvacek, 2009).

Blended instruction: The fusion of face-to-face and online learning experiences (Garrison, 2008).

Blog: A form of online reporting and journaling that allows authors to publish instantly to the Internet (Richardson, 2006; Simonson et al., 2009).

Brady Bunch display: A description used within the consortium used for this to describe the instructor's view of remote sites during a videoconferenced class in which each remote site appears in a separate window on the instructor's display. This is analogous to the television series that displayed each member of the television family in a separate window.

Course management systems: An integrated set of Internet instructional tools that provide content presentation, communication, assignment submission, testing, and management functions via a web browser (Simonson, Smaldino, Albright, & Zvacek, 2000).

Desktop videoconferencing: The use of personal computers and specialized software to send and receive real-time audio and video signals over the Internet.

Distance education: Institution-based formal education in which the learning group is separated and interactive telecommunications systems are used to connect learners, resources, and instructors (Schlosser & Simonson, 2006).

Face-to-Face instruction: An instructional environment where the students attend class in the same room with the instructor at the time of instruction.

Immediacy: The extent to which physical or psychological closeness in interpersonal communication is enhanced by communication behaviors, or put another way, the

communication behaviors that reduce perceived distance between people (Woods & Baker, 2004). It is the perceived presence, warmth, and attraction that are conveyed in interaction between people (Umphrey, Wickersham, & Sherblom, 2008).

Instructional interaction: A process of exchange in which individuals and groups influence each other and where the interactions are interpersonal and occur within an instructional context (Wagner, 1994, 1997).

Interaction: Reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another (Wagner, 1994).

Interactivity: A characteristic of the technology used in distance education. It is the technological capability for establishing connections between points in real time and may be viewed as a machine attribute (Wagner, 1997).

Multi-point videoconferencing: A videoconferencing environment that includes multiple remote sites.

Local classroom: In real-time synchronous videoconferencing instructional environments, the classroom in which the instructor is physically present. It is also referred to as a proximate classroom.

Online instruction: Conducting instruction partially or entirely though the Internet. Numerous interchangeable terms for online instruction include web-based learning, e-learning, computer-mediated conferencing, and computer-assisted learning (Ko & Rossen, 2003; Schweizer, Whipp, & Hayslett, 2002).

Podcast: The creation and distribution of recorded audio and/or video content over the Internet for playing or downloading using electronic devices such as iPods, MP3 players, and computers (Simonson et al., 2009).

Remote classroom: In real-time synchronous videoconferencing instructional environments, the classroom that receives instruction from an instructor who is not located at that site.

Social networking: Websites that promote the development of online communities by providing communication channels for individuals with common interests, often including posting personal information, journals, and photos (Simonson et al., 2009).

Synchronous communication: Real-time interaction between persons at a distance from each other (Moore & Anderson, 2003).

Title IV colleges and universities: Intuitions of higher education that are nationally accredited and provide Federal Student Financial Assistance Programs as authorized by the Higher Education Act of 1965.

Videoconferencing: A form of synchronous communication that involves audio and video communication between two or more distant locations and allows participants from several locations to interact with each other simultaneously (Lenz, Faulkner, & Monaghan, 2006).

Web 2.0: A set of web applications that are participatory and promote collaboration, networking, widespread generation of content, and mixing of existing content for new purposes (Simonson et al., 2009).

Wiki: An online collaborative writing space application that permits collaborative addition and editing of content using standard web browsers (Simonson et al., 2009).

Zoom: A change in the focal length of the camera lens that appears to move the subject closer to or farther away from the camera (Herring & Smaldino, 1998).

II. LITERATURE REVIEW

This chapter examines elements of distance education from a broad perspective, with a specific emphasis on videoconferencing technologies and their use in instruction. It begins with a definition of distance education, followed by a brief review of its current usage in higher education in the United States, and an overview of the primary technologies currently used in distance education. The concept of interaction in instruction is presented with specific focus on interaction in distance education in general and in videoconferencing in specific. The last section discusses the theory of Transactional Distance and the construct of immediacy.

Distance Education Defined

A singular definition of distance education does not exist in the literature, with different perspectives focusing on various aspects of what may be referred to as distance education. In general, all definitions identified for this literature review center on a separation between teacher and student and a general agreement that the elements of distance education include a teacher, one or more students, and a curriculum.

Defined in broad terms, distance education is a formal approach to instruction where the majority of instruction occurs while the teacher and the learner are at a distance from each other. Similarly, the United States Congress differentiated distance education from other forms of learning in a 1992 Office of Technology Assessment report which

broadly defined it as “the transmission of education or instructional programming to geographically dispersed individuals or groups” (as cited in Sherron & Boettcher, 1997, p. 1). By this congressional definition, 19th century correspondence courses marked the beginning of distance education. Delling (1985) views distance education as planned and systematic instruction that is comprised by choice, didactic preparation, presentation of teaching materials, and the supervision and support of student learning, further specifying bridging the physical distance between students and teachers by at least one technical medium (as cited in Simonson et al., 2009, p. 33).

Current understanding of the concept of distance education tends to focus on using technology to transmit instructional material across space and/or time and is generally understood as “learning that takes place when a teacher and student are separated by physical distance and technology is used to bridge the instructional gap” (Martin, 2005, p. 398). Schlosser and Simonson (2006) focus more specifically on the kinds of technology used when they define distance education as “institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors” (p. 1). The introduction of a requirement that the instruction be institutionally based distinguishes distance education from individual self-study. The type of institution is not generally specified and may include colleges, universities, public school systems, businesses or corporations, or other instructional outlets.

In general, Simonson et al. (2009) view the construct of the distance that exists between teacher and student as referring to any or all of the following: geographical

distance, a difference in time, and/or an intellectual distance. Historically, this distance has most often been viewed in geographical terms with the teacher in one location and the student in another. But the implementation of asynchronous instructional technologies such as online instruction and course management systems introduces the concept of time as the defining factor. In asynchronous instruction, the teacher and student can be separated in time, but not necessarily in location.

The distance between teacher and student can be permanent, as is the case of entirely online instruction where the teacher and student do not ever see each other in person, with an accompanying expectation that the vast majority of communication will take place exclusively through discussion tools. Or it can be semi-permanent and combined with traditional face-to-face instruction, as is the case in blended instruction where the teacher and student do meet in person at some points during the learning process. However, what seems to be fairly consistent across definitions is the use of technology and the provision of technology-mediated two-way communication between the teacher and the student(s) throughout the instructional experience to facilitate the learning process (Simonson et al., 2009).

Distance Education Status

While as Wagner (1994) points out, face-to-face instruction remains "the principle and venerated means of transmitting knowledge" in the university setting (p. 7), distance learning in higher education has emerged as a significant method for providing instruction. Recent years have seen a tremendous proliferation of distance education in higher education as a valid educational delivery method as well as a rapid move to

distance education technologies and the development of distance learning systems (Mahle, 2007; Murphy, 1999). In its survey of *Distance Education at Degree-Granting Postsecondary Institutions: 2006-07* the National Center for Education Statistics reports that 65% of two- and four-year Title IV colleges and universities offered credit courses via online, hybrid/blended online, or other distance education technologies, with 32% offering degree or certificate programs that were designed to be completed entirely through distance education (U.S. Department of Education, n.d.). The report estimates 12.2 million enrollments in credit courses at the college level, of which 77% were online courses, 12% were hybrid courses, and 10% were other types of distance education (U.S. Department of Education, n.d.). Clearly, distance education has become a primary delivery method for colleges and universities in the United States and is among the most rapidly advancing aspects of education today (Mahle, 2007).

Distance Education Technologies

From an historical perspective, distance education has been regarded as using technology for instruction across any distance (Heath & Holznagel, 2002). A variety of technologies have been employed to transmit instructional materials to students at a distance. Bates (1995) sees the evolution of distance education as being in parallel with the evolution of technology, being one of the few areas in education where technology has been a principle factor in teaching. The audiovisual technologies used in distance education have included prerecorded media and a variety of combinations of synchronous audio and video components, delivered together or separately in a one-way or two-way mode (Simonson et al., 2009). More recently, web-based applications have been

employed to provide instruction at a distance. Course management systems that integrate a set of Internet instructional tools to provide instructional elements such as content presentation, communication, assignment submission, testing, and management functions via a web browser are being employed (Simonson et al., 2000). While numerous technologies can and have been used in distance education (Simonson et al., 2009), the most common forms employed in the United States are videoconferencing and online instruction (Motamedi, 2001; Stanberry, 2000). These will be the focus of this section of the literature review.

Online Instruction

Online instruction involves instruction that is partially or entirely conducted through the Internet. Course material and information are made available to students via a website and involve applications such as e-mail, course management systems, and collaborative software (Bore, 2005; Williams, 2002). Numerous terms have emerged for online instruction including web-based learning, e-learning, computer-mediated conferencing, and computer-assisted learning (Ko & Rossen, 2003; Schweizer et al., 2002). What the terms have in common is using the Internet as the primary channel through which instruction is delivered. For the purposes of this discussion, these terms will be considered to be synonymous.

Instruction may be delivered synchronously with all students online and communicating at the same time, or asynchronously allowing students to log into the course and work at any time regardless of whether their peers or the instructor are logged in or not (Tallent-Runnels et al., 2006). Garrison, Anderson, and Archer (2003) discuss

two opposing teaching ideologies that have emerged concerning selecting and using asynchronous and synchronous instructional environments. Advocates of synchronous instruction argue that real-time communication is critical to the class experience because it provides higher levels of socialization, support for critical feedback, and social integration of students into the distance education experience. Asynchronous advocates stress greater levels of flexibility in the time, place, and pace of communication between the instructor and students, and among students, and more opportunities for reflective participation by those students.

Whether delivered synchronously or asynchronously, online instruction has tended to present information with little interactivity. As Simonson et al. (2009) observe, course management systems are often used predominantly as a means for making lecture notes and other materials available for student study, a means for students to obtain course materials, and as a method for administering tests and posting grades. The introduction of highly participatory and collaborative web-based tools, known as Web 2.0 technologies, have begun to change the landscape of online education. Applications such as blogs, wikis, podcasting, and social networking are increasingly being used in online education to provide enhanced opportunities for student involvement, collaboration, and content generation.

The combination of online instructional applications with face-to-face instruction, referred to as blended learning, has also emerged as a growing method of instruction. Garrison and Vaughan (2008) describe blended learning as the fusion of face-to-face and

online learning experiences by restructuring content contact hours and online instruction to integrate the strengths of each into a unique learning experience.

Videoconferencing

Videoconferencing is a form of synchronous communication that involves audio and video communication between two or more locations and that allows participants from several locations to interact with each other simultaneously (Lenz et al., 2006). It is live, two-way audio and full motion video that is digitized and transmitted between two or more sites over telecommunications networks (Bore, 2005). Videoconferencing may involve the connection of two locations referred to as point-to-point, or it may involve connections between more than two locations referred to as multi-point (Furr & Ragsdale, 2002).

While videoconferencing is used for other than educational purposes, it has played a significant role in distance education. From an instructional perspective it involves students located in at least two locations receiving instruction at the same time, allowing instructors and students to interact in real-time and facilitating interaction among students (Wisher & Curnow, 2003; Woods & Baker, 2004). It has sometimes been referred to as a one-to-many medium because it permits a single teacher to synchronously provide instruction to students at disparate locations (Knipe & Lee, 2002). Instructors and students use microphones, cameras, speakers, and visual display devices such as monitors or projectors to capture and receive audio and visual portions of instruction. The instructor is often located in a classroom with students and is able to see, hear, and talk with students at remote locations. Additionally, students at different sites

can both see and hear each other, allowing students to participate in discussion (Chen & Willits, 1998).

Generally, videoconferencing has required the use of specialized equipment that has been located in rooms dedicated to its use (Peacock, 2005). However, advances in technology and increasingly affordable personal computer hardware and software have resulted in the capacity to provide videoconferencing capabilities to individuals wherever they have access to an Internet connection (Bore, 2005). Desktop conferencing takes advantage of these developments by using personal computers fitted with cameras, microphones, speakers, and specialized software to bring videoconferencing to the individual, sending and receiving real-time audio and video signals over the Internet. "From their desks or a classroom, students can interact with a remote instructor by audio, video, and keyboard in a synchronous environment" (Furr & Ragsdale, 2002, p. 295). Increasing bandwidth, technology improvements, and declining costs are permitting desktop conferencing to become an increasingly important element in distance education applications (Furr & Ragsdale, 2002).

Effectiveness of Distance Education

Research into the effectiveness of distance education has sought to investigate how these forms of instructional delivery compare to the more traditional, face-to-face learning experience. Most often, criteria for evaluation are student outcomes, student attitudes toward distance education experiences, and overall student satisfaction. These criteria are generally used to compare a distance education course to the same or a similar course taught in a face-to-face environment (Bore, 2005; Heath & Holznagel, 2002). The

results of this research have varied, but in general most have reported no significant difference between various forms of distance education and more traditional forms of instruction (Saba, 2000). But this may be misleading. Results of a meta-analysis of research on distance education effectiveness conducted by Zhao, Lei, Yan, Lai, and Tan (2005) revealed that the aggregated data of studies they reviewed showed no significant difference in student outcomes between face-to-face instruction and distance education. But in examining this data further, they find a remarkable difference across the studies, stating that "distance education programs, just like traditional education programs, vary a great deal in their outcomes, and the outcome of distance education is associated with a number of pedagogical and technological factors" (Zhao et al., 2005, p. 1836). It is these technological factors as they are observed in videoconferencing that are the focus of this section of the literature review.

Evaluation of Videoconferencing

The instructional effectiveness of videoconferencing can be evaluated from a number of perspectives. When looking solely at student outcome, a common finding in the literature is little or no significant difference between videoconferencing and face-to-face instruction (Chisholm et al., 2000; Mobley, 2003; Wade, Cobb, Spruill, & Chisholm, 1999; Ward, Garrett, & Marsh, 2006). Wade et al. (1999) conducted a study in which three years' worth of data concerning student grades in an advanced pharmacokinetics course was examined. During the three years, students received instruction in a face-to-face mode, a combination of face-to-face and videoconferencing, and entirely by videoconferencing. No statistically significant difference was found in final grades

between any of the three instructional delivery methods. Similarly, in order to address concerns about the impact of videoconferencing on academic performance, Mobley (2003) compared the academic performance of students in four courses at three different sites, some of whom attended classes in a face-to-face setting and others via videoconferencing. No significant difference in the performance of students who received instruction via videoconferencing and those who attended classes in a traditional setting was found. These studies tend to typify those found in the literature, and the research in the field indicates that videoconferencing provides for equally effective instruction as measured by student outcomes.

But student outcome is not the only criterion for evaluation. The body of research also provides insight into another element in the assessment of effectiveness: student perception of and satisfaction with videoconferencing as an instructional delivery method. A predominant finding of the literature is a perceived difference in the frequency and quality of interaction between the instructor and students at local and remote sites and a lower level of satisfaction with instruction exhibited by students at remote locations (Knipe & Lee, 2002; Murphy, 1999; Raffelini, 2006; Simonson et al., 2009; Skopek & Schuhmann, 2008).

Ward et al. (2006) conducted a retrospective review of examining grades and student performance on assignments over three semesters of the same team that taught the therapeutics/pathophysiology course delivered via videoconferencing between four sites. Although students initially expressed a belief that they would perform better if instruction was delivered in a face-to-face setting, no significant difference was found in

student performance on assignments or examinations based on student location. It was therefore concluded that instructor presence in the classroom had little or no effect on student outcomes. But when examining whether instructor presence in the local classroom influenced student perceptions of their performance, a difference was found. Nearly 90% of respondents felt that having the instructor in the room with them had a positive impact on their academic performance, with 65% stating that having the instructor at a distance negatively impacted it. Further, a significant difference existed in student perception of videoconferencing as an effective instructional tool. Ward et al. concluded that while teacher presence in the classroom is not essential for students to perform satisfactorily, it may increase their perception that they can.

Raffelini (2006) examined the impact of location on the interaction between the instructor and students in videoconferenced medical school courses. Because the teacher in this study rotated between sites, all students experienced both face-to-face and videoconferenced classes. A questionnaire was used to collect information on student perceptions of interactions between the instructor and themselves, and between students at different sites. Raffelini found that interactions between the instructor and the students at the local site were more numerous and frequent than between the instructor and the remote site. Nearly 90% of respondents said that students in the originating site interacted more with the instructor than remote students. Only a somewhat smaller percentage felt that the instructor interacted with local students more frequently than with remote students, and two thirds of respondents indicated that there were more local student–teacher discussions than remote student–teacher discussions. Additionally, the

instructor seemed more comfortable interacting with local students than remote ones. A majority of students stressed what they perceived as a difference in the intensity of relationship between the instructor and the students based on location of the instructor, and nearly 70% of respondents expressed a feeling of inequality between sites. When at the remote site, students shared a sense of exclusion from other students, the instructor, and course content. Raffelini concludes that the quality and frequency of interactions was influenced by videoconferencing, suggesting that effective methods for reducing social distance that separates students at remote sites must be identified.

These results echo much of what is found in research into this area, namely that students who attend classes in remote sites generally report feeling like "second class citizens" (Kidd & Stamatakis, 2006, p. 2), and find interactions to be compromised and participation in discussions to be difficult (Simonson et al., 2009). Therefore, it is reasonable to conclude that student satisfaction with videoconferencing as an instructional tool is a cause for concern.

But why do students at remote locations have these perceptions? Among the greatest concerns associated with distance education is the level of interaction between instructors and students (Brooks, 2003; Purcell-Robertson & Purcell, 2000). Skopek and Schuhmann (2008) suggest that while videoconferencing may be the most interactive of distance education environments, perceptions of neglect by the instructor exist among students taking classes via this instructional delivery method. Simonson et al. (2009) find that a key to instruction in synchronous environments requires actively engaging students at remote locations, and note that distance education brings with it an increased need for

active participation. They go so far as to refer to a lack of student participation as the "kiss of death" for distance education courses (Simonson et al., 2009, p. 192). Engaging remote and local students equally presents a significant challenge to instructors, who must be intentional in their attempts to stimulate remote student engagement (Chakraborty & Victor, 2005; Raffelini, 2006). The addition of technology between the instructor and the students at remote sites increases the difficulties teachers face when attempting to interact with students at a distance, widening the communications gap between them. The frequency and quality of instructional interaction in videoconferencing, most particularly inequalities between those in the classroom with the instructor and those at distant sites, is of concern in the literature.

In order to examine interaction in videoconferencing, it is first necessary to consider interaction and the related construct of immediacy in greater depth. These are the subjects of the next section of the discussion.

Interaction

Definition of Interaction

The importance of interaction in instruction seems to be so generally accepted as to be a given, being seen as education in its most fundamental form (Garrison & Shale, 1990). Keegan (1996) suggests that interaction is central to effective learning. But while the importance of interaction in the classroom may seem self-evident and may enjoy wide support in the literature, a clear definition of the term is somewhat more elusive (Moore & Kearsley, 1996; Murphy, 1999). A review of prominent definitions follows. Wagner (1994) provides a foundational definition, holding that "Interactions are reciprocal events

that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another" (p. 8). Mahle (2007) narrows this focus by conceptualizing interaction as the level of communication, participation, and feedback between learners and instructors. Moore and Kearsley (1996) focus their perspective on the individual by stating that changes in the learner's understanding of content are the result of a process of personally interacting with it. Weller (1988) concurs with this idea, positing that a lesson's interactivity is an active process that enables learners to adapt content to their individual abilities and levels. Moore (1989) acknowledges the quantity of possible definitions when he notes that "Interaction is another important term that carries so many meanings as to be almost useless unless specific sub-meanings can be defined and generally agreed upon" (p. 1).

While definitions of interaction abound, instructional theory has placed a significant emphasis on the concept of feedback in the form of teachers providing students with thoughtful comments on their work, thereby helping students to grasp concepts and learn material. Not only have teachers been urged to provide frequent and appropriate evaluation of student work during the learning process, they have also been encouraged to employ social interaction as a motivational tool. Research in traditional face-to-face instruction has demonstrated that increasing levels of teacher–student interaction can enhance not only student achievement but also student educational involvement (Muirhead, 1999).

Bates (1995) took a somewhat different tack concerning interaction in the learning process, stating that there are two separate contexts for interaction. The first is

the individual and isolated interaction of the student with course material. But Bates takes a broader view of interaction between and among people than Moore, suggesting a social interaction as the second context. This form of interaction takes place between the student and teacher, or between students. Bates believes that both kinds of interaction are important in the learning process and require attention in designing instructional experiences in order to maximize the potential of each. Further defining the concept in order to assist educators in understanding the learning process, Henri (1992) developed an analytical model that emphasizes five dimensions of the learning process: participation, interaction, social, cognitive, and metacognitive. Building on Henri's model, Oliver and McLoughlin (1996) recognized five different kinds of interaction: social, procedural, expository, explanatory, and cognitive. In social interaction teachers interact with students in order to develop a social connection. This form of interaction may be as simple as asking a student "How are you?" Procedural interaction is a dialogue between a teacher and a student concerning direct and factual information about the management and expectations of the course, such as about assignment requirements. Expository interaction occurs when a teacher or student expresses his or her understanding of learning material by answering questions about it. Teachers engage in explanatory interaction when they use the student's reaction to explain some new information. Cognitive interaction involves the teacher providing a constructive reaction to the student, leading the student to reexamine his or her own ideas and make changes based on this new information. As a comparison between the distance learning environment and the traditional classroom, it has been found that the most commonly

used interactions in distance learning are procedural and expository, whereas cognition, social, and explanatory are the most often used in the traditional classroom (Offir & Lev, J., 2000).

Importance of Interaction in Instruction

The literature provides a number of perspectives on the role, function, and importance of interaction in the learning process, with emphasis being placed on its ability to provide motivation, stimulation, achievement, and student involvement. Carville and Mitchell (2000) find that interaction not only provides educational stimulation, but also contend that understanding is developed through interacting with other people and with ideas. Zirkin and Sumler (1995) found that interaction has an impact on student achievement, and has a positive relationship between the level of interaction and student learning, stating that "The weight of evidence from the research reviewed was that increased student involvement by immediate interaction resulted in increased learning as reflected in test performance, grades, and student satisfaction" (p. 101). Moore and Kearsley (1996) concur, stressing the importance of learners having appropriate and sufficient interactions with the instructor, their fellow students, and the material they are learning. Offir and Lev, J. (2000) find that interaction between teachers and learners is a dominant factor in the efficiency of the learning process as it can lead to learners taking an active part in the learning process, encouraging them to make decisions and analyze knowledge that is being transferred. As Murphy (1999) notes, "Clearly, student–student and faculty–student interaction is a crucial element in effective

instruction" (p. 2). Kennedy (2004) echoes this position when he states that interactivity can increase motivation and lead to better learning outcomes.

Given the critical nature of interaction in instruction, in its many forms, it would seem to follow that student perceptions of instructional quality would also be impacted by the level of interaction they experience during the learning process. The literature bears this out, introducing the concept of interaction involvement. Cegala, Savage, Brunner, and Conrad (1982) define interaction involvement as the measure of how engaged participants are in an interaction. Laurel (1991) expands on this thought, stating that perceptions of interaction exist on a continuum that contains four variables: frequency, range, significance, and feeling of participation. Frequency refers to how often choices are made available to the learner; range is identified as how many choices are available; significance refers to how much the choices affect the situation; and feeling of participation indicates how immersed the learner feels in the experience. Laurel believes that a highly interactive learning experience is one in which the learner feels engaged in an experience that includes frequent opportunities to make a wide array of significant choices. Visser and Keller (1990) found that research into the relationship between interaction, student success, and motivation demonstrates a strong relationship among these factors. Roblyer and Ekhaml (2000) conclude that the degree of interaction present in instruction is a primary factor in students' perceptions of course quality.

Interaction in Distance Education

Instructional interaction's value is not limited to the traditional classroom setting. Research generally supports the importance of interaction in distance education (Lehman

& Dewey, 1998). Woods and Baker (2004) note a "significant emphasis in the literature about how to promote interpersonal interaction with the tacit understanding that high levels of interaction will produce positive results, particularly results related to social dynamics" (p. 5). Atkinson (1999) notes that interaction is a major component in positive learner attitudes toward distance learning. Fischer and Scarff (1998) conclude that interactivity is of primary importance in technology-mediated environments, while Mahle (2007) sees interactive communication as a component that must be given serious consideration in distance learning environments. Didactic conversation and dialogue are viewed as critical and essential components of effective distance education (Hackman & Walker, 1990). The relative importance of this element of distance instruction would seem to point to a need to understand interaction's implications for and impact on the distance learning environment.

But how does interactivity differ in distance learning environments? Umphrey et al. (2008) argue that the literature reveals the belief that face-to-face communication provides a setting rich with opportunities for quick feedback, nonverbal cues, and a high personal focus that is altered in distance education. The inherently leaner medium of distance education reduces the participant's interactive experience. A distinction may be made by the use of the technology itself. While some authors view interaction and interactivity as synonymous, Wagner (1994) draws a distinction between the two, seeing interaction in distance education as a process of exchange in which individuals and groups influence each other and where the interactions are interpersonal and occur within an instructional context. By contrast, interactivity is a characteristic of the technology

used in distance education. It is the technological capability for establishing connections between points in real time. "Interactivity may eventually be viewed as a machine attribute, while interaction may be perceived as an outcome of using interactive instructional delivery systems" (Wagner, 1994, p. 26). Put another way, interaction refers to people's behaviors while interactivity refers to characteristics of the technology system (Wagner, 1994). Wagner's distinction between people and machines is an interesting and arguably critical one as it brings focus to not only what a technology system can do but how people can reasonably be expected to use it. Spitzer (1998) would seem to concur with this assessment, warning that the social dimension of learning can be forgotten in an excessive preoccupation with technology. As Cyrs (2003) states, "Students never learn from the technology. They learn from the way instructors communicate or show how to communicate through the technology" (p. 26). But technology and the people who use it are inextricably tied together in learning that uses telecommunications as a medium of delivery. Seeing a clear relationship between interaction and interactivity in distance education, Roblyer and Ekhaml (2000) suggest that technologies that permit high levels of interactivity are necessary in order to provide for high levels of interaction between individuals, between groups, and indeed between an individual and the technology itself. This is borne out by the literature, demonstrating that technology systems that incorporate high levels of interactivity and two-way communications capabilities are the most effective in meeting the needs of instruction (Ellis & Mathis, 1985; Hackman & Walker, 1990; Hough, 1984; Kozma, 1986). But distance education courses are not always designed to provide sufficient opportunities for

a variety of types of interaction. Bates (1990) believes that interaction among students is often neglected in designing and implementing distance education. The situation does not seem to have improved noticeably since Bates' publication. Muirhead (2001) notes that while interaction between students and instructors has a significant impact on the quality of distance education programs, he finds that research in the area reveals a problematic lack of it. Similarly, Chakraborty and Victor (2005) find evidence that many distance education courses provide weak levels of interaction because they tend to use overly verbal approaches to instruction that only serve to repeat limitations of traditional classroom instruction. While students' reactions and responsiveness may be considered a given in the traditional classroom, the same is not the case in distance learning. As Mottet (2000) states, distance education occurs in environments where the technology filters out portions of communication.

From the literature, it is clear that interaction is considered to be of utmost importance in traditional instruction. But in the venue of distance education it is arguably more important still. It is also an area of significant concern for the distance education industry, as is noted by Roblyer and Ekhaml (2000) when they cite faculty and students' serious doubts that distance learning can offer the same degree of interaction as can be found in a non-distance classroom. The impact of the separation of student from teacher must not be overlooked when designing courses for a distance education environment. Students taking a course from a distance often feel a sense of remoteness from the instructor and their peers, presenting what Woods and Baker (2004) see as "perhaps the greatest obstacle to fostering a student's sense community" in a distance course (p. 6). If

Bates' concept of social interaction is to be taken seriously, then it seems clear that ensuring that ample opportunities for distance students to engage with their instructor and their fellow classmates is critical. The literature seems to concur with this assessment, finding student satisfaction with distance learning to be strongly tied to the course's level of interaction. As examples, Roblyer and Ekhaml's (2000) study of the State University of Georgia's teacher education program revealed that a primary factor in student evaluation of course quality is the degree of interaction it contained. They contend that this observation is in keeping with previous research. Davie's (1988) study of graduate-level distance courses also reported high levels of student satisfaction that were primarily due to levels of interaction. Chakraborty and Victor (2005) posit that the most effective way to promote student success in the distance environment is to increase the communication and interaction between students and teachers. Recommendations abound for distance educators to examine interaction in distance education in order to identify strategies to enhance communication in the instructional setting (Chakraborty & Victor, 2005; Murphy, 1999; Peterson, 2004).

Interaction in Videoconferencing

Because the teacher and students can see and hear each other in real time, interaction in videoconferencing is seen as more intensive than in other distance education methods. Indeed, Offir and Lev, J. (2000) assert that videoconferencing is the most interactive technology used in distance education. While this may be true, the literature discusses a number of concerns stressing that interactions in this environment cannot be viewed as duplicates of those found in the face-to-face classroom. Heath and

Holznagel (2002) state that the synchronous connections between and among students, between students and the teacher, and between locations that videoconferencing establishes provide opportunities for heightened interaction. But they caution that assuming that using the technology will inherently result in automatically high levels of interaction is misguided. "Interactions between students as well as between teachers and students must be designed into the lesson and fostered constantly by the instructor" (Offir & Lev, Y., 2000, p. 12). Numerous authors find that interaction in the videoconferenced classroom may well be less than optimal, raising questions about the overall effectiveness of this delivery method. To use Wagner's (1994) distinction between the two, videoconferencing is a rich source of interactivity, but not necessarily interaction.

While the use of cameras, microphones, television monitors, and/or projectors provide teachers and students located miles away from each other the ability to see and hear each other in real time, those very pieces of equipment may place limits on the levels of interaction that can be employed in instruction (Carville & Mitchell, 2000). Stenerson (1999) contends that students' awareness of technology may have a significant impact on their normal communication styles. In a study of three different learning environments, Ritchie and Newby (1989) found that students in a videoconferenced classroom were very aware of the cameras, monitors, and having to speak into microphones to be heard. They felt less involved in the class, less able to ask questions, and they enjoyed the class less than in a more traditional, face-to-face setting. In studying the impact of videoconferencing on professional education, Johnson and Roman (2003) found that videoconferencing technology can create a barrier to establishing a

sense of interest and trust between students and the instructor. Mottet (2000) finds that the nature of interaction between students and the instructor is disrupted in the videoconferenced classroom, noting that communication that is transmitted through sight and sound in the face-to-face context must be captured and transmitted through space and time in the videoconferenced context. He suggests that some of those messages may be altered or distorted, most particularly the nonverbal aspects of interaction. This is supported by Culnan and Markus (1987) when they state that electronic communication technology may filter out cues that are found in traditional face-to-face classroom environments, making it more difficult to regulate conversations, gather social contexts for the messages transmitted, and form impressions of others at the other end of the system. Harris and Sherblom (2008) and Umphrey et al. (2008) also discuss a decrease in both visual and vocal cues available in the videoconferenced environment, suggesting that the experience of connectedness, communication satisfaction, and communication quality may all be reduced. The impact of a reduced set of verbal and visual cues may impact not only students' perceptions, but also their behavior. Walker and Hackman (1991) found that students in videoconferenced classes "who have limited access to environmental cues may need to focus on nonverbal behaviors to a greater extent than those in the physically proximate classroom" (p. 11).

The impact of the technology is not limited to the perceptions of nonverbal aspects of communication. In evaluating the effectiveness of videoconferencing as a teaching and learning medium, Carville and Mitchell (2000) found that the technology had a direct impact on the instructor's delivery. Instructors who participated in the study

stated that they felt their instructional delivery style was far more stilted and formal and less interactive. This finding is echoed by Peterson's (2004) observation that efforts to involve students at remote sites may seem artificial or forced. In Carville and Mitchell's (2000) study, a time delay in the audio portion of the transmission had several effects on this aspect of instruction, causing the teachers to slow their rate of speech and discouraging them from encouraging questions from the remote site. They also experienced difficulty in identifying students at the remote site, and in interpreting nonverbal gestures such as indicating the desire to ask a question. The students at the remote site also reacted to the situation, stating that they had to develop strategies for coping with the technology that were different from classes where the instructor is in the same room with them, including having to remain more alert and paying more attention to what they heard than what they saw. Additionally, they felt that students at the originating site were allowed to contribute to discussion at much greater length. This gave the students at the remote site the impression that the teacher was ignoring them. From a visual perspective, the teachers noticed having to remain in a fairly static position and restrict their body movements in order to remain in view of the camera lens. They also identified a need to remember to look into the lens to establish eye contact with the students at the remote site, whom they saw on a television monitor. Several of the instructors mentioned the toll that teaching in this environment had taken on them personally, feeling drained after each class (Carville & Mitchell, 2000).

Peterson's (2004) work may serve to identify both effective strategies for enhancing interaction between the instructor and remote students, as well as their

limitations. Conducting a study of graduate-level nursing instruction offered in two locations through West Virginia University's Interactive Video Network, Peterson attempted to identify best practices in videoconferencing that accentuate the quality of interaction. In this study, the instructor actively used strategies to encourage interaction, such as student discussion and alternating between local and originating sites when calling on students for response. The student respondents felt this generated an atmosphere that was conducive to both educational goals and social interaction and that it tended to facilitate it. Some students stated that since an expectation that the instructor would call on them existed, they spoke more quickly than they might otherwise have. The participants did not feel the technology caused them to feel isolated from the instructor or have difficulty participating in discussions or relating to other students. However, both the instructor and students described interactions as "stifled" and "artificial" (Peterson, 2004, p. 67). Additionally, students at the remote site discussed a necessity to make a concerted effort to be heard, feeling that it was more difficult to get the instructor's attention. As a result, Peterson's study would seem to indicate that a focused approach to encourage interaction with students at each site may improve the situation, but that it will not by itself answer all concerns about interaction quality.

A number of other strategies for increasing interactions and their quality can be found in the literature. The necessity to call remote students by name rather than the location of their classroom is mentioned numerous times, as is posing questions actively to students at all sites. Purposefully alternating between sites in questioning and discussion facilitation is seen as a significant contributor to student interaction, as is the

importance of maintaining eye contact by looking directly into the camera lens (Carville & Mitchell, 2000; Chakraborty & Victor, 2005; Peterson, 2004).

Transactional Distance Theory

Whatever form it may take, distance education is predicated on the absence of the instructor from at least some of the students during the instructional process. This distance between learner and teacher may impact the level and quality of interactions, creating an "informationalizing of the learning environment and thereby potentially decreasing the effectiveness of the instruction" (Peterson, 2004, p. 64). In order to systematically study and more completely understand the interactional complexities of distance education, a theoretical framework for interaction in distance learning has emerged.

Moore's Theory of Transactional Distance is discussed at some length in the literature and serves as a foundation of distance education theory. The theory, derived from Dewey (Dewey & Bentley, 1949) and developed by Boyd and Apps (1980), describes the "interplay among the environment, the individuals and the patterns of behaviors in a situation" (as cited in Moore, 1997, p. 22). Moore argues that distance education is not only a geographic separation of teachers and students, but a pedagogical one as well. He conceptualizes distance education as a transaction that occurs between instructors and students in an environment where they are separated from one another. Transactional distance describes the collection of relationships between teachers and students that exists when they are separated by time and/or space. It refers to a distance of understanding and perception that creates a psychological and communications space

between the teacher and the student, which may lead to misunderstandings between the instructor's and the student's input. Transactional distance is this psychological and communications space. However, the distance between the teacher and students is a continuous variable rather than a discrete one, meaning that the distance between the teacher and each student is not identical. Therefore, the distance between the teacher and student #1 will be somewhat different than the distance between the teacher and student #2, and so forth.

The pedagogical aspects of transactional distance are not limited only to distance education environments, and occur in traditional face-to-face classrooms. But the separation of teacher and student in the distance environment is considered to have a more significant effect on teaching and learning. Seeing distance education as a subset of the larger whole of education, Moore (1997) argues that the separation of teacher and student in distance education is significant enough that it leads to special patterns of learner and teacher behaviors that profoundly affect both teaching and learning. Therefore, special teaching and learning strategies and techniques are required. He sees these special instructional strategies and techniques as falling into three categories, two of which center on teacher behaviors and a third that centers on student behavior. The extent of transactional distance that exists in instruction is a function of these three sets of variables, which he identifies as Dialogue, Structure, and Learner Autonomy (Moore, 1997).

Dialogue centers on the interchange of words, actions, and ideas that occurs between the teacher and the learner when one gives instruction and the other responds to

it. Moore (1997) draws a distinction between dialogue and interaction, stating that dialogue is purposeful, constructive, and valued by each party to it. It is characterized by respect, active listening, and mutual and synergistic contribution that is directed toward improved student comprehension. While interaction may be neutral or negative, Moore reserves the term dialogue to refer only to positive interactions. The extent and nature of the dialogue in an instructional setting is determined by course design, personalities, subject matter, and the environment. The personalities of the teacher and the student play a role in determining whether or not they are willing and able to take full advantage of the opportunities for dialogue that exist in the setting. Based on his own experience, Moore argues that subject matter also impacts dialogue, noting that it is influenced both by content and academic level. He suggests that courses at the graduate level, particularly in disciplines like the social sciences, offer the opportunity for highly inductive teaching methods. Courses that focus on basic information content, particularly in disciplines like the hard sciences and mathematics, may require a more teacher-directed approach (Moore, 1997). Holmberg (1986) suggests that dialogue between teacher and student is the most critical aspect of distance education. As dialogue increases, transactional distance decreases. As Moore sees it, whether or not dialogue between learners and instructors is possible and the extent to which it is achieved are major determinants of the extent to which the transactional distance will be overcome (Atkinson, 1999).

Structure refers to course design, or the way the course is structured in order to be delivered through communications media. It reflects the flexibility of the course's

instructional objectives, teaching strategies, and evaluation methods and describes to what extent the course can respond to individual learning needs (Moore, 1997). In distance education, the nature of the communication medium used for the course plays a large role in determining the necessary structure. But in a larger context the philosophy and emotional characteristics of the teacher and the students and institutional constraints impact the structure imposed on a course. When a course is highly structured, with entirely predetermined content and every activity proscribed in advance, there is little room for flexibility or variation from the plan and therefore little room to respond to the individual needs of students. Dialogue between the teacher and the student will likely be rare, and transaction distance will be high (Moore, 1997). Courses with low transactional distance are more loosely structured, provide student direction and guidance through ongoing dialogue with the instructor, and use materials that allow students to modify them to meet their particular learning needs or styles. When there is no dialogue or structure, students must make their own decisions about what to study and how to study it. The greater the structure and the lower the dialogue, the more responsibility the student must assume for his or her own learning. This is referred to as learner autonomy (Atkinson, 1999).

Learner autonomy is the extent to which the student, rather than the teacher, determines the goals, learning experiences, and evaluation decisions of the course. A fully autonomous learner would be an adult who is emotionally independent of an instructor, does not require any assistance in the learning process, and is able to engage in entirely self-directed learning. Since, as Moore notes, this is an ideal and only a minority

of students is prepared for truly self-directed learning, teachers bear the obligation to assist students in developing the skills necessary for autonomous learning (1997). In examining distance education courses to determine the extent to which teachers and learners control the main instructional processes, Moore hypothesized a relationship between transactional distance and learner autonomy. He found that students who have more well-developed competence as autonomous learners are comfortable with less dialogue and little structure, and therefore more transactional distance. More dependent students tend to prefer more dialogue and more structure, whether that structure is formal and provided by the course design or informal and found in the personal relationship with the instructor.

The nature of the communications medium used in distance education also has a direct influence the transactional distance found in instructional situations. As Heath and Holznagel (2002) note, each medium has its strengths and weaknesses in terms of interactive potential and has a direct impact on the instructional setting. Moore (1997) contends that the interactive components of distance education technologies are a major factor in establishing the level of transactional distance. By manipulating the media used it is possible to increase dialogue, and thereby reduce transactional distance. When communication is solely one-way, as in prerecorded video modules, the medium does not offer any opportunities for dialogue between the teacher and the student and transactional distance will be high. Correspondence courses and asynchronous online education provide methods for two-way communication via the postal service, email, or discussion tools. Opportunities for dialogue that is thoughtful and reflective, if somewhat less

spontaneous, are provided which reduces transactional distance. Videoconferencing is a far more interactive, synchronous distance education technology and provides for more intensive, more personalized, and more dynamic dialogue. It therefore has the potential to bridge transactional distance more effectively than other, less interactive technologies (Moore, 1997).

Saba (1988) proposed a system dynamics model to represent the relationship between dialogue, structure, and autonomy. Saba and Shearer (1994) used this model to measure teacher and learner behaviors in 30 interactions between instructors and students in a computer conferencing setting where they could see each other via a video link and talk with each other via telephone. Each student worked individually with the instructor, and student satisfaction was evaluated. Defining dialogue as the extent of verbal interaction between teacher and student, the discourse analysis counted and categorized each act of speech. Very much in keeping with Moore's theory, structure was defined as the course's responsiveness to individual student needs, and was measured by the extent that pace, sequence, feedback, and content were organized. Defined as "a function of the variance of dialogue and structure as they relate to each other" (Saba & Shearer, 1994, p. 42), transactional distance was measured as the ratio between the amount of dialogue and the extent of structure. They found that transactional distance varied differently with dialogue and structure. An inverse proportion was found between transactional distance and dialogue in that as dialogue increased, distance decreased. But as structure increased so did transactional distance. The validity of the study is limited by the fact that it looked at transactional distance as a function of the variance in dialogue and structure, which is

not entirely in keeping with the theory. Additionally, the study only examined one-on-one interaction and did not include other forms of interaction that occur in a more standard classroom setting. Therefore generalization is problematic.

In conducting factor and path analysis of videoconferencing to explore the dimensions of instructional transactions, Chen and Willits (1998) tested Moore's theory by looking at the experiences of postsecondary students in 12 videoconferencing classes at Pennsylvania State University and examined in-class discussion, out-of-class face-to-face interaction, and out-of-class electronic communication. Frequency of occurrence was used to measure dialogue. Structure was evaluated by examining teaching methods, learning activities, choice of readings, requirements, deadlines, and grading and was measured by student perceptions of its level of rigidity or flexibility. Learner autonomy was defined as the students' ability to self-direct their work and develop personal study plans. Transactional distance was defined as the distance between the understandings and perceptions of teachers, students at the originating site, and students at the remote site. Their findings only partially support Moore's theory. Dialogue had a positive direct and indirect effect on learning outcomes. Transactional distance was inversely related to learning outcomes, but structure and autonomy had no significant impact on learning outcomes. Transactional distance between the teacher and the students and the frequency of class discussion were the only significant factors. The greater the perceived transactional distance between the teacher and the student, the lower the perceived outcome. The more frequent class discussion, the higher the learning outcome. These factors influenced student perceptions of the transactional distance between themselves

and their peers, both at the same and different sites. Limitations of this study include the fact that data was collected only once during the semester and was in the form of subjective perceptions at only one point in time rather than observable behaviors or measurements taken multiple times during the semester to gain a more holistic view of student perception.

Shin (2002, 2003) proposed a link between transactional distance theory and the concept of presence in the videoconferencing classroom, coining the term "transactional presence, which he defines as:

> The degree to which a distance student perceives the availability of and connectedness with people in his/her educational setting. "Availability" implies that what is needed or desired is obtainable upon request involving the responsiveness of interpersonal relationships. "Connectedness" indicates the belief or feeling that a reciprocal relationship exists between two or more parties, involving an individual's subjective judgment upon the extent of the engagement in relationships with others. (2003, p. 71)

In testing his theory in postsecondary distance education classes, Shin found that distance students' perceptions of the psychological presence of the teacher and peers can be a significant predictor of their success, and that availability and connectedness were significantly correlated constructs. He suggests that understanding transactional presence may be useful in evaluating the effectiveness of instruction, specifically in videoconferencing classroom settings.

Other research supports Shin's findings. Chen (1997, as cited in Shin, 2003) compared students who were in the same room with the teacher with those who were at a remote site and found that the teacher's physical presence had a positive influence on student participation in discussion, as well as their perceived learning achievement. Knipe and Lee (2002) compared learning experiences of students at local and remote videoconferencing sites using a self-observation schedule and found a significant difference in attitude and achievement between the students based on location. Attitude and achievement were both significantly higher for the local students.

Immediacy

Shin's transactional presence construct refers to the feeling of closeness and connectedness distance students feel with others in their educational setting (Shin, 2002, 2003). A focus on a feeling of closeness in transactional distance and transactional presence seems to link with the concepts of immediacy and social presence as seen in the literature on instructional interaction. Mehrabian defines immediacy as the extent to which physical or psychological closeness in interpersonal communication is enhanced by communication behaviors, or put another way, it is communication behaviors that reduce perceived distance between people and is the presence, warmth, and attraction that is conveyed in interaction between people (as cited in Woods & Baker, 2004). Feelings of connectedness have also been described as the degree to which the participants in an interaction feel connected to each other (Umphrey et al., 2008). The more immediate a person is, the more likely he or she is to be viewed as being friendly and warm (Woods & Baker, 2004).

Immediacy is generally considered to be a behavioral construct, with both verbal and nonverbal components. As Offir, Lev, Lev, Barth, & Shteinbok (2004) note, human communication contains both verbal and nonverbal message components. The verbal messages transmit information linguistically, in the form of words. Verbal immediacy behaviors have been identified as "linguistic differences in expressions from which feelings of like and dislike are inferred" and are influenced by word selection, sharing personal examples, asking questions, using humor, addressing individuals by name, and initiating discussion (Woods & Baker, 2004, p. 4). Nonverbal messages transmit information via external appearance, eye contact, posture, body movement, physical proximity, touch, gestures, facial expressions, and voice characteristics. Nonverbal immediacy behaviors include leaning toward another person, facing another person, establishing and maintaining eye contact, positive head nods, and vocal expressiveness. Immediacy that is generated by nonverbal communication is a sense of psychological closeness that is produced by these physical behaviors. In general, the more a person smiles, engages in eye contact, calls another person by name in an interaction, uses personal examples, uses direct body orientations, gestures and touch, and is vocally expressive, the more friendly and warm—or immediate—he or she will seem (Woods & Baker, 2004).

Immediacy was originally developed in the context of interpersonal communication, but has frequently been used in instructional communication research as well and is seen as an important factor in classroom environments (Gunawardena, 1995; Woods & Baker, 2004). Since Richmond, Gorham, and McCroskey (1987) identified

non-verbal immediacy behaviors and Gorham (1988) added verbal-linguistic behaviors to the construct, these behaviors have been studied in both traditional classrooms and mediated classrooms and have been shown to significantly impact both learning and teacher–student relationships (Gorham, 1988; Kelley & Gorham, 1988; Richmond et al., 1987). Research in traditional face-to-face instruction stresses the importance of teacher immediacy in the instructional process, demonstrating that it has both a positive relationship with student learning as well as a significant impact on it (Gorham, 1988; Richmond et al., 1987). In terms of student satisfaction with instruction and their instructor, immediacy behaviors seem to play a significant role (Hackman & Walker, 1990). Hackman and Walker find that instructors who engage in behaviors that minimize the psychological distance between themselves and their students are seen as being more fair and effective. The importance of immediacy in the classroom is underscored by Walker and Hackman (1991) when they write "If the principle means of delivering instruction remains the lecture, those instructors who use immediate behaviors (whether naturally or strategically) will likely be perceived as more socially present and conveying more information than those who do not" (p. 11).

In the instructional context verbal immediacy behaviors also include things like encouraging students, praising student contributions, thinking aloud, involving students in discussion, clarifying student contributions and stimulating discussion about them to take ideas further, stating positions on issues, and using self-disclosure (Hackman & Walker, 1990; Offir et al., 2004; Walker & Hackman, 1991; Woods & Baker, 2004). Richmond et al. (1987) identified nonverbal immediacy behaviors in instruction that

include smiling at students, moving around the classroom while teaching, having a relaxed body position while teaching, and using vocal variety while speaking to students. More recently, Umphrey et al. (2008) examined differences in the student communications experience in face-to-face and videoconferencing environments, surveying students in 24 different videoconferencing courses. They measured student perception of immediacy, connectedness, communication quality and satisfaction, and interaction involvement. In both environments, the students' perceptions of connectedness were affected by their perceptions of instructor immediacy, as expressed in the instructor's perceived presence and warmth. Instructor relational characteristics of immediacy and receptivity, perceptions of connectedness, communication satisfaction and quality, and interaction involvement were all rated significantly more positively in the face-to-face context than the videoconferencing one. Significant differences in perceptions of communication satisfaction and quality in the face-to-face environment were found. Most importantly from an immediacy perspective, the perceived degree of connectedness was affected by perceptions of instructor immediacy. The authors find that instructors who increase their verbal communication with strategies such as using inclusive pronouns will likely improve the sense of connectedness their students feel in the classroom.

Nonverbal communication and its impact on immediacy are of interest in the literature. A number of studies find that it plays a large role in communication and has a significant effect on impressions, feelings, and attitudes toward other people, approximating 70% of interpersonal communication being transmitted by body language

(Anderson & Kent, 2002; Hackman & Walker, 1990; Freitas, Myers, & Avtgis, 1998; Offir & et al. 2004; Peterson, 2004; Umphrey et al. 2008; Walker & Hackman, 1991; Woods & Baker, 2004). The prominence of nonverbal components in communication is demonstrated by research, indicating that when the verbal and nonverbal messages in an interaction are incompatible, the nonverbal message is given more credibility "since we intuitively feel that people have less control over their nonverbal messages" (Offir et al., 2004, p. 104). The importance of nonverbal communication transfers to classroom environments as well. Offir et al. find that the research demonstrates that significant amounts of conscious and subconscious nonverbal communication take place between teachers and students and cite Grant and Hennings' 1971 finding that teachers transmit 82% of their emotional messages through nonverbal channels (2004, p. 104). Using facial expressions, gestures, and other forms of nonverbal behaviors, teachers mediate between students and the content to enhance student comprehension. These facial expressions are decoded by students to assess the teacher's attitude toward the instructional content, the class, themselves, and the teacher's expectations for the student. Teacher nonverbal behaviors also give indications of agreement or disagreement and acknowledgement that a student wishes to contribute to class discussion. In studying verbal and nonverbal interaction in both distance and traditional classrooms, Offir et al. observed nonverbal teacher behaviors that included walking toward students to shorten the physical distance between them and using gestures to emphasize and clarify content. They observed the use of facial expression while talking and listening to students to convey the instructor's desire to continue or cut short the interaction, as well as the extent

of instructor agreement or disagreement with student statements. Finally, they observed the use of eye contact between the teacher and the student, suggesting that this form of nonverbal communication provides an important method of maintaining communication flow by allowing instructors to help students concentrate and to estimate student comprehension. If, as the research tends to indicate, the nonverbal channels of communication have a greater impact on credibility, attention must be paid to this form of immediacy in instruction.

But the impact of verbal and nonverbal communication is not unidirectional, or only from teacher to student. The literature also discusses the impact of student nonverbal behaviors on teacher performance, finding that student nonverbal expressions play an important role in the formation of the teacher's impressions and attitudes, as well as in reciprocal teacher behavior that creates a circular pattern in teaching and learning. As an example, nonverbal behaviors associated with attentiveness such as maintaining eye contact have been demonstrated to have a positive effect on teacher evaluation of student learning, competence, and attitude (Mottet, 2000). Conversely, the absence of nonverbal attentiveness cues had negative impacts on teacher evaluation of student performance (Mottet, 2000). The timing of student contributions and the latency in student response to teacher requests also impact teacher impressions. Students who tend to make requests at inappropriate times are viewed negatively, whereas students who respond to teacher requests more promptly are viewed more positively (Mottet, 2000). Mottet contends that a teacher's perception of student nonverbal behavior is "most influential in how instructors perceive the interpersonal relationships they have with their

students" (2000, p. 161). Teachers rely heavily on student nonverbal behaviors in evaluating their own performance, using students' behaviors as feedback that encourages some teaching behaviors and discourages others. He posits that "Teaching behavior is then a function of student behavior" (Mottet, 2000, p. 149).

Social presence and immediacy are influenced by the delivery method used for communication. Communications of a socioemotional nature will require a greater sense of presence than those communications that are routine or purely informational (Walker & Hackman, 1991). In the distance education context, social presence is the ability to approximate the characteristics of face-to-face interactions and is influenced by the delivery mode used for the communication. As an example, written communication conveys less social presence than face-to-face delivery of the same information and is less effective in tasks that require higher levels of social connection, such as relationship initiation or conflict resolution (Hackman & Walker, 1990). In 1982 Ruchinkskas found that participants in mediated instruction experienced frustration when social presence was absent from instructional interactions that generally required it (as cited in Hackman & Walker, 1990, p. 3). As Guzley, Avanzino, and Bor (2001) note, instructors in traditional classrooms use verbal and nonverbal immediacy behaviors to engage their students. But for the instructor in the videoconferencing classroom this engagement takes place through camera angles and microphones, causing them to both display and interpret verbal and nonverbal communication as mediated through the technology. Students in videoconferenced classrooms must also decode instructor immediacy through the technology. Freitas et al. (1998) compared student perceptions of instructor verbal and

nonverbal immediacy behaviors in both conventional and synchronous distance education classrooms. While they found no significant differences in perceived instructor verbal immediacy between the environments, a significant difference in perception of instructor nonverbal immediacy was found. Similarly, Offir et al. (2004) compared patterns of verbal and nonverbal teacher–student interactions in both traditional and videoconferenced classrooms using content analysis of verbal and nonverbal behaviors. The central assumptions of the study were that the separation of teachers and learners would create a more formal environment and that it would have a negative effect on the teacher's immediacy behaviors, as demonstrated through verbal and nonverbal behavior patterns. While they found no significant difference in total verbal exchanges between environments, they did find that teachers engaged in procedural interactions more often in the videoconferencing setting, while explanatory interactions and complex verbal interactions were more frequent in the face-to-face classroom than the videoconferencing one. Additionally, teachers in their study used significantly fewer nonverbal behaviors in the videoconferencing classroom than the traditional one. The researchers attribute a reduced number of student questions in the videoconferenced classroom to the teacher's reduced use of nonverbal cues. They see the decrease in explanatory teacher behavior as an indication that instructors in the videoconferencing classroom must ensure that they use both verbal and nonverbal strategies that encourage student engagement.

The presence of instructor immediacy, in the form of both verbal and nonverbal behaviors in the classroom, promotes increased feelings of closeness and connectedness between students and instructors, and therefore enhances instructional interaction, which

in turn has been demonstrated to have a positive effect on both student learning and student satisfaction. While this effect is clearly demonstrated in traditional, face-to-face classrooms, research is still required to understand instructor immediacy behavior in the technology-mediated environment of videoconferencing.

Example Studies

Three research studies have been used to guide the design of this study. These studies are Atkinson (1999), Peterson (2004), and Offir et al. (2004).

Atkinson

Atkinson (1999) used a qualitative case study to examine interaction, the effects of instructional strategies, and participant perceptions that occurred during two courses in higher education taught via videoconferencing. Interactions were grouped using an interaction model, and instructor behaviors included acceptance and clarification of feelings, praise and encouragement, acceptance of ideas, asking questions about content or procedures, lecture, giving direction, and criticizing. Student behaviors included response to instructor, response to another student, and initiation of interaction with the instructor or with another student. General observations included general comments, delays or silences, group discussion, technical delay, camera changes, and the use of document cameras during instruction. Observational data was collected at three specific times over the course of one semester. Additionally, students and the two instructors were interviewed to obtain a qualitative perspective for the study. Observational data was analyzed by frequency, time, and duration.

The results indicated that both instructors talked the entire class for the majority of the observations, and approximately equally with local and remote sites. Instructors were referred to as Case A and Case B. The instructor referred to as Case A was more accepting of remote student ideas but praised local students more, whereas Case B was more accepting of local students and was more critical of remote students. In both cases, the local students were more responsive than the remote students. When comparing the instructors' behaviors, Atkinson concluded that the use of praise and statements of acceptance were effective in soliciting student response and that using student names increased participation.

Peterson

Peterson (2004) studied interaction in a master's level nursing course via the West Virginia University Interactive Video Network. The course used for the study included two sites, with the instructor traveling between them and teaching at each during the semester. Using a combination of observations, interviews, and surveys, Peterson examined how technology impacted interaction over time, at the local versus the remote site, and student perceptions of interaction in the environment. The observational aspect serves as a basis for this current study as it focused on who was talking to whom using six interaction categories: teacher to the entire class, teacher to specific student, originating site student to teacher, remote site student to teacher, student to student at the same site, and student to student at the other site. Students were asked to complete surveys concerning their impressions of interaction and the technology's impact on it. Observations were conducted at 5-minute intervals during class sessions, with a total of

16 hours of class time observed. Both students and the instructor were interviewed to discuss their interaction experiences during the course. Peterson found little fluctuation in interaction patterns over time, and that the teacher to the entire class category was the most frequent. Interestingly, perceptions concerning interaction frequency did not match the actual results. Students perceived that student to student at the same site was most frequent, and both the students and the instructor believed that the instructor interacted most with the remote site. In fact, the teacher interacted more frequently with the local site than the remote. The instructor alternated questions between sites, causing the students at the remote site to answer more quickly than they might otherwise in order to avoid being called on by the instructor. In interviews, both the students and the instructor stated the perception that interactions were stifled and artificial and found that the technology detracted from interaction both at the local and remote sites.

Offir et al.

Offir et al. (2004) used a transactional distance theory approach to examine verbal and nonverbal dialog patterns as compared in face-to-face and videoconferencing instruction among five university professors. The central assumption of the study was that the separation of teachers and students in videoconferencing would have a negative impact on verbal dialog and teacher nonverbal behaviors, with fewer social interactions, more emphasis on procedural interactions, less encouragement for remote students to engage in deeper cognitive interaction, and fewer in-depth exchanges between the instructors and students. A total of 30 lectures in a videoconferencing environment and 30 lectures by the same instructors were videotaped in a more traditional classroom

setting. Behaviors were categorized as social, procedural, expository, explanatory, and in-depth. Nonverbal behaviors observed included eye contact, facial expression, the use of gesture, and changes in posture. One-minute observation intervals were used to collect interaction data. No significant differences were found between the face-to-face and videoconferencing classes in the number of verbal exchanges, social interaction, expository interactions, or in-depth interactions. But explanatory interactions were fewer in the videoconferencing observations. Additionally, in the traditional classroom setting all the nonverbal behaviors were both more frequent and occurred in a wider range than in the videoconferencing environment.

Influences on This Current Study

Aspects of each of these studies were used to formulate a methodology for this current study. Each study utilized interviews and observations of verbal and nonverbal instructor behaviors, which served as a basis for the mixed methods case study approach used in this study. Peterson (2004(focuses on who interacted with whom. Offir et al. (2004) categorized the content of interaction to discern any differences between local and remote populations. Atkinson (1999) observed both instructor and student behaviors based in both interaction and immediacy constructs. Elements of each of these studies were modified for this study; a detailed recitation of the methodology used is presented in chapter three.

III. METHODS

Design

This study used a descriptive case study approach that included collecting and analyzing qualitative, quantitative, and behavior observation data. I observed instructor interaction behavior using archived video recordings of class sessions of the statewide distance education consortium administered by an institute at one of the participating universities. In contrast to experimental research methodologies, case studies are often selected when the focus of research is on a real-life contemporary phenomenon over which researchers have little control or ability to manipulate behaviors, as was the case here (Yin, 2003a). While the information gleaned from this study may inform the instructors' future management of instructional interaction, I had no ability to impact on what happened in the past.

A descriptive case study approach seeks to more fully understand a phenomenon by examining its contextual conditions and presenting a complete description of the phenomenon within its context. That was the purpose of this research. My intent was to gain a greater understanding of how instructors in multi-point videoconferencing classrooms interact with students who are located at multiple locations by examining characteristics of participant instructors and how they interact with students at multiple locations, as compared to their peers in the study. As Good and Brophy (2000) note,

classroom interactions are complex communications that happen rapidly and require instructors to interpret and respond to numerous stimuli at the same time. In the multi-point videoconferencing environment the sources of stimuli increase, with the literature suggesting that the environment itself alters the character of those stimuli. As Yin (2003b) states, the case study is appropriate when the phenomenon being studied is not readily distinguishable from its context and therefore requires that the scope and depth of that context be included as a major part of the study. Simply observing and analyzing discrete instructor interaction behaviors in these classrooms without regard to the context in which those behaviors occur would provide an insufficiently narrow perspective that fails to acknowledge the complexity of this environment and the interactions that occur within it. In keeping with the descriptive case study's all-encompassing approach that collects multiple forms of data (Creswell, 2005; Yin, 2003a), I pursued an holistic course in describing the milieu, considering the characteristics of the individual teachers, characteristics of the classrooms and technology configurations, general characteristics of interactions in these classrooms, and specific instructor interaction behaviors. It was my hope that this would provide a comprehensive perspective on how these instructors managed instructional interactions with students located both in the classroom with them and those whom they could only see and hear via the technology-mediated environment of a distance education system.

Sample

The sample for this study was drawn from the pool of instructors who had taught at least one course in the consortium via the multi-point videoconferencing system and

whose class sessions had been recorded and archived. Instructors were selected based on the availability of archived video recordings of class sessions, instructor consent, and instructor availability for interview. The instructors were both full-time and adjunct, and had a variety of levels of experience teaching in this environment.

Preliminary discussions with some instructors in the consortium took place during a regularly scheduled consortium meeting at the beginning of the 2010 academic year. This discussion provided those who attended that meeting with an overview of the study as planning existed at that time. To recruit participants for the study an e-mail message (Appendix A), was sent to instructors in the consortium providing general information about the study and asking for their voluntary participation. Professors who taught in the consortium were sent two paper copies of an informed consent form via the U.S. Postal Service, along with a paper copy of the e-mail message describing the study. They were asked to read the informed consent form, complete and sign both copies, and return one of the signed copies to me in an enclosed self-addressed envelope. They were asked to keep the second signed copy for their records. They were provided with my contact information if they wished to discuss the study, the consent procedures, the study's purpose, and the extent and nature of their participation in it.

Participants

The participants in this study were instructors who had taught in the consortium via the multi-point videoconferencing system, whose class sessions had been recorded and archived, and who volunteered to participate. Additionally, technical personnel who

supported the technology at each participant's university were contacted to provide information about the classrooms used for the consortium distance education classes.

Setting

The study took place in a predominantly electronic and telephonic environment. Because the consortium consists of universities across the state, no face-to-face communication with participants or technical personnel took place. The primary sources of communication were e-mail and telephone conversations.

I had hoped to use the online behavioral data collection system A Deeper View (ADV) KiHD System to collect behavioral data for this study. The system involves the use of a computer, Internet connection, and video clips that have been embedded into the A Deeper View system. However, technical problems arose in the use of A Deeper View, so a set of paper data collection instruments was used that had been created for that purpose.

Data Collection Methods

Data collection did not take place until appropriate permissions were obtained from the Human Subjects Review Board at my university. Consent forms were collected in paper form from each participant prior to scheduling interview sessions with each individual instructor. There were six data collection instruments for this study: an instructor profile form, an interview protocol, a checklist for each originating classroom, a checklist for each remote classroom, a gross interaction observation data collection instrument, and a verbal interaction data collection system.

Materials

Instructor profile form. The instructor profile form (Appendix B) contained four sections and requested information from each participant concerning academic credentials, teaching experience in and outside the consortium, expertise in the use of instructional technology, and use of videoconferencing technology for teaching and other purposes.

Professor interview protocol. The professor interview protocol (Appendix C) centered on the instructor's experiences teaching in the multi-point videoconferencing environment used by the consortium and focused on aspects of the participant's interaction with students. The intent was for the interviews to be semi-structured in that each instructor was asked each question in sequence and as written in the interview protocol, but was also encouraged to expand on any subject concerning their experiences using the distance education system that they wished. Each interview took approximately one hour.

Classroom profile checklist-originating site. This checklist was used to collect data on all classrooms from which participating instructors taught. It covered the basic configuration and type of the classroom, its furniture, and the placement and size of elements of the computing, presentation, and videoconferencing technologies used by both instructor and students in each classroom.

Classroom profile checklist: remote site. This checklist was used to collect data on classrooms from which students attended classes. It collected data on an abbreviated list of attributes of the remote site classrooms.

Gross observation data collection form. This data collection instrument (Appendix D) was designed to collect descriptive information from selected segments of recorded class sessions to obtain contextual information about the videoconferencing environment across the consortium. It collected data on the number of remote locations and the number of students at each site, the quality and practices in using elements of the videoconferencing system, instructor interaction and immediacy behaviors as they were observed with local and remote students, and any observed differences in the frequency and character of the way in which the instructor interacted with students based on their locations.

A Deeper View (ADV) KiHD System. This online data capture and progress monitoring tool measures observable data by embedding video segments and programming the system for the specific kinds of behavioral data to be collected. The system is able to track frequency, duration, and latency behaviors, all of which may have been of interest in this study. The types of behaviors included in this study could be accommodated by the A Deeper View system, and it was believed that it would prove useful. This online system provides for modification of the user's interface to accommodate a wide variety of behavioral data collection, most of which appear on the interface as buttons that may be clicked when a behavior occurs. However, the interface for using this system for the study had not yet been created and tested for this purpose prior to the beginning of the study, and as such could not be included.

Data collected was to include contextual information concerning course information, the location of remote sites and the number of students at each, the quality

and practices in the use of elements of the videoconferencing system, and specific observable verbal interaction behaviors. Once the system was programmed for use in this study, selected video clips were to be uploaded to the online system for viewing and data collection. Data would be collected using a customizable user interface that connects to a database within the system. The system was to be used to collect data during selected video segments for each instructor who participated in the study.

Verbal interaction behavior data collection form. Technical difficulties prevented the A Deeper View (ADV) KiHD System from being used for this study, so this paper data collection instrument (Appendix E), was created in anticipation of potential difficulties and was used in its stead. It was designed to collect data on the same contextual information and specific verbal interaction behaviors using the coding system that appears on the form.

Each discreet interaction was numerically coded in order of its occurrence during the class segment. The starting time of the interaction was noted immediately prior to the first interaction behavior code. Verbal interaction behavior definitions are provided in Appendix F. Verbal interaction behavior codes are provided at the top of the form, with a set of codes for instructor behavior and a set for student behavior. Each site was given a code to provide the ability to be specific in coding the location of students as they interacted with instructors. Each discreet interaction verbal interaction behavior was coded in order of occurrence for the duration of that interaction. The end time of the interaction was noted at the end of the coding string.

Data Collection Procedures

Data collection procedures for this study included collecting and storing data in both electronic and paper format. Consent forms, faculty profile forms, room profile forms, and gross observation data were collected and stored in paper format. Verbal interaction behavior data were collected on paper using the verbal interaction behavior data collection form.

Consent and Faculty Profiles

Two copies of the consent form and one copy of the faculty profile form were sent to instructors in the consortium via the U.S. Postal Service, accompanied by a self-addressed stamped envelope. Instructors were asked to read the consent form, complete and sign both copies to indicate a willingness to participate, and keep one for their records. They were asked to complete the faculty profile form and return one signed copy of the consent form and the completed faculty profile form to me in the envelope provided. The returned consent forms are kept in a locked filing cabinet in my home. When an instructor submitted a signed consent form and faculty profile, a pseudonym was assigned to be used for all data collection and written results in order to ensure his or her confidentiality.

Selection of Instructors

A total of 6 to 12 instructors were intended to be included in this study. If more than 12 instructors had indicated a willingness to participate, participants were to be selected to provide the broadest range of teaching experience and technological comfort level. In the end, 5 instructors participated.

Interviews

After receiving consent forms, participating instructors were contacted via e-mail and telephone to establish a time for interview. When instructors responded with their availability, a time was established for those interviews. The interviews were recorded using a digital recording device, and the files transferred to a password-protected computer in my home and erased from the digital recorder. I transcribed the interviews using Microsoft Word and saved these documents on the same computer in my home.

Originating and Remote Class Profile Checklists

The technical staff responsible for supporting videoconferencing classes for the consortium were sent the checklists for room profile information via e-mail and asked to return the completed forms to me. When more than one classroom at a location was used for consortium classes, I asked that a separate form be completed for each. In cases where classrooms at a location were used both as teaching locations and as remotes sites, the technical staff was sent only the originating classroom profile checklist.

Class Sessions

Each class session of consortium classes was recorded in real time and stored on digital storage devices maintained by one university in the consortium, with several years of class sessions having been archived. I was given access to these storage devices for the purpose of obtaining the videos of class sessions taught by instructors who agreed to participate in this study. I located each class session taught by participating instructors and copied them onto a digital storage device in my home.

Gross Observation

Randomly selected 30-minute segments of class sessions were used for gross observation for each participating instructor, and were viewed on DVD using the researcher's computer and media player. Thirty-minute segments of class sessions were chosen for gross observation to allow including more instructors in the study, thereby providing a more comprehensive investigation of interaction in this environment. Using longer class segments or entire class sessions would entail significantly more time for data collection, which would limit the number of instructors who could be included in the study. When a 30-minute segment was selected, I created a DVD of that session for gross observation and provided it to my associate researcher. I watched the video of the class session using the digital storage device in my home.

The selection process for gross observation segments was as follows:

- eliminate the first and last class session of each semester for each instructor,
- randomly select a single class session for each instructor from the remaining pool of class sessions, and
- randomly select a 30-minute segment from the approximate 240 minutes of the class session.

The first and last class session were assumed to be different in character from the rest of the classes in a course because they tend to include more procedural and student presentation content. In order to observe interactions that are most common in these class sessions, the first and last class session were eliminated. Additionally, class sessions that included a guest lecturer or that were predominantly used for group work or

student presentation were eliminated from the pool of available class sessions and another session was randomly selected. If the selected 30-minute segment included the use of audiovisual materials such as videos or group work that lasted more than 5 minutes, another 30-minute segment was chosen. The class session detail portion of the gross observation data collection form was completed prior to beginning the observation. Observations began at the selected first minute of the segment and continued for 30 minutes. At the end of this time, the gross observation data collection form was completed.

Verbal Interaction Behavior

Class sessions used for verbal interaction behavior were randomly selected from the available class sessions for each instructor. Class sessions used in gross observation were available for verbal interaction, but the specific 30-minute segments used in gross observation were eliminated from the pool of available minutes in those class sessions. For this phase of data collection, 30-minute segments were selected for several reasons. First, this allowed for more participants to be used. Using longer class segments or entire class sessions would entail significantly more time for data collection, which would have limited the number of instructors who could be included in the study. Second, the A Deeper View system permitted only 30-minute video files to be uploaded into the system for data collection purposes. Although the A Deeper View system could not be successfully used for this study, the use of 30-minute video segments was designed to reduce error in data collection. Class sessions in these graduate-level courses tend to be active, with interactions being both frequent and complex. Attempting to reliably collect

interaction data for longer periods of time would have increased the possibility that the researcher would become fatigued and begin to miss details of interactions. Two researchers were likely to become fatigued at different times and to differing degrees, introducing the possibility not only for error but also for inconsistent error. Limiting the timeframe for each discreet data collection session helped control for this kind of error.

Essentially, the same random selection process and provision of selected class segments my associate researcher used for gross observations was used for verbal interaction behavior data collection:

- eliminate the first and last class session of each semester for each instructor,
- divide the semester into thirds and randomly select one session from each third, and
- randomly select a 30-minute segment from the approximate 240 minutes of each selected class session.

In order to collect data from points throughout the semester, each semester was divided into thirds with a single class session selected from each third. The class session detail portion of the verbal interaction behavior data collection form was completed prior to beginning the observation. Behavioral data collection began with the first interaction after the randomly selected starting point and continued for 30 minutes. If an interaction was in progress at the randomly selected first minute, the observation began with the next interaction and continued for 30 minutes. As an example, minutes 19 to 49 are randomly selected, but an interaction is underway at minute 19. This interaction ends at minute 21 and another begins at minute 25. Data collection would begin at minute 25 and continue

until minute 55. If an interaction was in progress at the end of the selected time frame, the 30-minute mark was noted in the data and data collection continued until that interaction ended. If the 30-minute segment included the use of audiovisual materials or group work, data collection began at the first onset of interaction following its conclusion.

The selected 30-minute segments were previewed to determine the exact start time of the data collection session, based on the beginning of the first interaction in the segment. Each 30-minute segment was edited into a discrete video file and saved onto the digital storage device in my home and copied onto a DVD for my associate researcher. Because the A Deeper View system could not be successfully used for this study, the paper data collection form created for that possibility was used.

Notes concerning any irregularities or other items of concern or interest were collected using the notes section of the verbal interaction behavior data collection form. These notations were not considered to be data as such, but may be mentioned as points of interest or mitigating circumstances in data analysis.

Data Analysis

Data analysis included both qualitative and quantitative procedures. All forms of data collected were used to create the descriptive perspective of instructor interaction in this environment.

The study included a number of descriptive data sources. Analysis of qualitative interview data sought common threads and themes that described the environment from the instructor's perspective. A grounded theory approach was used for this aspect of data

analysis. As Creswell (2005) notes, grounded theory is generally used in qualitative data analysis when the individuals involved have all experienced the same situation, and is used to generate a general explanation for that experience. Other sources of descriptive data included faculty profile information, room profile information, and gross observation data. These were used in concert to provide a comprehensive portrait of the instructional environment and those who taught in it. I collected information on the configuration of the classrooms such as the placement of remote student displays in the originating classroom, as well as how often the cameras in remote locations were zoomed in on students who were speaking, providing the instructor with a clearer view of the individual student's face. From this information I created classroom models, based on the placement of remote student display. If there had been an adequate distribution of instructors across models, this information would have been used in the analysis of interaction data to examine any impact the classroom model may have had on instructor interaction behaviors. While this was not expected to be a key element, it is one of interest that was explored in data analysis.

Quantitative data included verbal interaction behavior observations which were analyzed statistically using SPSS version 18. The frequency of each interaction behavior by site and instructor, the participants in each discreet interaction, and data concerning where students were located when they spoke was collected. This data was collapsed into local and remote populations for statistical analysis. Chi square operations were used to compare groups based on more than two categories of data. Effect sizes were

calculated to determine the magnitude and direction of differences in interaction and immediacy behaviors based on student population.

Percentage and per capita approaches were also used with frequency data to determine the distribution of instructor behaviors by site and by population. A visual representation of frequency data was also conducted to more clearly understand the results of the percentages of instructor behaviors across the student populations.

Reliability

Of the five data sources, reliability checks were conducted for three data collection instruments: the faculty interview, the gross observations, and verbal interaction behaviors. The remaining two, faculty profile and room profiles, were factual in nature and therefore did not present a risk to the reliability of the study.

Faculty Interviews

A participant check was conducted on interview data. Professors who participated in the interviews conducted for the study were sent a summarization of their comments via e-mail to ensure that their perspectives were accurately portrayed. If they requested any changes, or wished to deepen or otherwise alter any of their answers as a result of this participant check, these changes were reflected in the final data analysis and description of the teaching environment.

Interobserver Reliability

An associate researcher was selected for this study to provide interobserver reliability checks on the reliability and consistency of data obtained in both gross observation and verbal interaction behavior data collection. This researcher participated

in the development of study behaviors, definitions, and coding schema and was well-versed in the procedures used. To further ensure agreement between myself and my associate researcher, I conducted a refresher session on all definitions and data collection procedures prior to the beginning of data collection. Neither of us had used the A Deeper View system for data collection prior to the beginning of data collection. If this system could have been used for the study, my associate and I would have been trained in its use by the system designer, and would have test coded two 30-minute segments to ensure that we were both using the system in the same way.

In keeping with current convention, interobserver reliability checks were conducted on approximately 33% of data collection in both gross observation and verbal interaction behavior data collection (Kennedy, 2005). My associate independently conducted the same data collection procedures using the same data collection instruments on 33% of the same 30-minute segments of class sessions that I used. The 30-minute segments that she used were randomly selected from those that I used for data collection. Her data collection was compared with mine to determine the consistency and reliability of my data collection.

Gross Observation

The reliability of data collected for gross observations was calculated using the interval agreement approach. Both researchers independently watched the same 30-minute class segments and completed the gross observation forms. The answers to each question were examined and coded as either an agreement or disagreement, meaning both gave the same response to the question or different responses. The interval agreement

formula $A \div A + Dx100\%$ was used, where A is agreements and D is disagreements (Kennedy, 2005, p. 116). This provided a percentage of agreement for each 30-minute gross observation session. These percentages were averaged to provide an overall percentage of agreement on the gross observations of the teaching environment.

Verbal Interaction Behaviors

The reliability of data collected during the verbal interaction behavior portion of the study was twofold. The reliability of the coding of verbal interactions used the interval agreement approach. When comparing the coding of verbal interaction behaviors in a 30-minute segment, the codes of both researchers were judged to be in agreement or disagreement. Agreement of codes meant that the associate researcher recorded the same code in sequence as I did. Disagreement meant that she either recorded a different code or no code at all. This captured agreement on not only which behavior occurred, but also whether the behavior occurred. An interval agreement approach was also used for this data, conducted in the same manner as for gross observation responses.

The second form of interobserver agreement conducted on verbal interaction behavior data concerned the duration of each interaction in the class sessions. The starting and ending times for each interaction string during the 30-minute class segment was recorded by both researchers. The total time for each interaction string was calculated for each researcher. The reliability of data collection for each interaction string was calculated using the duration agreement formula of $S \div Lx100\%$ where S is the shorter duration and L is the longer duration (Kennedy, 2005, p. 119). This rendered an agreement percentage for the duration of each interaction string. These percentages

were averaged to obtain an overall agreement percentage for that 30-minute segment. The agreement percentages for all 30-minute segments were then averaged to provide an overall agreement rating for the study.

IV. RESULTS

This chapter presents a description of interaction in the distance education environment and faculty perspectives on teaching in that environment through discussion of faculty profile forms completed by the participating professors, qualitative data collected during interviews with them, and analysis of gross observation data. Analysis of quantitative data collected on specific verbal interaction behaviors follows, providing a more detailed examination of interaction as it occurred in the observation sessions. Because the number of participating instructors was small and the environment somewhat unique, the results cannot be generalized to instructors who teach in other multi-point videoconferencing environments.

Classroom Profiles

Data concerning the physical environment of the classrooms used at each location was collected. While the physical environment of the classrooms as it related to instructor behavior was intended to be analyzed, few differences existed between these classrooms. As a result, no comparisons could be made across the environment concerning the physical aspects of the rooms and instructor interaction or immediacy behaviors. Therefore, this data is not presented in this chapter. The single exception to this was found in the classroom used

by Professor Parker (a pseudonym), with the monitor that displayed the remote sites being located farther to the side than any other like monitor in the classrooms.

Use of A Deeper View for Data Collection

The online data collection system A Deeper View was the intended instrument for instructor verbal interaction behavior data collection. However, the system did not provide a sufficient number of discrete behaviors as required by the study, and therefore was unable to be used. The paper data collection form that was created to be employed in lieu of the online system was used for the study.

Faculty Profiles and Enrollment Data

The participants in this study were instructors who had taught in the special education teacher preparation program via multi-point videoconferencing, whose class sessions had been recorded and archived, and who volunteered to participate. After agreeing to participate, each professor completed a profile form concerning his or her educational level, faculty status, and experience using instructional technology. The profile form is included in Appendix B. A total of seven professors agreed to participate in this study. However, too few archived recordings existed for one professor's course and she was dropped from the study before data collection began. Data collection was completed for a second professor, but this instructor's instructional technology background and the enrollment for his class proved too dissimilar to the other professors and courses in the study. As a result, this professor's data was dropped from analysis.

Use of Pseudonyms

To ensure the confidentiality of each professor's data, each was assigned a pseudonym. Additionally, the students in the courses used in this study were located in a total of eight locations, although none of the courses included all eight sites. Each location was assigned the name of a color to ensure the confidentiality of students who enrolled in and participated in the class sessions observed in this study. When a direct quote that included the name of a specific site was used, the site's actual name was replaced with color name assigned to it.

Faculty Profiles

Professor Clark holds a Ph.D. in curriculum and instruction and is a full-time professor at one of the consortium universities. Professor Clark has taught for a total of 26 years, 23 years of which have been spent teaching in higher education with 14 years' experience teaching undergraduates and 9 years teaching at the graduate level. She has taught three different courses over 13 semesters in this distance education consortium and has used instructional technology in teaching for more than 15 years. She describes herself as very experienced in the use of instructional technologies and very comfortable using them during teaching, having used technologies like computer projectors and presentation software for more than 15 years and web conferencing tools like those used in the distance education environment for seven years. Professor Clark's use of videoconferencing technology includes using the technology for non-instructional purposes and she has taught classes using videoconferencing outside this consortium's environment. She has not taken any classes via this delivery method. The course taught

by Professor Clark and included in this study concerns special education assessment techniques.

Professor Yates holds a Ph.D. in Special Education. She is a full-time professor at her consortium university and serves as the coordinator of the consortium. She has seven years' experience teaching in higher education, and has taught two different courses over six semesters in this teacher preparation program. She describes herself as very experienced in the use of instructional technologies and very comfortable using them during teaching, having used computer projection and presentation software for seven years and web conferencing tools like those used in the distance education environment for five years. Professor Yates's use of videoconferencing includes participation in meetings and other non-instructional purposes. She has taught courses via videoconferencing outside this environment, and has also taken classes using this technology. The course taught by Professor Yates and included in this study concerns communications needs and accommodations for people with severe communication related disabilities.

Professor West holds a Ph.D. in Special Education and serves as a full-time professor at his consortium university. He taught at the elementary level for 2 years and has 33 years' experience teaching at the graduate level in higher education. Professor West has taught two different courses over a total of 11 semesters in this consortium distance education environment and describes himself as an experienced and comfortable instructional technology user, having used presentation technology and software for 12 years and web conferencing tools for 6 years. He has used videoconferencing for non-

instructional uses but has never taught a videoconferenced class outside this environment, nor taken any classes as a student using this kind of technology. Professor West's course concerns teamwork and collaboration among special education providers and others involved in instructing people with disabilities.

Professor Parker holds a master's degree in Special Education and Assistive Technology. She is an adjunct professor at her university and has taught a total of 22 graduate classes. She has taught one course in this consortium distance education environment for four semesters. Her use of presentation technology and software in instruction spans teaching 19 courses, with the use of web conferencing tools being included in four of those semesters. She describes herself as a very experienced and very comfortable instructional technology user. Her use of videoconferencing technology includes non-instructional purposes, but she has not taught classes outside this environment nor taken any classes as a student in a videoconferencing classroom. Professor Parker's course covers physical techniques that can be used to assist people with significant mobility impairments.

Professor Davis holds a Ph.D. in Special Education and is a full-time professor at her consortium university. She has a total of 5 years' teaching experience at the primary and secondary levels. In higher education, Professor Davis has 8 years' experience teaching undergraduates and 30 years' experience teaching at the graduate level. She has taught in this distance education consortium since its inception in 2001, having taught two different courses over that time. She has used computer projection and presentation software for a total of 15 years, and web conferencing tools for 11 years. She describes

herself as an experienced instructional technology user and is very comfortable in using instructional technology while teaching. She has used videoconferencing technologies outside the classroom. Additionally, Professor Davis has taught courses via videoconferencing using other distance education systems and was teaching webinars outside this teacher preparation distance education program when she completed the faculty profile form. She has not taken a class via videoconferencing as a student. The courses taught by Professor Davis and included in this study concern behavioral supports and curricular methods for students with severe disabilities.

Enrollment Data

Data concerning the number of students at each location was collected during observation. But because the local site is rarely shown on the video recordings, it was frequently impossible to determine how many students were present at the local site. The remote sites often used a wide camera angle, making it difficult to reliability determine the number of students present at those sites. Consequently, student population numbers were drawn from the enrollment data of each course.

The environment for this study was comprised of 168 students across all locations and all courses. The enrollment for each course is presented in Table 1. The total number of students in the local and remote populations was calculated by adding the enrollment for each instructor's course. The numbers of students located in the local site for each course were added to provide an overall size of the local population. Similarly, the numbers of students in the remote populations for each course were added to obtain a

total size for the remote population. These products were then added together to obtain a total population for the environment as a whole.

Table 1

Enrollment Data

	Number of students per professor						
Site	Clark	Yates	West	Parker	Davis Class 1	Davis Class 2	Davis Total
Blue	5	4	4	5	-	2	2
Purple	7	18	13	11	7	12	19
Red	1	4	3	-	2	-	2
Green	5	4	5	4	4	10	14
Yellow	5	-	5	3	2	2	4
Teal	-	5	2	-	4	5	9
Brown	-	-	-	3	-	-	-
Orange	-	-	1	-	-	1	1
	Total students						
Local	5	18	5	11	4	5	9
Remote	18	17	28	15	15	27	42
Everybody	23	35	33	26	19	32	51

The percentage of the total enrollment for the environment that the local and remote populations comprised was calculated by dividing the total number of students by the number in each of the local and remote populations. As can be seen in Table 2, students located in a proximate classroom with the instructor in these courses totaled 48 and comprised 29% of the total population. Students located at a location distant from the instructor totaled 120 students and comprised 71% of the total population.

Table 2

Total Student Population Across the Observations

	Number of students	Percentage of population
Local students	48	29%
Remote students	120	71%
Total	168	

Qualitative Results

Interview Data Overview

The professors who participated in this study were interviewed by telephone to gain a greater understanding of their experiences teaching in this multi-point videoconferencing environment. The interviews were semi-structured using the faculty interview protocol provided in Appendix C. The interviews lasted approximately one hour.

Reliability of Interview Data

Each interview was recorded to ensure that the professors' comments were accurately captured. A verbatim transcript was created for each interview, which was sent to each participating instructor for a reliability check. Instructors were asked to verify that the transcript accurately captured their comments, and to provide any additional commentary they wished. No errors or inaccuracies were found by the instructors in these reliability checks, nor were any additional comments provided by them.

Interview Data Results

Interview data collected for the study focus on the instructors' perspectives on the consortium program, their experiences teaching in the environment, how interaction works in this milieu, their experiences interacting with their local and remote students, strategies they employ to encourage and manage interaction, and the impact of the technology on their teaching experience. The results of those interviews follow.

Overall teaching experience. The faculty interviewed for this study described a teaching experience that is by and large a positive one, but also one that is quite challenging and has required them to learn new instructional methods to teach effectively in an environment they see as being less spontaneous, less personal, and more complex. Professor Clark noted that "It is probably one of my most challenging teaching assignments," and went on to note that when she first started teaching, "I literally couldn't sleep because it was so cognitively challenging." Professor West stated that he feels teaching in this environment requires adjustment and a new set of skills and approaches, but that it can be enjoyable: "And when it goes well it's pretty fun, and when…there are major problems it's sometimes aggravating. It's usually in between...It has its great moments. It has its tough moments." For Professor Yates the good moments tend to outweigh the difficulties, as noted in her comment, "I very much enjoy my teaching experience, and I like using the technology." Professor Davis stated that over time she has come to enjoy teaching in this environment almost as much as in a more traditional classroom. But she also appreciates her face-to-face more because of

this experience, believing that she can be more natural and humorous when all her students are the in same room with her.

The ability to combine five otherwise relatively small university programs is seen as a major advantage to the consortium. As Professor Parker stated, "I think it certainly offers a good solution for being able to combine some very small groups that would not necessarily be able to float the program, each individually." This sentiment is amplified by Professor West's observation that the consortium approach has provided the faculty with more contact with special education colleagues, stating that, "one of the great things about this program is that it's enabled us all to keep our programs alive in difficult times. It's also given us all a peer group to talk to statewide."

Diverse student population. Similarly, the consortium's ability to draw from a diverse student population from across the state is also seen as a significant advantage, not only for the success of the program but also because it enriches the teaching and learning experience. Professor Parker's statement concerning this aspect of the consortium encapsulates the perspectives of all five professors:

> I think it really enhances us to be able to draw on experiences from other areas and hear…their questions. What are their challenges in the classroom? What have they found that works? And so they can add those viewpoints to the discussion…there are definite differences within the regions in the school systems and in just the way things are done.

Professor Clark echoed this sentiment when she stated,

> We bring in individuals with an incredibly wide range of experience, life experience, family experience, work experience and knowledge. So it really does function as an—if you will a proximal zone of development for less able, less knowledgeable learners…people get a statewide perspective that they wouldn't get otherwise.

The diverse nature of the student population is not without areas of concern, however. The distributed nature of the consortium brings with it differing admissions criteria for students. The fact that there are five different universities and therefore five different sets of admissions criteria and academic support services is seen as creating differences in student academic preparation and performance that impact the classroom experience. Professor Davis observed,

> One thing is we all have our own procedures for selecting students and we've tried to make them a little more homogenous but, and it's true I look at my…students and I have a range of capability. But within the consortium I have a bigger range of capability…I think their admission criteria are different…I think it's a generalization that they have come in with fewer academic skills, college learning skills. So, that's one thing that's a challenge…. But that doesn't mean I don't get dynamite students from other universities. I do.

Professor Yates has found the varied levels of academic and experiential preparation to have an impact on how she manages classroom interaction, posing questions to the various sites in her classes based on the students' experience level: "I kind of gave one site an easier question because I knew they didn't have the background knowledge to

answer the more complex questions." While an instructor may tend to gauge the academic level of students in a traditional classroom and guide interaction accordingly, Professor Yates expressed the belief that the diversity of the student population drawn from five university programs amplifies those differences and requires more of her as an instructor.

Planning and logistics. The additional demands placed on the instructor in terms or organizational requirements and workload were also discussed by these professors. Professor West finds that "there's no question but that this approach takes more time and effort and…it's more challenging on a lot of levels." This is particularly true when the enrollment for a course is higher than normal, as was the case for the course he taught that is included in this study. The workload was "simply overwhelming," and he estimated that teaching the same number of students in a traditional classroom would have been about "a 10^{th} of the workload." The logistical nature of a synchronous distance education environment adds an increased amount of course design, planning, and preparation. Professor Yates related her experience with this aspect of the teaching experience:

> I think one thing that I know is different is that is hard for me as an instructor is planning, and pre-planning, and making sure that I have everything ready to go, in electronic format, in a clickable format that everybody can get to on time and the activities are thought out in advance. In my face-to-face class sometimes I get some inspirations to do things last minute, and that doesn't work in this environment. I can't do that in my distance classes.

Professor West has also found this to be somewhat challenging, noting that it is necessary to provide course content in advance of class, expanding on that thought with,

> You can't just walk into a room with a set of notes and talk to people…you've got to consciously think about…getting it out to the group far enough in advance. I think it requires more thoughtful advance preparation and communication.

However, while this increased planning may increase the workload associated with teaching in this environment, this is not viewed entirely as a negative. It can result not only in a higher level of preparation at class time, but also in a greater level of reflection on the mechanics of interaction for these instructors. As Professor Yates stated,

> I do a lot more pre-planning, which again I think is good for me as an instructor. I really thought about how I can engage them throughout the class…it made me more cognizant of the fact that I can't just be a talking head because a talking head at a remote site is just deadly and I'm going to lose them.

The distance between locations also has an impact on the instructional experience, providing logistical and pedagogical challenges that can be difficult to overcome. Getting software, equipment, and other instructional items to all locations prior to their use in class can be quite difficult, and by its very nature requires more planning on the part of the instructor. It also may limit what can be done in the classroom, particularly pertaining to the more physical aspects of teaching students to work with people who have severe disabilities. As an example, Professor Parker noted that she is not always able to clearly see what her remote students are doing while practicing techniques and therefore give them the most effective feedback. Additionally, she expressed a sense of

guilt concerning her remote students' ability to interact with materials as effectively as her local students may:

> I feel guilty that sometimes they bring things in that the remote students can see, but they can't really get their hands on them to kind of see what it feels like. You know, try it with yourself and.... And the remote students can see it. I can demonstrate it, but they don't get their hands on it the way that those who are sitting in the class with me would have that opportunity. So, sometimes I feel guilty about that.

She goes on to state that, like Professor Yates, she sometimes finds an instrument that is pertinent to the class after the schedule has been set and the logistics determined:

> Sometimes it is something that I have just seen that I bring in. So, it is not a case of planning at the beginning of the course. You know, I am going to use this whatever...on this night. So, it isn't always logistically possible to...to ship it down, or to get another set.

Professor Clark noted the difficulty in presenting instruments to students at a distance, stating that in a face-to-face class students are better able to use them, providing "a much more interactive hands-on walk through with those instruments."

Interaction differences between local and remote students. While the instructors discussed a number of aspects of their teaching experience, the primary focus of the interviews was on interaction in the classroom. Each of the professors in this study stated a belief that interaction is critically important in instruction. Professor Davis summed up the views expressed with her comment, "Oh, I think it's crucial." Professor

Parker uses interaction to gauge her students' comprehension of course material, stating that "it gives me a sense of how well they are understanding concepts. Are they able to take that basic information and synthesize it, analyze it at a higher level? Not just spit things back at me."

While the basic instructional modality of question and response may not alter significantly and the amount of interaction between the instructor and students may not be noticeably different based on location, there are differences in the ease of those interactions. Interaction with local students is seen as being easier due to their location in the same room with the instructor. "Oh, it's easier because they're right there. They're face-to-face," notes Professor Davis. Professor Clark characterized her interaction with remote students, stating, "I think it's incredibly difficult to have individual interaction." The physical and technological distance between instructor and remote student introduces a similar distance in relationship, as noted by Professor West:

> It really is challenging in teaching a teamwork class when you are physically separated from the students you are working with…and you can't be in a room with them, you can't get the same level of intimate interaction in terms of non-verbals and so on…. I don't think it's impossible, but I think it's not as rich.

A significant reason for the differences in character in the interactions with local and remote students may have to do with the greater level of access local students have to the instructor before and after class, during breaks, and during group work when the microphones at each site are muted. As Professor West observed, "I am having a running conversation within the minutes leading up to the start of class and during the break and

they may approach me after class…it's not an equivalent relationship just by virtue of location." Professor Clark also mentioned the impact of technological distance between herself and her remote students:

> When they are doing group work I tried to say to the students, "Don't talk to me." But the reality is that they just get more from me because of the spontaneity of, "What do you think?" We get to talk after class, before class. There's that personal piece.

Being able to walk up to the instructor and talk with him or her may provide the local student with not only more access but also more freedom to discuss issues than a remote student may experience, as referenced by Professor Parker when she said, "They stay after if they have got something they want to ask me about that is not really relevant to the large group, or they don't want to bring up in a large group setting." The quality of interactions with local student may also be impacted by their presence in the same room with the instructor. Professor Parker noted,

> I think most of the meaningful discussion and interaction we have comes at break time, before class time, when we're muted. Because I get to walk around with them and hear their thought process and talk to them during that and they always ask me questions.

Because the microphones are muted during group work, she does not feel she is able to observe her remote students' thought processes nearly as well:

> I get none of that thought process…as they are working in groups. And I'm not sure how I can capture that…. I don't know how to capture some of that more intense interaction…. I don't like that I can't have some of those conversations.

The professors attempt to bridge that gap by doing things like repeating questions asked by local students during breaks, but find somewhat limited success. And while it is possible for the instructor to interact with a remote site during group work, the logistics of that can be cumbersome. Professor Clark elaborated:

> I could [interact with the remote students during group work]…but [it's hard] because it takes so much to set up. You've got to ask somebody to pull people out of the conference, put me in the conference with that group. It just gets very complicated and it means that somebody has to be really devoting technology support for the whole class. That sort of teacher/student interaction piece is hard for me and the way I like to structure it.

Relationship development. Relationship development is also seen as being easier with local students. Professor Yates explains the difference this way,

> I think the students like it when the instructor's in the class with them and they get excited, not just because they might perceive it as a better experience in class but also because they get that connection with the instructor.

Professor Davis finds the biggest challenge she faces in teaching in this environment is trying to replicate the experience of the face-to-face classroom in terms of being close to students in a visual and auditory sense despite a delay caused by the transmission of signals to remote sites. She stated that "it can get close to being in the classroom. But

it's never quite there." Some concern was expressed that remote students may not get quite as much from the course and from them as instructors. Professor Yates summed it up this way:

> My worry with them is how connected can I be to them? And how much are they getting out of the experience…? I think I worry more about are they getting the same as…as my on-campus students, the ones in front of me.

The ability to develop a social connection with remote students is also something of a concern, as stated by Professor Clark:

> I can look at my student's face and I know their name. So I can say, "Amanda that was a great idea." I can't do that with my distance students…. But, and I think that's what I need to do with my distance classes also. But it takes me sometimes almost to the end of the semester where I can see that shadowy figure and know, "Okay, that's Melissa."

Professor West stated that he has found connecting with remote students to be challenging, stating that

> I find it very hard to connect with them on camera because, especially if you have a large group, …there were students I did not see practically all semester because they weren't all on camera. And if they're on camera, the camera angle is pulled back so far that they look like blips to me and I can't even identify their faces…so it's very hard for me to connect with students in that way.

Impact of student characteristics on interaction. The quality and quantity of interaction is not solely a function of proximity. The professors also noted the impact of

student characteristics. When remote students tend to be quiet or hesitant to answer or ask questions, the instructor's relationship with them becomes more difficult to establish and maintain. But when remote students actively participate, more connections are possible. This is expressed in Professor Davis's comment:

> I think that it comes down to students. Like for example…last semester one student…always had good answers. And the other student didn't say much. And then one day, the student who had the good answers was absent, and finally I heard this person talk…I think it kind of depends on the student.

This matches Professor West's experience in that he has noticed some students in the consortium tend not to engage in interaction while others "sort of put themselves out there more. It seems to me I've got more connections and interactions as a result of those exchanges." He sees these differences as being primarily a function of student willingness to contribute rather than of location. Professor Parker shares this experience and expresses the impact of individual student personality this way: "As much as I encourage them always to be speaking up…you always have some that are harder to engage in conversation."

Visual aspects of the environment. The visual aspect of teaching via videoconferencing presents a number of concerns for these faculty members, most particularly the ability to clearly see remote students on camera. When a remote site contains more than two or three students, a wider camera angle is often used to place as many students on camera as possible. However, this inherently provides a much smaller and less distinct view of each student's face. Most remote sites have presets established

for the cameras that will zoom into a closer shot of the students, and the established practice is for remote cameras to zoom in on a student who is speaking. But, as Professor Davis notes, the use of presets can be difficult without dedicated onsite support.

> But some of these classrooms have not…have their little remote control set up so that they can…quickly do presets, or have presets built-in and they can push it and make the camera rotate. I want to force people to do that just because it's, it means then that you get to see who's talking and it automatically is close-up.

This ability to zoom can impact the development of relationships between the teacher and a remote student, as noted by Professor West: "I do have a hard time distinguishing…the specific individual students at the other sites unless there's a camera zoomed in them while they're asking a question." Professor Davis has also had some difficulty in identifying her remote students, relating the experience this way:

> Depending upon the number of students in the class and the way they've set it up, you still might only see tiny little dots sitting at desks…. I'm not seeing the people and I can't easily identify who they are…they never do close-ups…I can't discriminate what their names are. That just really interferes with me being able to know students. When I'm face-to-face in a classroom I know who everyone is and I can quickly approach a student if I need to, if they're having issues. It's very easy to make contact.... And that's a bit more challenging [with remote students].

Professor Clark also related some difficulty in getting to know her remote students, saying, “I think you truly don’t get to know them in the way you do in a face-to-face class…I don’t have that interpersonal getting to know people.”

The inability to consistently see remote students’ faces not only impacts the development of the more social aspects of instructional relationships, but can also present a barrier to the instructor’s assessing student engagement through the nonverbal aspects of student communication. As professor Davis stated,

> You can’t see facial expression…. I use those a lot in my face-to-face teaching to judge how things are going…if I see frowns on the faces of part of the students I can usually conclude that I’m confusing them. It’s really hard to see that in distance ed.

While a wider camera angle provides a view of the students’ bodies, the nuances of body language that might be used to assess student comprehension and engagement tend to be lost in this environment. As Professor West notes ,

> I can’t pick up on subtle things like…their posture and their level of engagement and their eyes…it’s hard for me to check the pace, pick it up, move on to something else, ask a follow-up question if there’s apparently a lack of understanding or boredom.

Professor Clark also finds the nonverbal cues from remote students missing:

> You don’t get any of that classroom feedback where you can get a feel for “uh oh, the natives are restless. I need to check in”…just what a teacher typically does in

> a classroom with that piece of you've lost this person, this group is getting sleepy, or this group is getting antsy. You can't see any of that.

Strategies to encourage interaction. As a result of the differences in interaction with local and remote students these instructors employ a variety of instructional strategies to encourage interaction, including question direction and prompting, group discussion, and the use of text-based discussion tools both during and outside class time. The use of open-ended questions is generally seen as being ineffective, as related by Professor Yates.

> If I just open up a very general topic like that I get dead silence everywhere. Everybody looks at each other and goes "uhhhhh." And, you know…if I did that eventually a local person would answer me because…the other sites I think feel like that's not necessarily directed at them. And they wouldn't think to unmute their mics.

Professor Davis routinely employs question direction in a specific and pre-planned manner, deciding in advance which questions will be asked of each site. "I call on people. I set up my lectures so that I will have questions about the readings…I program my PowerPoint slides." She goes on to observe that she tends to call on students in the videoconferencing environment more often than in her face-to-face classes because of the limitations of the environment. "In a face-to-face classroom I can throw something out there for discussion. I can quickly scan the group…I can always know who has volunteered and who hasn't…I can get discussion going…with distance ed it's not that

way." Professor Yates also uses scripted question direction to ensure that interaction with remote students takes place.

> You know, I scripted who was going to give me an answer. I do that a lot when I ask a question. I will put little parts and say "Okay, purple site give me this answer part A, teal site do part B." So I do a lot of that to make sure that I give everyone a chance to have a voice and answer it.

However, scripting questions does have its downside. Professor Yates notes that this approach takes more time due to the need to ensure that each site participates. Professor Davis worries that it may in fact inhibit discussion, saying "am I just programming all of this to get you to respond. Do I do it so much so that I am eliminating the possibility for discussion?"

Not all the instructors believe in calling on students, however. In response to a question on strategies to encourage interaction, Professor Clark commented,

> I also just don't kind of believe in calling on graduate students…that isn't my style. Go down the attendance list and say, "Okay here's the next one on the list. You need to answer this question that I'm putting out there."

Another form of question direction is employed by Professors Clark, Parker, and West, who chose to observe the interaction of each site during a class session and then attempt to draw in less active sites and quiet those who tend to dominate discussion. Professor Parker explained it this way:

> If I feel as if I am not sure how a group is doing comprehending the...what we are talking about or I find that they are not speaking up as much as I would like them to offer information, then I will specifically ask them questions.

Professor Clark described her process this way:

> I will use strategies such as saying, "We've only heard from a couple of people there at each site so far, let's make sure on this next round that some different folks speak up this time." Sometimes I will actually do kind of what they call a lightening round so that we make sure that every person kind of checks in.

Another common strategy to encourage interaction is placing students into small groups for discussion. The importance of group work is expressed in Professor Davis's comment, "Well, I think it's crucial…I feel like it's a part of learning that helps increase investment. It really ultimately contributes then to the connections people make." Typically instructors will place students into small groups to discuss class material, with the groups then reporting the results of their discussion to the class as a whole. These groups may be the students at one location. But if a site contains only one or two students, they are placed electronically into a group with students from another site. The use of group discussions tends to be a bit different in the distance environment. Professor Parker explained that "The way we do group discussion is different. The small groups will actually be posting discussions so that we can see them as they report out instead of just all verbal." The use of electronic, text-based discussion tools is common among these instructors. Professor Clark describes her use of web conferencing this way.

> I have multiple layouts. And have several discussion layouts and I'll have a discussion posted and then I'll have each site or each discussion group have places for notes. And then we almost always will try to bring that back in and synthesize it as some kind of whole class activity.

Professor Yates also uses this feature of the web conferencing technology, describing an example from a recent class session.

> I use what I call the…posting area…. And I will put out a question…. And, they all go into their groups and then they all post at the same time…and then I can look at what they've all written…. I can see what they said and then I can make comments about it generally and then I can call on a specific site if I want to for clarification or to add something or explain something.

Professor Clark makes use of a polling feature in the web conferencing application to guide discussion and gauge student comprehension. At the beginning of nearly every class session, she asks a question about a piece of course content and then gives the students the option of selecting from a set of pre-programmed responses. As she explained,

> I'll say "So, how are you feeling about the assessment-based assignment?" and they click on as many of the responses as they want.... So if I've got one person that says "I'm really confused and I wish you'd spend a bit of time explaining this better" I will…. It's kind of a check in.

Impact of the technology. The nature of the technology used to conduct these classes and the accompanying technical difficulties that can be experienced present a set

of problems unique to a synchronous distance education milieu. Remote sites may drop from the class, causing delay and a loss of fluidity in instruction, and loss of class time. As Professor West stated, "When stuff goes down, my students in the class, in the local classroom still see me and hear me. When another site goes down, though, we've got to wait and pause…for people to get hooked up again." Technical difficulties can at times force the cancellation of classes, particularly if the problem is at the purple site where the equipment used to connect all of the sites is located. The unpredictability of technology problems also provides a source of frustration, as noted by Professor Davis.

> We had a fair number of technology problems for the first I would say half of last semester. And it was really frustrating...I was getting really irritated. Getting delayed every week…. You've got your full lecture, which takes the entire class. And you're there screwing around with volume or something like that.

The configuration of the classrooms also has an impact on instructional interaction in this program. The technology is viewed as being deeply intertwined with room arrangement, affecting the provision of good instruction. While the audio aspects of the technology are generally acceptable and the instructors agree that they can usually hear what they need to hear when they need to hear it, volume can have an impact on teaching in this environment. As Professor Davis stated,

> I mean, there are four or five sites and sometimes their volume is low, sometimes my volume is low…there are times when people are waving their hands…and what that means is that they're not hearing me. And I can't hear them.

Professor Clark also mentioned the impact of poor audio.

> We have a problem with the yellow site where it's too loud. They're way too loud. And at the purple site there's two mics spread out over 15 people. So that inhibits their spontaneity because they have to pass the mic around.

The visual aspects of room arrangement seem to be of greater concern for the instructors in this environment. As Professor West stated, the classrooms are configured to accommodate the technology but not necessarily the instruction: "The cameras are in fixed locations, the microphones are in a fixed location…I can't vary it…it would be physically impossible. As it is, it's challenging on the technology already." The inflexibility of camera placement means that it is generally necessary for instructors to remain in one location while teaching, limiting their freedom of movement. Professor West finds that his local students must sit in a designated area to be visible on camera and seen by remote students when that camera is selected. He must also remain in a particular location to be seen by the camera. This allows his remote students to see him but it also limits the view his local students have of him. As he said, "If I had my druthers I would prefer it so that we were closer to one another and we could see each other a little more directly than we do." Professor Parker finds that it is easier to stay in one place while teaching because changing camera angles can be difficult during lecture: "I am kind of tied to the computer and the camera. So, we don't have to keep switching back and forth and break the flow…I am really tied to the desk." While she noted that it is possible to arrange it so that she can move around to demonstrate a physical technique, it is not preferable to do that often and requires the assistance of onsite technology support. "I tend not to be as adept at changing the camera." Professor Yates related that

she tends to remain seated while teaching, so the limitation of movement is not a particular concern for her. But when she acted as a guest lecturer in a room where the camera placement allowed for more movement, she found it distracting.

> I decided I would try to stand and talk. And when I stood up and talked, I kept fighting the urge to walk away from the computer…. I kept walking out of camera range…as soon as I was standing, I had the urge to walk…I had to remember and bring myself back.

Professor Davis summed up the visual needs and challenges of the professors in these classrooms:

> Part of the problem is that you need to look at the students and your class. You need to have a camera that you can look in the eye at. You need to see the pips of all the other classrooms. And you need to see the PowerPoints…I can look down at my own PowerPoints, but I like to look up at the screen so that I'm looking up. So, to get that balance is tricky.

Interview data summary. All instructors interviewed for this study find great value in the teacher education program, and in the fact that the distance nature of the program allows for a more diverse student population than they would likely encounter in a more traditional single university classroom setting. However, that distance creates a more challenging instructional experience for them and also requires them to engage in a good deal more planning and organization than they would if the classes were taught in a solely face-to-face environment. The students who are located in the local classroom have greater access to the instructor, and developing and maintaining relationships with

them is seen as easier than with students located at a distance. The inability to clearly see remote students' faces and use body language as a measure of student engagement and comprehension provides challenges not found in a face-to-face classroom, and has encouraged these instructors to develop a variety of strategies to encourage active interaction with their remote students.

Observation Sessions

Each class session of the consortium courses is recorded in real time and stored in digital archives, in the form of one video file for each class session. Class sessions were generally 240 minutes in length. Observation sessions for each participating instructor were obtained from archived class sessions that had taken place during the 2009 academic year. The first and last class sessions of the semester were eliminated from the pool of available class sessions and class sessions from the remaining pool were randomly selected for observation. Discreet 30-minute segments were randomly selected from each class session. Thirty-minute segments that included student presentation, guest lecture, group work, or class breaks were considered ineligible for observation and were eliminated from the available pool of segments that could be used for the study. For purposes of this discussion, time segments are presented in timekeeping nomenclature. A segment that began 1 hour 40 minutes and 5 seconds into a class session will be referred to as beginning at 1:40:05, with the 1 representing the hour, the 40 representing the minute, and the 05 representing the seconds.

Gross Observation

The purpose of gross observation was to examine the instructor's approach to local and remote students to detect any differences; to collect qualitative, contextual data on the each instructor's overall approach to interaction with students; and to describe visual and auditory aspects of the environment. Data was collected using the gross observation data collection form (Appendix D). Examples of verbal behaviors observed include tendencies to encourage student contribution, tendencies to engage in social interaction with students, the frequency of question direction to the two populations and provision of time to answer questions, responding to student requests to contribute and expanding on student contributions, use of praise, and use of inclusive pronouns when speaking to local or remote students. Nonverbal tendencies focused on instructor behavior while students were speaking and included where the instructor tended to look most frequently when local or remote students were speaking, use of positive reinforcing behaviors, use of gestures, and use of vocal variety. A gross observation data collection form was used to collect data on these behaviors. For each item on the data collection form a judgment was made concerning the instructor's tendencies during the entirety of the 30-minute segment and was recorded on the gross observation data collection form, using the scales provided on the form. Additionally, whether the faces of the students at each site could be clearly seen was recorded, as were judgments concerning the quality of the audio and video aspects of the recording. The gross observation data collection form is provided in Appendix D.

Gross Observation Segments

One 30-minute class session was randomly selected from one randomly selected 240-minute class session in each instructor's course for gross observation. Details and general characteristics of those gross observation segments follow.

Professor Clark. The 30-minute segment used for Professor Clark's gross observation took place on September 9, 2009. The segment was 29 minutes and 29 seconds in length, began at 1:40:28 and ended at 2:09:58. The segment was a discussion of an assessment assignment the students were to complete and its underlying concepts. The video quality for this segment was fair with a few instances where the video froze momentarily. The site where Professor Clark was located was dropped from the conference several times, each instance lasting for less than 10 seconds. When the site returned to the conference Professor Clark addressed the loss with humor and picked up the discussion where it was left at the time of the technical difficulty. Audio disturbances were noticeable during the course of the 30-minute segment, but did not interfere with the ability to understand what was said.

Professor Yates. The segment used for Professor Yates's gross observation took place on February 3, 2010, was 30 minutes 7 seconds in length, began at 0:06:13 and ended at 0:36:21. This segment was a discussion of a recently completed assignment and student reaction to it. The video and audio quality of this segment were excellent and no sites were dropped from the conference during the 30-minute observation.

Professor West. The gross observation session for Professor West took place on April 20, 2010, was 31 minutes and 39 seconds in length, began at 1:40:10 and ended at

2:11:49. The segment included a discussion of traditional and non-traditional forms of therapy. Both video and audio quality were excellent for this segment and no site was dropped from the conference during the 30-minute segment.

Professor Parker. The gross observation segment used for Professor Parker took place on November 8, 2009, was 30 minutes 17 seconds long, began at 1:40:37 and ended at 2:10:54. The segment began with a discussion about an assignment and was followed by a discussion of the challenges special education professionals face when working with related service providers. The video was poor, with noticeable pixelization throughout the segment. However, the audio quality was excellent. Several sites were dropped from the conference during the segment, with the blue site dropping out for approximately 10 seconds, followed closely by the yellow site dropping out for approximately 6 seconds. The yellow site dropped out again approximately 20 seconds later and remained absent for 11 seconds. Professor Parker did not refer to these losses of remote locations and continued lecturing while the sites were absent.

Professor Davis. The gross observation for Professor Davis was taken from the February 16, 2010, class of her Curriculum and Methods course, was 29 minutes 59 seconds in length, began at 0:16:52 and ended at 0:46:51. The segment was a discussion of the task analysis process and an evaluation of examples of task analyses that were provided to the students. The video quality was poor, with frequent blurriness and pixelization. Additionally, the lighting on Professor Davis was too dim, further degrading the quality of the video image. The audio quality was excellent. The green

site dropped from the conference once briefly, and Professor Davis paused until the site returned.

Reliability of Gross Observation Data

An associate researcher was selected and trained in study data collection methods to provide an interobserver reliability check of data obtained in gross observations. In keeping with current convention, this associate researcher collected data independently on approximately 33% of data collection in both gross and verbal interaction data collection sessions. Of the five gross observation sessions used in the study, the associate researcher collected data in two sessions, those for Professors West and Davis.

The answers to each question on the gross observation given by both researchers were compared and coded as either an agreement or disagreement, meaning both either gave the same response to the question or different responses. The interval agreement formula (A / A +D)*100 was used to determine the percentage of agreement for each 30-minute gross observation session, where A is agreements and D is disagreements (Kennedy, 2005, p. 116). This provided a percentage of agreement for each 30-minute gross observation session. These percentages were averaged to provide an overall percentage of agreement on the gross observations of the teaching environment. As can be seen in Table 3, agreement for Professor West's gross observation session was 84% and agreement for Professor Davis's gross observation session was 75%. The overall agreement for gross observation equaled 80%.

Table 3

Gross Observation Reliability Results

Instructor observation session	Percentage of agreement
West	84%
Davis	75%
Overall gross observation agreement	80%

Specific and explicit definitions were not created for the possible choices for each gross observation item. As a result, some differences in interpretation occurred between researchers. Because the overall reliability score is within acceptable parameters, the reliability results were accepted.

Gross Observation Results

To provide an overview of instructor interaction and immediacy behaviors, the results of all five gross observations sessions conducted by the primary researcher were examined in tandem. The most common response to each item on the gross observation data collection form was recorded as an overall result for that item. When no one response received the greatest number of selections across the five observation data collections, the two with the greatest frequency were recorded. As an example, the item "Uses gestures when speaking to local student" received an equal number of "always" and "rarely" results across the five instructors. Consequently, both answers were recorded in the overall results. The results of the gross observations are presented in Table 4.

Table 4

Results of Gross Observations for All Instructors' Behavior Toward Local and Remote Sites

Gross observations	Behaviors
General observations of instructor behaviors	
Overall approach to students	No difference
Encourages student contribution	No difference
Engages in social interaction with students	No difference
Instructor behaviors during interactions	
Interacts with local/remote students	More remote
Directs questions most often to	Everybody
Gives time to answer	Same
Responds to student request to contribute	Same
Interrupts students	Same
Local and remote request to contribute simultaneously	No preference
Non-verbal instructor immediacy behaviors during interactions	
Most often looks in direction of	Camera
Looks at local student when student is speaking	Usually
Looks at camera when remote student is speaking	Usually
Looks at remote student display when remote student is speaking	Usually
Engages in positive reinforcement with local students	Always
Engages in positive reinforcement when remote student is speaking	Always
Uses gestures when speaking to local student	Always/Rarely
Uses gestures when speaking to remote student	Always
Uses vocal variety when speaking to local student	Always
Uses vocal variety when speaking to remote student	Always
Verbal instructor immediacy behaviors during interactions	
Uses general praise with local and remote students	No difference
Uses specific praise with local and remote students	No difference
Expands or elaborates on local and remote student contribution	No difference
Thanks student for contributing	No difference
Uses inclusive pronouns when speaking to local and remote students	No difference

No difference was observed in these instructors' interactions with local and remote students in terms of their overall approach to students, tendency to encourage student contribution, and engagement in social interactions with students. However, on average the instructors were observed as interacting more frequently with remote students during the observation sessions. They tended to direct questions most frequently to the entire class rather than to a specific site or student, but gave equal time for local and remote students to answer. They responded to student requests to contribute equally and interrupted students equally. When local and remote students requested permission to contribute at the same time, the instructors demonstrated no preference for either local or remote students in deciding to whom they would respond first.

In examining where the instructors looked most frequently during the observations, these instructors tended to look in the direction of the camera most often. When a local student spoke, they usually looked in the direction of the student. When remote students spoke, they usually looked in the direction of the remote student display or the camera.

In terms of non-verbal immediacy behaviors, the instructors engaged in positive reinforcement consistently when their students were speaking, with no difference detected between local and remote student contribution. Although the instructors consistently used gestures when speaking to remote students, they were less consistent in this area when speaking to local students. The results showed that some of the instructors used gestures frequently, while other instructors consistently did not. Their use of vocal

variety with both local and remote students revealed no difference between students based on location.

In terms of verbal immediacy behaviors, no difference was found in any measure. The instructors used general and specific praise equally, expanded or elaborated on student contribution equally, thanked students for contributing and used inclusive pronouns while speaking with students equally whether the students were at local or remote locations.

Verbal Interaction Observation Segments

In order to provide an analysis of interaction from a cross section of the semester for each instructor, the semester was divided into thirds and a class session from each third was randomly selected, with a discreet 30-minute segment being selected from each session using the same process as for the gross observations. While class sessions used in gross observations were eligible for use in verbal interaction observations, the specific 30-minutes segments used in gross observations were not eligible to be used for verbal interaction behavior observations.

When an interaction was underway at the end of the 30-minute segment, the observation ended at the end of that interaction and as close to the 30-minute mark as possible. If an interaction extended more than two minutes beyond the 30-minute mark, the observation ended immediately prior to the beginning of that interaction. Details and general characteristics of those gross observation segments follow. Results of the verbal interaction behavior data collection are presented in the quantitative results section of this chapter.

Professor Clark. The 30-minute segment used for the first verbal interaction behavior observation took place on September 22, 2009, was 30 minutes and 8 seconds long, began at 0:24:53 seconds and continued to 0:55:01. This segment concerned an Intelligence Quotient (IQ) instrument in use in the public school system with Professor Clark reading the various questions on the IQ test and asking students to answer them. The audio from the local site for this segment was relatively noisy as compared to other videos in the study, with numerous instances of audio distortion that impaired the intelligibility of the words being spoken. Additionally, the local students tended to make sounds and talk to each other within range of the microphone, adding to the general noise level from that site. The microphones at the remote sites were generally muted when a student was not speaking, and the audio quality from the remote sites was distortion free.

The second verbal interaction session took place on October 14, 2009, was 29 minutes 42 seconds in length, began at 0:03:14 and ended at 0:32:56. This segment was a discussion of environment-based and routine-based assessments used in Special Education settings in public schools. The audio quality from the local site in this segment was better than for the first verbal observation session, but still contained distortions that were noticeable.

The third verbal interaction session took place on November 18, 2009, was 30 minutes 1 second in length, began at 0:21:35 and ended at 0:51:36. This segment concerned a discussion of alternate assessment used for students with disabilities. The audio from the local site distorted frequently during this segment and the audio quality degraded as the segment continued with words being dropped, increasing the difficulty in

understanding what was being said. The audio and video portions of the transmission were noticeably out of synchronization with each other, which also worsened as the segment continued. The room at the remote green site was dimly lit, impairing the ability to clearly see students. This was compounded by a camera angle that was too narrow to include all students in the room. The yellow site was dropped from the conference for 11 seconds about midway through the segment. Professor Clark noted the loss of the site but continued with the class during the site's absence.

Professor Yates. The first verbal observation segment was recorded on February 3, 2009, was 30 minutes in length, began at 0:37:33 and ended at 1:07:33. This segment was a discussion of student reaction to a video they had watched and how it applied to student experience followed by a discussion of the conversational challenges of students with communication impairments. The video quality for this segment was excellent, but the audio quality was only fair due to several brief distortions during the 30-minute segment. The distortions did not interfere with the observer's ability to understand words being spoken.

The second verbal observation segment took place on February 17, 2010, was 29 minutes 58 seconds in length, began at 1:48:51 and ended at 2:18:49. This segment was a discussion of an assignment that was due two weeks hence. The video and audio quality were both excellent in this segment, however the blue site was dropped from the conference for approximately 1 minute and 20 seconds. Professor Yates continued with discussion during the blue site's absence and greeted the students at that site when the site was restored to the conference.

The third verbal observation segment took place on March 3, 2010, was 29 minutes 57 seconds in length, began at 1:40:24 and ended at 2:10:22. This segment took place immediately after a guest lecture presentation and was a discussion of assignments and the schedule for the remainder of the semester. The video quality for this segment was fair with instances when the video pixilated noticeably. At other times the video was not in synchronization with the audio. The audio quality was poor with frequent instances of noise. The red site dropped out of the conference four times during the 30 minutes. The first instance occurred two minutes and 25 seconds into the segment and lasted nearly 4 minutes. The second instance occurred 9 minutes and 47 seconds into the segment and lasted approximately 45 seconds. The third instance occurred at 13 minutes and 34 seconds and lasted approximately 20 seconds. The fourth instance occurred at 21 minutes 54 seconds into the segment and lasted approximately 1 minute. No other sites dropped out of the conference during the segment.

Professor West. The segment used for Professor West's first verbal interaction observation took place on February 23, 2010, was 30 minutes 1 second in length, began at 0:02:35 and ended at 0:32:36. The segment began with a discussion of a comment that had recently been made by a public official concerning disability and moved to a discussion of a group activity from the class session prior to this one. The video quality was fair with the video of some remote sites being blurry and slightly out of focus. Audio quality was excellent. However, a student connecting from her home was unable to completely connect with the conference, and repeatedly asked if she could be heard.

Professor West was apparently unable to hear these questions as he did not respond to them until approximately 11 minutes into the segment.

The second verbal interaction observation took place on March 2, 2010, was 30 minutes in length, began at 0:26:10 and ended at 0:56:10. The first half of the 30-minute segment was devoted to a discussion of an assignment, followed by a discussion about an assigned reading. The video quality was fair with some remote sites being slightly out of focus and noticeable pixilation of the video in the last 10 minutes of the segment. The audio quality for this segment was poor due to the instructor's microphone being at too high a setting, causing noticeable distortion. The blue site was dropped from the conference at 27 minutes and 24 seconds, returning approximately 30 seconds later.

The third verbal interaction observation took place on April 6, 2010, was 30 minutes 9 seconds long, began at 0:41:14 and ended at 1:11:23. This segment took place after a group work session where students had been broken into various groups to discuss handling conflict. The 30 minutes was devoted to a discussion of the results of that group work and student experiences with the topic. The video quality was poor for this segment due to a dimly lit local classroom, causing the instructor's face to be less distinct. Audio was also poor for this segment, with the instructor's microphone again being at too high a setting, causing distortion. Additionally, audio from the blue site was distorted briefly during the segment.

Professor Parker. The first verbal observation segment for Professor Parker took place on September 17, 2009, was 30 minutes 12 seconds long, began at 0:13:57 and ended at 0:44:09. The segment was a lecture and discussion of various mobility

impairments that children who have disabilities may have, the impact of these impairments, and methods for effectively assisting these children. The video quality was fair with some pixilation and a noticeable lack of synchronization between the video and the audio portions. The audio quality was poor with the instructor's microphone being set at too low a level. Additionally a rumble could be heard in the background at times. The audio quality deteriorated significantly during the ninth minute of the segment which continued intermittently throughout the remainder of the segment, with significant distortions that caused words to be unintelligible.

The second verbal observation segment took place on October 8, 2009, was 30 minutes in length, began at 1:12:59 and ended at 1:42:59. The segment was a lecture concerning low technology assistive technology that can be used with various disabilities. The video quality was fair with some pixilation throughout the segment. The audio quality was poor, with a high-pitched whine sound being audible during the entire 30-minute segment. Sound from the hallway outside the local classroom became loud enough at times to be mistaken for a remote site speaking.

The third verbal interaction observation took place in the October 29, 2009, class session, was 30 minutes 11 seconds long, began at 0:03:51 and ended at 0:34:03. The segment was a review of terminology and their definitions. The video quality was fair, with some pixilation. The audio quality was poor, with significant distortions that caused words to be unintelligible throughout the entirety of the segment.

Professor Davis. The first verbal observation segment for Professor Davis was taken from the September 15, 2009, class session in Professor Davis's Positive Behavior

Supports course, was 30 minutes 16 seconds in length, began at 0:29:27 and ended at 0:59:43. The segment was a discussion about aspects and details of a research article that had been assigned as reading for this class session. The video quality was poor with pixilations and instances when the video was not in synchronization with the audio. The audio quality was also poor, with remote site microphones at too high a setting, causing distortion and significant distortion across sites that caused words to be unintelligible.

The second verbal observation segment was taken from the October 20, 2009, class session if the Positive Behavior Support course, was 30 minutes 8 seconds long, began at 0:45:13 and ended at 1:15:20. This segment took place after a class break and was a discussion about the details of an assigned research article reading. The video and audio quality were both fair, with some pixilation and distortion. Additionally, the lighting at the green site was too dim to clearly see students.

The third verbal observation segment was taken from the March 23, 2010, class session in her Curriculum and Methods course, was 30 minutes 38 seconds in length, began at 1:59:12 and ended at 2:29:50. This segment was a discussion about research methods and designs that had been discussed up to this point in the course. The video quality was fair, with the lighting on Professor Davis being too dim to provide a quality image and the camera at the green site being out of focus. The audio quality was also fair, with the microphone at the green site being at too low a setting, causing noise.

Summary of Qualitative Results

In summary, the study included five participating instructors, all of whom hold graduate degrees in special education, have taught in higher education for many years,

have taught in the consortium's distance education environment for multiple semesters, and consider themselves to be experienced and comfortable instructional technology users. The instructors find teaching in the multi-point videoconferencing environment to be challenging, requiring more planning and organization and presenting some barriers to the development of relationships with remote students. Interaction in this environment is seen as being more complex and taking more time than in a more traditional, face-to-face classroom. The visual aspects of the environment, including the inability to clearly see their remote students' faces and body language, create some difficulty in using nonverbal cues to assess student engagement and in engaging in interaction with remote students. The instructors employ several strategies facilitate and manage active interaction with their remote students, with some success. However, their ability to connect with their remote students effectively remains a concern for them. The quality of both video and audio portions of the recordings tends to be inconsistent, with frequent audio disturbances, pixilated video, and a lack of synchronization between the audio and video portions of the signals.

Quantitative Results

The quantitative results include frequency data for the professors' verbal interaction behaviors collected during three 30-minute observations in each of the participating instructors' courses. The data was analyzed to determine whether any differences existed in the frequency with which these instructors interacted with the local and remote populations in their classes, as well as any differences that may have existed in their interactions with individual sites in those classes. Results will be presented for all

the professors combined to assess the interaction patterns of the environment as a whole. This will be followed by an examination of each individual professor's interaction tendencies.

The focus of the qualitative data is on professor interaction behaviors, but data on student interaction behaviors was also collected and analyzed and will be presented as context for the instructors' interaction behaviors.

Definition of Verbal Behaviors

A summary of verbal behavior definitions used for this study are included below. A more detailed set of definitions is provided in Appendix F.

Instructor verbal behaviors. Definitions of instructor verbal behavior are as follows:

- Comment: providing content in response to student question, providing information on content, discussing student contribution to present an additional context or connecting student response to content or other student contribution, providing examples, addressing errors in student contribution, and restating another's contribution. It is distinguished from lecture by direct relation to student contribution.
- Asking a question: requesting information from students. The question may be directed to specific students, specific sites, or to groupings of sites or students.
- Delay: indicating that a student question or comment will be addressed at a later time, which may or may not be specified.

- Interruption: verbally speaking while a student is speaking to address content, engage in other verbal interaction behaviors, and address student behavior.
- Positive response behaviors: expressions of approval for student contribution and thanking students for contributing. Positive response behaviors take the form of complete sentences or phrases.
- Negative response behaviors: expressions of disapproval or unfavorable judgment of student contribution or behavior, or expressions of disagreement with student contribution. Negative response behaviors take the form of complete sentences of phrases.
- Wait time: silence following a request for contribution. Wait times must exceed two seconds in length and do not include silences that occur during lecture, student presentation, or group work.
- Positive interruption: brief verbal utterances to encourage a student to continue contributing, and may take the form of words or sounds. They may be inserted in gaps in student speech or during student speech. Positive interruption is distinguished from interruption and positive response by the length of the utterance, the fact that the utterance may not be an actual word, and the fact that it addresses the act of student contribution but not necessarily the content of that contribution. Examples of words used to encourage include interesting, go on, and yes. Examples of sounds include non-linguistic verbalizations such as mmm hmmm, hmm, and uh huh.

- Negative interruption: brief verbal utterances to discourage a student from continuing contributing, and may take the form of words or sounds. They may be inserted in gaps in student speech or during student speech. Negative interruption is distinguished from interruption and negative response by the length of the utterance, the fact that the utterance may not be an actual word, and the fact that it addresses the act of student contribution but not necessarily its content. Examples of words used to discourage contribution include no, uh uh, and wrong.
- Use of student name: the professor uttering the first name or surname of a specific student.
- Calls on: the instructor selecting one person or site to contribute in response to multiple sites or multiple students indicating a desire to contribute or answer a question either by speaking the name of a student or site, or by non-verbally indicating which site may speak.

Student verbal behaviors. Student verbal behavior definitions are as follows:

- Comment: providing content in response to the instructor's question or a question asked by another student, providing information on content, presenting an additional context, providing examples, addressing errors in another student's contribution, and restating another's contribution. Student comments may concern student's understanding of course content and may occur without prompting from the instructor or other students.

- Asking a question: requesting information from the instructor or other students. The question may be directed to the instructor, specific students, specific sites, or to groupings of sites or students and may include references to student's own experience or understanding of course as a part of the question.
- Interruption: verbally speaking while another person is speaking to address content or engage in other verbal interaction behaviors. It may or may not cause the other person to stop speaking.

Elimination of Behaviors Due to Insufficient Occurrences

Data on all verbal behaviors included in study were recorded for each instructor in all observation sessions. However, some of the behaviors did not produce sufficient occurrences for meaningful results. Consequently, criteria were established to remove those behaviors prior to further data analysis. Interaction behaviors were eliminated if they met one or more of the following elimination criteria:

- Behaviors that occurred less than five times across all observations.
- A majority of instructors did not engage in the behavior, meaning that three of the five did not engage in the behavior.

Using these criteria, four interaction behaviors were eliminated from data analysis. The eliminated behaviors and the criteria for their elimination include "calls on" with only two occurrences across all observations and three of the five instructors not engaging in the behavior, "delay" with only two occurrences across all observations and three of the five instructors not engaging in the behavior, "negative response" with three of the five

instructors not engaging in the behavior, and "negative interruption" with no occurrences in any observation.

Grouping of Behavior Results

After behaviors that produced insufficient results were eliminated from analysis, the remaining verbal behaviors were grouped into interaction and immediacy classifications in order to answer the research questions. Instructional theory's emphasis on providing comments and engaging students in examination of content guided the selection of interaction behaviors according to their focus on information transmission and the flow of verbal interaction. As a result "comment," "asking a question," and "interruption" were grouped together to form the interaction behavior classification.

Immediacy behaviors were grouped based on the literature's concept of immediacy as behaviors that establish a connection or closeness between people. As Woods and Baker (2004) delineate, addressing people by name, vocal expressiveness, and expressions of approval can be considered immediate behaviors. Therefore, verbal behaviors in this classification include "positive response behaviors," "positive interruptions," and "use of student name."

Reliability of verbal behavior results. An interobserver reliability check was conducted by the same associate researcher that participated in the reliability check on gross observation data. The reliability check on verbal interaction behavior data was twofold, examining both the coding of verbal interaction behaviors and the duration of interaction strings. The reliability of coding the verbal interaction behaviors used the same interval agreement approach used for gross observation reliability. Each code used

in data collection was analyzed for agreement or disagreement. As an example, when an instructor directed a question of a social nature that was directed to the entire class, the code recorded was I?ES, which each character being one code. "I" indicates that the person speaking was the instructor, the "?" indicates that the utterance was a question, the "E" indicates that the utterance was directed to everybody in the class, and the "S" indicates that the question was of a social nature. In this case, there are four instances of agreement or disagreement.

The initial reliability check on the observations proved unacceptably low. Consequently, the researchers watched each observation session together and examined each code to identify points of disagreement and refine coding decisions. A second set of randomly selected 30-minute sessions was provided to the associate researcher for observation and a reliability check was conducted on those results.

Each agreement and disagreement in a 30-minute segment was recorded and the interval agreement approach was used to obtain a percentage of agreement for each instructor's verbal interaction observation. The agreement percentages for each verbal interaction behavior observation were then averaged to provide an overall agreement percentage for the study. To determine agreement concerning the duration of each interaction string, a duration agreement formula was used, $S \div Lx100\%$ where S is the shorter duration and L is the longer duration (Kennedy, 2005, p. 119). The agreement percentages for each instructor's verbal interaction behavior observation were averaged to obtain an overall agreement rating for the study. The results of the verbal interaction behavior analysis are provided in Table 5. The agreement on each verbal behavior

observation ranged from 85% to 91%, with an overall agreement of 88%. The agreement on the duration of interaction strings ranged from 90% to 98%, with an overall agreement percentage of 96%.

Table 5

Verbal Interaction Behavior Reliability Results

Instructor	Session	Verbal behavior agreement	Time agreement
Clark	Verbal 3	88%	96%
Yates	Verbal 3	85%	98%
West	Verbal 2	91%	98%
Parker	Verbal 2	90%	90%
Davis	Verbal 3	87%	97%
Average overall agreement		88%	96%

Analysis of Quantitative Data

Behavioral data was analyzed using three approaches, the results of which are presented together for each behavior. Statistical analysis was performed to determine the significance of any differences between instructor and student behaviors by population. A chi square was performed using instructor interaction and immediacy data, instructor interaction category data, and student interaction data. However, due to the small sample size, the data did not contain enough statistical power to produce reliable results. The calculation of effect size provides information about the direction and magnitude of differences between groups. As Durlak (2009) notes, the Hedges' *g* test is a positively based estimator of an effect size when sample sizes are small. Therefore, Hedge's *g* tests

were conducted on the data to determine the effect size and magnitude of the differences discovered.

Percentages of interaction and immediacy behaviors were calculated to determine the distribution of instructor and student behaviors by population and by site. This analysis provides a view of interaction across the environment to analyze any differences that exist in the frequency of behaviors that were directed to populations and/or sites regardless of their size.

A per capita analysis was conducted to determine the average number of instructor behaviors that were directed to students in each population and each site, as well as the average number of behaviors engaged in by students in those populations and at each specific site. This analysis provides a view of the distribution of behaviors based on the size of the populations and sites in the courses.

Interaction Behavior Results Across All Instructors

Analysis of verbal interaction behavior data began with an examination of behaviors across all instructors. The total numbers of behaviors directed toward the local population, the remote population, and to the class as a whole were calculated using each instructor's behaviors directed to those groups. All instructors' behaviors directed to the local site in their respective classes were added together to obtain a grand total of behaviors directed to local populations. This process was replicated for the remote sites to obtain a grand total of behaviors for the remote population, and again for the behaviors that were directed to entire classes. As can be seen in Table 6, a total of 699 interaction behaviors were recorded. There was one behavior directed to a student whose location

could not be determined so the location was referred to as "unknown." To assist in consistent analysis of the data, this one behavior was removed, providing an adjusted total of 698 interaction behaviors.

Table 6

Total Interaction Behaviors Across All Observations and All Instructors

Population	Total behaviors	Percentage of interaction	Per capita behaviors
Local students	162	23%	3.38
Remote students	359	51%	2.99
Everybody	177	25%	1.05
Unknown*	1		
Totals	699		
Adjusted total	698		

Note. * One behavior was directed to a student whose location could not be determined, so it is listed as unknown. To assist in consistent analysis of the data, this one behavior was removed, providing an adjusted total of 698 interaction behaviors.

Statistical analysis. Table 7 presents descriptive statistics for instructor interaction behaviors across all instructors for the local and remote populations.

Table 7

Descriptive Statistics for Instructor Interaction Behaviors by Population Across All Instructors

	n	Minimum	Maximum	*M*	*SD*
Local	5	15.00	51.00	32.40	16.9
Remote	5	23.00	128.00	71.80	43.24

Across all instructors, the results of the Hedges' *g* show that there is slightly more than one standard deviation (*SD* = -1.084) between the local population (*M* = 32.4, *SD* = 16.9, *n* = 5) and remote population (*M* = 71.8, *SD* = 43.2, *n* =5) favoring the remote population.

Percentage analysis. A total of 162 interaction behaviors were directed to the local population, 359 interaction behaviors were directed to the remote population, and a total of 177 interaction behaviors were directed to the class as a whole. To obtain the percentage of interaction that these values represent, the number of behaviors that was directed to a population was divided by the total number of behaviors. These results are provided in Table 6. Interaction behaviors directed to the local population accounted for 23% of all instructor interaction behaviors across the observations. Interaction behaviors directed to remote population accounted for 51% of all interaction, with the remaining 25% of interaction being directed to the class as a whole.

Looking at the interaction percentages, there appears to be a disparity in the percentage of interaction behaviors based on student location. The local students comprise 29% of the population and receive 23% of the interaction behaviors, nearly equal the population size. This is also essentially equal to the percentage of behaviors directed to the entire class and indicates that these instructors interacted with their local students approximately as often as they did with the entire class. The remote population comprises 71% of the population, but receives only 51% of the interaction behaviors, or 20% less interaction than the population size. This would seem to reveal a tendency to interact more with the local population as compared to the remote population.

While looking at simple percentages gives a glimpse into the experiences of the populations, this approach paints with a very broad brush. Using only this calculation is incomplete and may be misleading because it does not examine any differences that may be experienced by the students who comprise the populations. The local students share 29% of the interaction behaviors, and the remote students share 51%. But the populations are not of equal size. How many interaction behaviors does each student in each population receive on average, and is that any different from the percentage that their populations receive? To examine this, the number of students in each population was divided by the total number of interactions directed to that population to provide a per capita examination of the data, finding the average number of behaviors each student received. This analysis is included in Table 6.

Per capita analysis. The per capita analysis indicates that the discrepancy found in the populations' percentage of interaction is not quite so clear cut, and the discrepancy not nearly so large. The local students received 3.38 interactions per capita, and the remote students received 2.99 interactions per capita. In other words, local students got an average of 3.38 behaviors directed to each of them and remote students had 2.99 behaviors directed to each of them. The local students did receive more interaction behaviors than their remote peers, but the difference is 0.39, or less than one half of one behavior each.

Individual Instructor Interaction Behavior Results

Just as the populations were comprised of individual students, the environment for this study was comprised of courses taught by individual instructors. The research

questions for this study can be answered by narrowing the focus of analysis to data compiled into population totals across all instructors. But doing so would limit the investigation and would provide an insufficient perspective on interaction in this complex environment. Therefore, the interaction behaviors of the individual instructors were analyzed to identify differences that may exist between how each of these instructors interacted with their student populations. Frequency data for all instructors is provided in Table 8 and visually represented in Figure 1. Per capita data for the instructor interaction behaviors is provided in Table 9 and visually represented in Figure 2.

Table 8

Interaction Behaviors: Raw Data

Population	Clark		Yates		West		Parker		Davis	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Local	25	24%	15	17%	21	11%	51	39%	50	26%
Remote	49	48%	54	63%	128	68%	23	18%	105	55%
Everybody	29	28%	16	19%	40	21%	57	44%	35	18%
Unknown	0	0%	1	1%	0	0%	0	0%	0	0%
Totals	103		86		189		131		190	

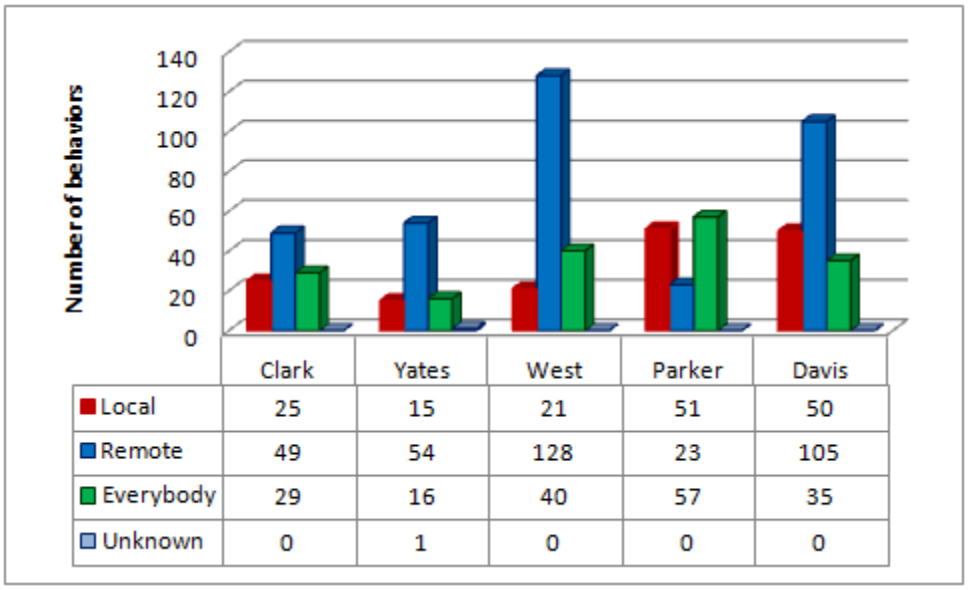
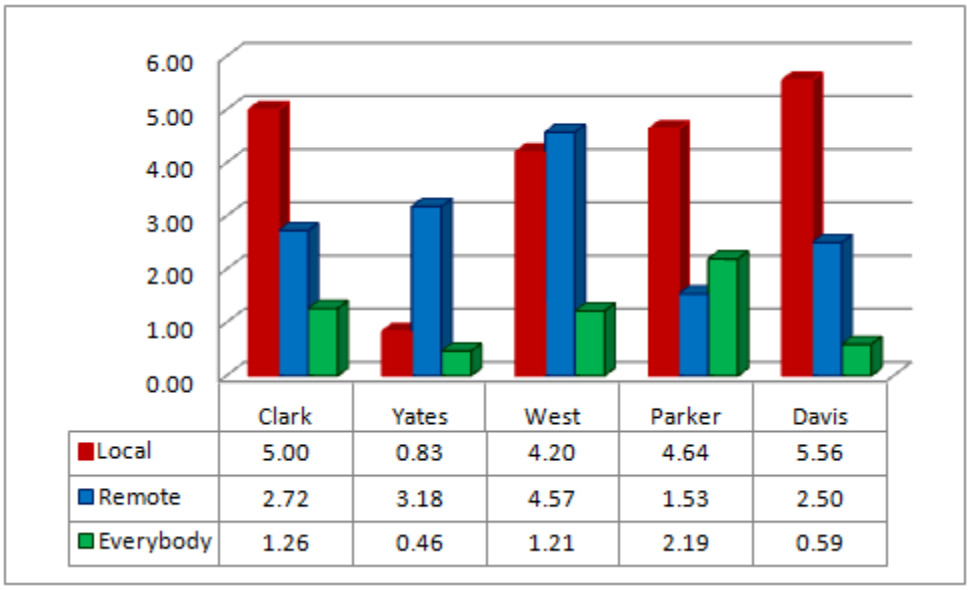


Figure 1. Interaction behaviors, raw data.

Table 9
Interaction Behaviors: Per Capita Data

Population	Clark	Yates	West	Parker	Davis
	n	*n*	*n*	*n*	*n*
Local	5.00	0.83	4.20	4.64	5.56
Remote	2.72	3.18	4.57	1.53	2.50
Everybody	1.26	0.46	1.21	2.19	0.69
Totals	8.85	4.46	9.98	8.36	8.74



	Clark	Yates	West	Parker	Davis
Local	5.00	0.83	4.20	4.64	5.56
Remote	2.72	3.18	4.57	1.53	2.50
Everybody	1.26	0.46	1.21	2.19	0.59

Figure 2. Interaction behaviors: per capita data.

Total interaction behaviors across all populations and instructors occurred in a range from 86 occurrences by Professor Yates to 190 behaviors engaged in by Professor Davis, with a total of 698 behaviors and an average of 139.8 total interaction behaviors per instructor. The range of behaviors directed to local students is between 15 by Professor Yates to 51 by Professor Parker, with an average of 32.4. The range for interaction behaviors directed to the remote population was 23 behaviors from Professor Parker and 128 from Professor West, with an average of 71.8 per instructor. The range of behaviors directed to the class as a whole includes 16 behaviors from Professor Yates to 57 behaviors from Professor Parker.

In general the remote population received more occurrences of interaction behaviors from these instructors, with four of the five instructors having a much higher frequency of behaviors with the remote population than either the local population or the

class as a whole. In each case the remote population received at least twice as many behavior occurrences as the local population or the entire class. In Professor West's and Professor Yates's data, the difference is greater still, with the remote population receiving three times or more as many behaviors as both the local population or the entire class. Professor Parker is an outlier in the frequency data with both local population and class as a whole having more than twice the number of behavior occurrences as the remote population.

The difference between the local population and the entire class is generally smaller. In three cases the local population and the entire class received nearly the same number of interaction behaviors. Professor Clark's data shows a difference between the local population and the entire class of four behavior occurrences. Professor Yates's data shows a difference of only one behavior occurrence, and Professor Parker's data shows a difference of six behaviors between the local population and the entire class. Professor West had the largest difference between these groups, engaging in nearly twice as many interactions with the entire class as with the local population, with 21 behaviors directed to the local population and 40 directed to the entire class. This instructor also had the greatest degree of difference between remote population and the others. As a result, it can be observed that all but one of these instructors interacted with the local population about as frequently as they did with the entire class.

As with the analysis of all instructor behaviors combined, a per capita analysis of the interaction behavior frequency data provides a more detailed picture of interaction. This data is presented in Table 9 and visually represented in Figure 2. A far less clear-cut

picture of interaction among these instructors emerges. In three cases the local students received more interaction behaviors per capita, with the difference between the local students and the remote students being marked. Professor Clark's local students received an average of 5.00 interaction behaviors each, while the remote students received an average of 2.72. Professor Parker's local students received more than three times the number of behaviors as did the remote students, at 4.64 and 1.53 respectively. In the case of this instructor, the remote students also received fewer behaviors than the class as a whole. Professor Davis's local students received 5.56 behaviors per capita, while the remote students received approximately half as many at 2.50.

Two of the instructors directed more behaviors per capita to the remote students than to the local ones, or to the class as a whole. Professor Yates's remote students received on average 3.18 behaviors each, while the local students received less than a third that many at 0.83. The difference between local and remote students is by far the least in Professor West's data, with local students receiving 4.20 behaviors and remote students receiving 4.57.

From the per capita analysis, it can be said that the instructors interact more frequently with specific populations than with the class as a whole and that most directed more behaviors to the local students than to the remote students.

Analysis of instructor interaction behaviors by specific behavior. Total instructor interaction behaviors were comprised of three discrete behaviors: comment, question, and interruption. In order to more clearly understand how the instructors interacted with their local and remote populations in this environment, and with the entire

class, the data for each discrete interaction behavior was calculated. These results are presented in Table 10.

Table 10

Combined Instructor Interaction Behaviors by Population

Behavior	Population	*n*	Percentage	Per capita
Comment	Local	113	30%	2.35
	Remote	219	57%	1.83
	Everybody	50	13%	0.30
	Total	382		4.46
Question	Local	38	14%	0.79
	Remote	111	40%	0.93
	Everybody	127	46%	0.76
	Total	276		2.47
Interruption	Local	11	28%	0.23
	Remote	29	73%	0.24
	Everybody*	0	0%	n/a
	Total	40		0.47

Note. * It is not possible to interrupt the entire class, so 0, 0%, and n/a in this row.

A total of 382 comments were made during the observations, with a majority of 57% being directed to the remote population, 30% being directed to the local population, and 13% directed to the entire class. The percentage of questions asked of the local population essentially matches its population size of 29%, but the percentage of questions for the remote population does not match its population size of 71%. On a per capita basis, the local population garnered the most behaviors at 2.35, with the remote population receiving 1.83 on average per student, which is approximately 78% of the

local population's total. The class as a whole received 0.30 behaviors on average per student.

At 46%, nearly half of the 276 questions asked were directed to the class as a whole, garnering the greatest percentage. The remote population received 40% of questions asked, and the local population received only 14% of all questions. Once again population size and percentage of this behavior do not match, but in this case both the local and remote populations have this result. From a per capita standpoint the remote population had somewhat more behaviors per student at 0.93, with the local population receiving 0.79 per student.

These instructors did not tend to interrupt students in either population frequently, with only a total 40 interruptions during 450 minutes of observation. However, the interruptions that did occur tended to nearly match the population sizes, with the remotes having 73% of the total interruptions and the local 28%. By definition, it is not possible to interrupt the entire class, accounting for no result in that row. Just as the population sizes match the percentage of interruption, so too the per capita data provides a very even distribution of interruptions with the local population experiencing 0.23 interruptions per student and the remote 0.24.

Analysis of instructor interaction behaviors by individual site. Just as the populations are not equal in size, the individual sites in this study vary greatly in the number of students at each, ranging from a single student at a site to as many as 18 in one location. Analyzing the behaviors from the perspective of populations does not address the impact of the number of students at each site. If one site is much larger than another

site and the instructor were to direct the same number of behaviors on average to each student at all sites, class time may be too focused on that one large site at the expense of the others. Examining population data does provide a valid assessment of interaction as it occurred. But only looking at populations does not provide a detailed and therefore fully useful view of interaction in this multi-point milieu. This distance education environment is a complex amalgamation of technology, instructional style, diverse student groups, and course material. Only looking at interaction from a population standpoint is too simplistic, and may be somewhat risky if judgments are made solely on the basis of even a per capita analysis of behaviors. In order to more clearly understand how interaction occurred in these instructors' courses, an analysis of interaction behaviors directed to each of the sites included in those courses was conducted. What follows is an analysis of how often these instructors interacted with the local and remote populations and the entire class, and also with the individual sites in their classes.

The instructors in this study interacted with specific sites and also with the class as a whole. Interaction with a specific site is understood to include a mention of the site or student to whom a behavior is directed. Interaction with the class as a whole is considered to be interaction behaviors that include wording that indicates that the behavior is directed to all students or may simply include no specific direction to a site or student. Examples of interaction behaviors directed to the class as a whole include phrasing a question as "Can anybody tell me…" or simply asking a question or making a comment without mention of any site. Additionally, instructors in this study sometimes directed interaction behaviors to only the remote population as a whole, excluding the

local site. These interaction behaviors are not directed to a specific remote site or to all students and may take the form of asking students "out there" a question.

Professor Clark. The instructor taught this course from the blue site. The student enrollment was 23 students across five sites. Professor Clark's students were fairly evenly distributed across all sites, with no single site being considerably larger than any other. However, the red site contained only one student, fewer than at any other site. Five of the students, or 22% of the class, were located in the local blue classroom with the instructor. A total of 18 students were located across the four remote locations, comprising 78% of the class. The results of Professor Clark's analysis are presented in Table 11, and visually represented in Figure 3.

Table 11

Professor Clark's Total Interaction Behaviors

		Total behaviors		
Site	Number of students	Raw data	Percentage	Per capita
Blue*	5	25	24%	5.00
Purple	7	12	12%	1.71
Red	1	0	0%	0.00
Green	5	28	27%	5.60
Yellow	5	9	9%	1.80
Remote	18	0	0%	0.00
Everybody	23	29	28%	1.26
Totals		103		

Note. * Local site.

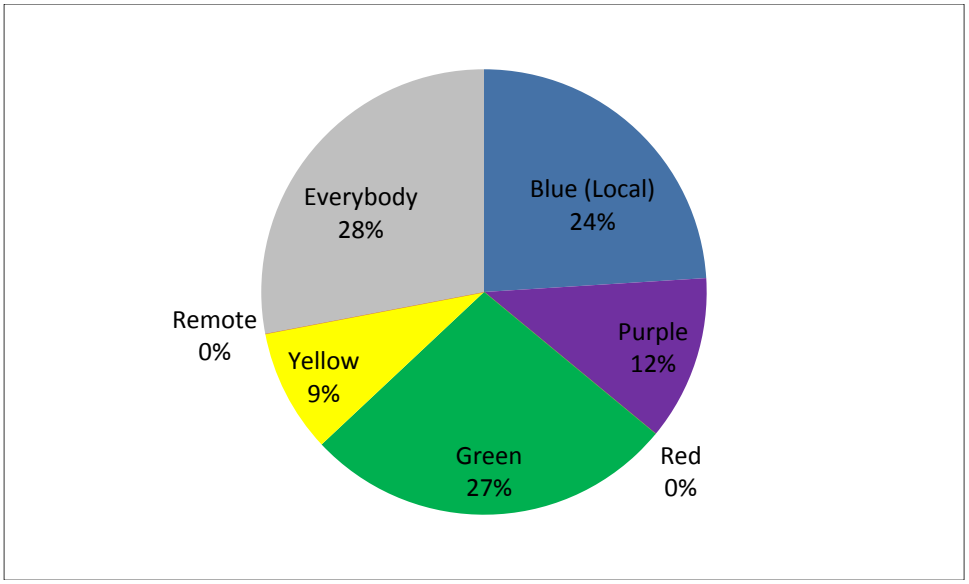


Figure 3. Professor Clark's interaction behaviors by site with percentages of total interaction.

The distribution of interaction behaviors across the sites was not quite as equal as the enrollment. The percentages of interaction behaviors are visually expressed in Figure 3. The local blue site and the remote site green site each garnered the largest percentage of total interactions, at 24% and 27% respectively. The purple and yellow sites received noticeably fewer occurrences, at 12% and 9% respectively. The class as a whole also received approximately the same percentage of interaction behaviors as the blue site and green site. The red site received no interaction behaviors across any of the observations. Professor Clark did not direct any behaviors to the remote students as a population. All behaviors were directed to either a specific site or student, or to the class as a whole.

Because the numbers of students at each site are so close to the same, the per capita analysis revealed no differences in the general distribution of total interaction behaviors from the percentage analysis. The blue site and the green site students had 5.0

and 5.6 behaviors each, while the purple and yellow sites received fewer and nearly the same number of behaviors per student at 1.71 and 1.80 respectively.

Professor Yates. Professor Yates taught this course from the purple location. The student enrollment equaled 35 total students across five sites. The distribution of students across sites is quite different from many of the other instructors' courses, with local and remote populations of almost equal size, at 18 and 17 students respectively. Consequently, the local site, purple, is at least three times the size of any single remote site.

From a population standpoint, Professor Yates's data contains a definite emphasis on the remote sites, in all measures. At 54 occurrences, the remote population received more than three times the behaviors directed to the local population and to the class as a whole. The local population represents 51% of the class enrollment, but shares only 17% of the interaction behaviors, which is less than the 19% of interaction frequencies for the class as a whole. The remote population represents 49% of the class, but 63% of the interaction behaviors. These differences become slightly more pronounced in the per capita analysis. The remote students received 3.18 behaviors per student or 71%, whereas the local students received only 0.83 or 19% and the class as a whole received 0.46 or 10%.

From a population standpoint, Professor Yates's data contains a definite emphasis on the remote sites, in all measures. But what is happening with each individual site in this class? Does one remote site receive far more behaviors than any other, thereby causing the remote population to have numbers that are so much higher? In short, the

answer appears to be no. The results for this instructor's data are presented in Table 12, with percentage of interaction with each site represented in Figure 4.

Table 12

Professor Yates's Total Interaction Behaviors

		Total behaviors		
Site	Number of students	Raw data	Percentage	Per capita
Blue	4	4	5%	1.00
Purple*	18	15	17%	0.83
Red	4	16	19%	4.00
Green	4	24	28%	6.00
Teal	5	9	10%	1.80
Remote	17	1	1%	0.06
Everybody	35	16	19%	0.46
Unknown		1	1%	
Totals		86		14.15

Note. * Local site.

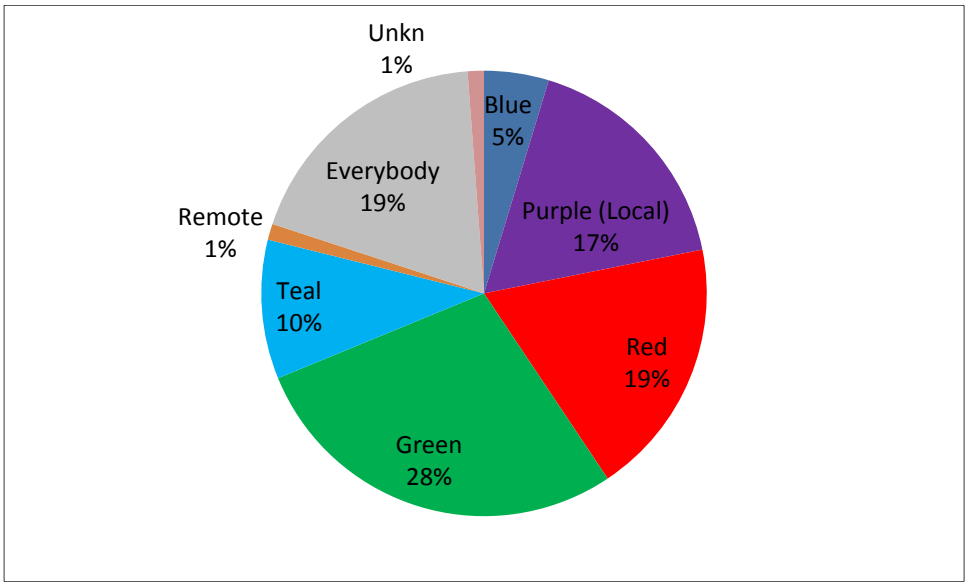


Figure 4. Professor Yates's interaction behaviors by site with percentages of total interaction. "Unkn" = unknown.

The remote green site received the greatest number of total behaviors at 24. This is followed by the remote red site and the local purple sites with 16 and 15 respectively. The class as a whole also received a total of 16 behaviors. The teal site and the blue site received the next most total interaction behaviors as a pair, at 9 and 4 respectively. One behavior was directed to the remote students as a population. When looking at the percentage of behaviors directed to each site, the green site received 28%, the red site and the entire class each comprised 19% of the total interaction, and the local purple site 17%. The blue site received 5% and the teal site received 10%. So while two remote sites received fewer behaviors and a smaller percentage than some of their peers, no single site dominated the results. When analyzed in raw frequency data and percentages of interaction, Professor Yates interacted with three sites and the class as a whole the most often, with little difference between the local purple site and one remote site and the class as a whole.

The per capita analysis of Professor Yates's data presents a somewhat different distribution of behaviors. As is the case in the raw data, the remote green and red sites received the greatest total number of behaviors per student on average at 6.0 and 4.0 respectively. However, the local students and the class as a whole dropped from the middle of the group to the lowest end of it, at 0.83 and 0.46 respectively. In a simple frequency approach, the purple site and the class as a whole received more interaction behaviors. In a per capita approach, the teal site's 1.80 behaviors and the blue site site's 1.0 received somewhat more than the local site.

Professor West. Professor West taught this course from the green site. The total enrollment of 33 students was spread across seven locations, with the local site having five students and accounting for 15% of the class. The remote population's 28 students represent 85% of the enrollment. At 13 students the purple site is once again much larger than any other site in the course, and is more than six times the teal site and more than double the largest of the other sites (green and yellow). This course is somewhat different than many others in this study in that one student attended classes from home rather than a university classroom.

As may be expected given the size of the populations in the course, Professor West's interaction behaviors weigh more heavily toward the much larger remote population. The remote students as a whole received a total of 128 interaction behaviors, or 68% of the total number. The class as a whole received the next highest number at 40, or 21%. The local population received the fewest, at 21, or 11% of the total interaction behaviors.

Things even out between the remote and local populations when looking at the per capita data, however. When dividing the total number of interactive behaviors for each population by the number of students in that population, the local students received 4.20 behaviors each whereas the remote students received 4.57 behaviors each. This analysis demonstrates essentially no difference between local and remote populations in terms of the average number of interaction behaviors directed to them.

The distribution of Professor West's interaction behaviors across sites is also reasonably equal. Professor West's data frequency data is presented in Table 13, with a

visual representation of the percentages of interaction behaviors by site presented in Figure 5.

Table 13

Professor West's Total Interaction Behaviors

		Total behaviors		
Site	Number of students	Raw data	Percentage	Per capita
Blue	4	34	18%	8.50
Purple	13	35	19%	2.69
Red	3	25	13%	8.33
Green*	5	21	11%	4.20
Teal	2	2	1%	1.00
Yellow	5	26	14%	5.20
Orange	1	3	1%	3.00
Remote	28	3	1%	0.07
Everybody	33	40	21%	1.21
Unknown		0	0%	
Totals		189		

Note. * Local site.

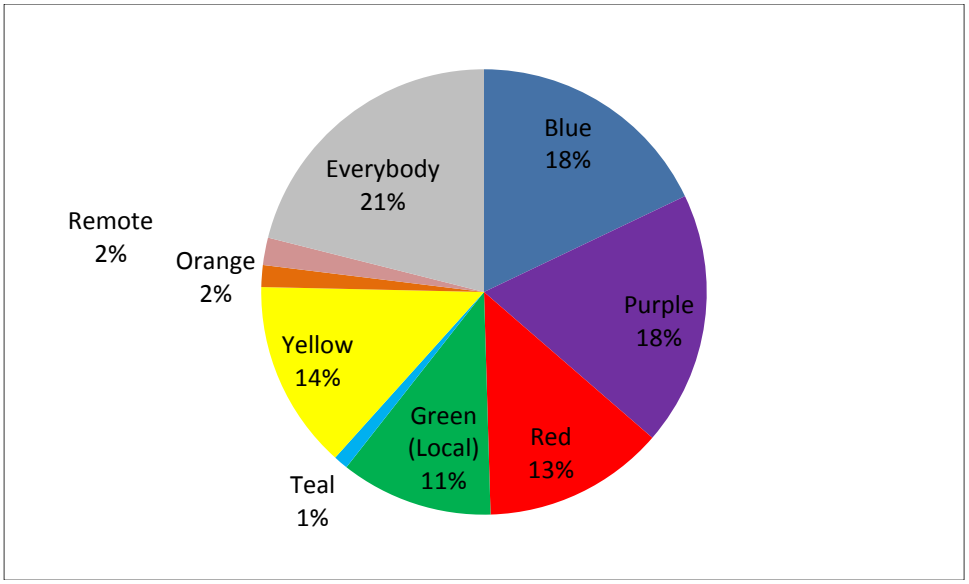


Figure 5. Professor West's interaction behaviors by site with percentages of total interaction.

As can be seen in Figure 5, the frequency data across sites reveals a very equal distribution, with the class as a whole having the most interaction behaviors at 40, or 21% of the total interaction. The remote purple and blue site sites receive nearly the same number of behaviors at 35 and 34 respectively. The remote yellow and red sites receive the next largest number of behaviors at 26 and 25. The local green site is close behind at 21 behaviors. The orange site's student and the teal site's students receive far less at 3 behaviors each. From the standpoint of how many interaction behaviors are directed to each site and the percentage of interaction that those behaviors represent, no one site dominates the data. Most behaviors are very evenly distributed. Four remote sites receive more interaction behaviors than the local site.

When examined from a per capita perspective, the data becomes somewhat less equally distributed, however. The blue site's four students and the red site's three

students remain in the highest end of the sites, with 8.5 and 8.33 respectively. The yellow site's students received the next highest number of behaviors at 5.2, or approximately three behaviors less per student than the blue and red sites. The orange site's single student rises noticeably among peers of this site, with an average of 3.0 behaviors across the observations. With only one student at this site, the number of behaviors directed to it is the same as in the raw data, explaining the jump in per capita data. The difference of the per capita analysis is most clear in looking at the large purple site. The purple site's students share 35 behaviors among the 13 students, equaling 2.69 each on average and dropping this site from the highest number in the raw data to much closer to the lowest of the per capita behaviors.

Professor Parker. Professor Parker taught this course from the purple location and had a total student population of 26 students across five sites. The local purple site was again the largest at 11 students or 42% of the enrollment. The other four sites were nearly equal in size, with the blue site at five students, green site at four students, and the yellow and brown sites each having three students.

Professor Parker's frequency data is presented in Table 14 and visually represented in Figure 6. In the raw data for the populations, the class as a whole receives the highest number of interaction behaviors at 57, or 44% of the total. At 51 behaviors, Professor Parker's local population received more than twice the number of interaction behaviors as the remote population's 23 behaviors. From a standpoint of percentages, the local population in this case receives 39% of the total interaction behaviors. This figure is reasonably consonant with the relative size of the local population at 42%, whereas the

remote population accounts for 58% of the enrollment and receives only 18% of interaction behaviors.

The per capita analysis of Professor Parker's data increases the disparity between the local and remote populations. When accounting for the number of students in each population, the local students received an average of 4.64 behaviors each, while the remote students received only 1.53 each. At 2.19 behaviors, the class as a whole received more behaviors on average than the local population.

Table 14

Professor Parker's Total Interaction Behaviors

Site		Total behaviors		
	Number of students	Raw data	Percentage	Per capita
Blue	5	6	5%	1.20
Purple*	11	51	39%	4.64
Green	4	9	7%	2.25
Yellow	3	4	3%	1.33
Brown	3	2	2%	0.67
Remote	15	2	2%	0.13
Everybody	26	57	44%	2.19
Unknown		0	0%	
Totals		131		

Note. * Local site.

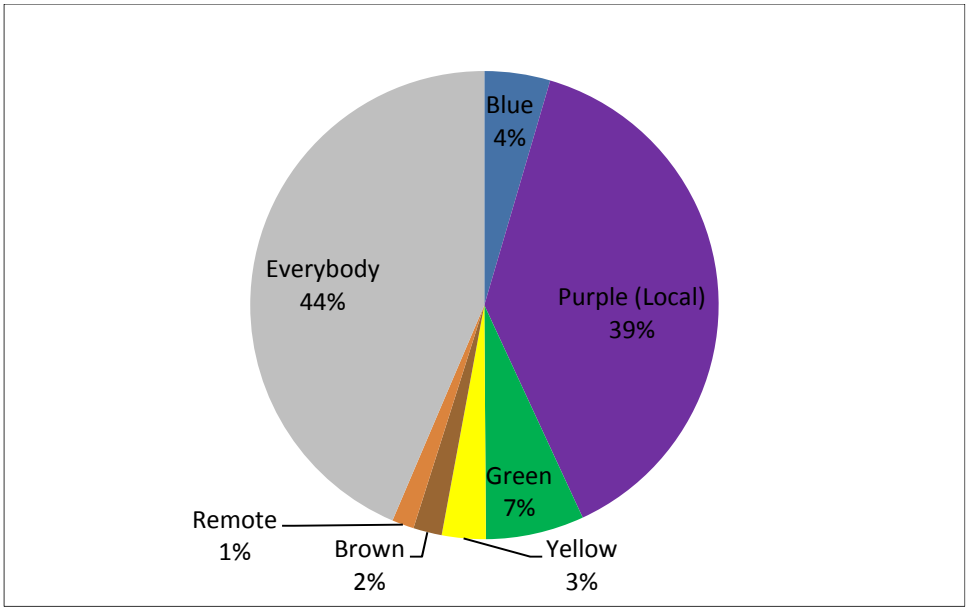


Figure 6. Professor Parker's interaction behaviors by site with percentages of total interaction.

The frequency data for the individual sites provides a more detailed view of interaction for this instructor, although not a noticeably different one. As stated above, the local site received 51 behaviors or 39% of the total interaction, while the next closest site is green at nine behaviors or only 7% of the total interaction. The blue site received a total of six behaviors or 5% of the total, with the yellow site receiving four and the brown site receiving two, or 3% and 2% respectively.

The order of sites in the per capita data changes a bit from the raw data. As is the case in the raw data, the local students received the most behaviors at 4.64 behaviors each as stated above. The green site remains the second highest per capita amount at 2.25, followed by the yellow site at 1.33 and the blue site at 1.20 behaviors per student. The brown site remains the lowest in per capita analysis at 0.67 behaviors per student. While

this is a somewhat lesser difference than the raw data, the local site still receives more than twice the number of the closest remote site.

Professor Davis. Professor Davis's data is comprised of verbal interactions across two courses and two semesters. The class enrollments and verbal interaction behavior data were both collapsed into single data sets for analysis. Data for this instructor's interaction behaviors is presented in Table 15 and visually represented in Figure 7. Both of the courses were taught from the teal site. The total enrollment for both courses together equaled 51 students. The local population included a total of nine students across the two courses, or 18% of the enrollment. There were six remote sites including one student attending class from home, with the 42 remote students accounting for 82% of the total population. The purple site is once again the largest in the course with 19 students. However, rather than all of the other sites being much smaller in size, the green site included a total of 14 students. The remaining sites are much smaller in comparison, with the yellow site containing four students, and the blue and red sites including two students each.

As can be seen in Table 8, Professor Davis engaged in interaction behaviors more frequently with the remote population than either the local population or the classes as a whole. The interaction behavior frequencies do not match the percentages of interaction, however. The local population students account for 18% of the enrollment but shared 26% of the interaction behaviors while the remote population accounts for 82% of the enrollment and shared 55%. The classes as a whole received 18% of the interaction behaviors.

On average, the nine local students received 5.56 behaviors each, with the remote students receiving 2.50 behaviors or less than half those of their local counterparts. The classes as a whole received 0.69 behaviors per student. This analysis reveals a tendency on the part of Professor Davis to interact with specific sites and/or populations more frequently than with the class as a whole, and to interact with the local students noticeably more often than with the remote students.

But, as with Professor Yates, the interaction among the individual sites paints a somewhat different picture. This data for Professor Davis is presented in Table 15 and is visually represented in Figure 7. At 50 the local teal site remains the site with the greatest number of interaction behaviors. But the remote purple site follows closely behind with 41 behaviors, representing a smaller gap between the local site and at least one remote site than exists in the population data. A total of 35 behaviors were directed to the class as a whole. The remaining remote sites each share an interaction behavior total that is far smaller than the local site's frequency. The green, red, yellow, and orange sites' students received 20, 18, 13, and 12 behaviors respectively.

On a per capita basis, the distribution of interaction behaviors becomes less even. The orange site's student receives the greatest number of interaction behaviors of the sites at 12. Because there is only one student at that site, the total interaction behaviors are divided by one. In other words, the interaction behaviors directed to the orange site's student were not shared by any other student, thereby increasing the per capita value for that single student. Similarly, the red site's two students garner the second highest number of behaviors at nine each. Again, the small number of students at that site

impacts the per capita result. This is not, however, the case for the other site with only two students. The blue site did not receive any interaction behaviors across the observations. Among sites with more than two students, the local students received the third most number of interaction behaviors at 5.56. The yellow site's students received 3.25 behaviors each, with the purple students receiving 2.16. The green students received the fewest behaviors at 1.43 each.

Table 15

Professor Davis's Total Interaction Behaviors

		Total behaviors		
Site	Number of students	Raw data	Percentage	Per capita
Blue	2	0	0%	0.00
Purple	19	41	22%	2.16
Red	2	18	10%	9.00
Green	14	20	11%	1.43
Teal*	9	50	26%	5.56
Yellow	4	13	7%	3.25
Orange	1	12	6%	12.00
Remote	42	1	1%	0.02
Everybody	51	35	18%	0.69
Unknown		0	0%	
Totals		190		

Note. * Local site.

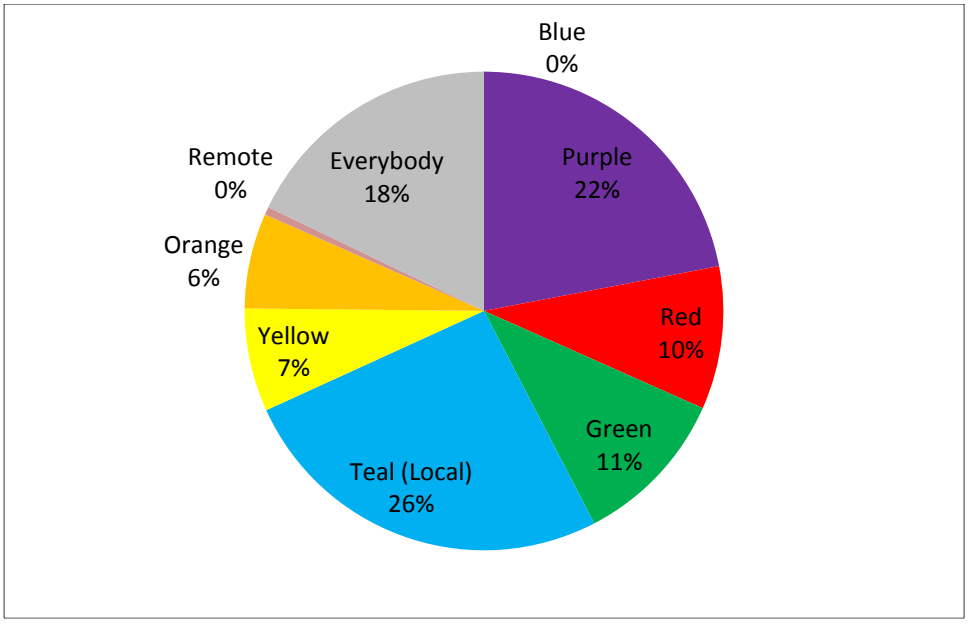


Figure 7. Professor Davis's interaction behaviors by site with percentages of total interaction.

Summary of instructor interaction behavior analysis. In summary, the analysis of interaction behaviors demonstrates a list of findings that is perhaps as complex and individual as the professors and courses in the study. In general, the local populations tended to receive fewer interaction behaviors, but those behaviors comprised a higher percentage of the total interactions than the percentage of the population to whom they were directed. The remote populations generally received more interaction behaviors, but less than the percentage of the population that they represent. When comparing individual instructors' population data, three of the instructors interacted more with local students than remote students on a per capita basis. Two of the instructors interacted more frequently with the remote students, although for one of these instructors the difference was quite small.

Student Interaction Behavior Results

As stated above, the focus of this study was instructor interaction behaviors. But the instructors were interacting with students, not in a vacuum. As Mottet contends, instructor behaviors are intrinsically tied to student behaviors and the two cannot be effectively separated if instructor behaviors are to be genuinely understood (2000). Therefore, student interaction behavioral data was collected and analyzed and is presented here as context for how the instructors interacted with the students and sites in their classes.

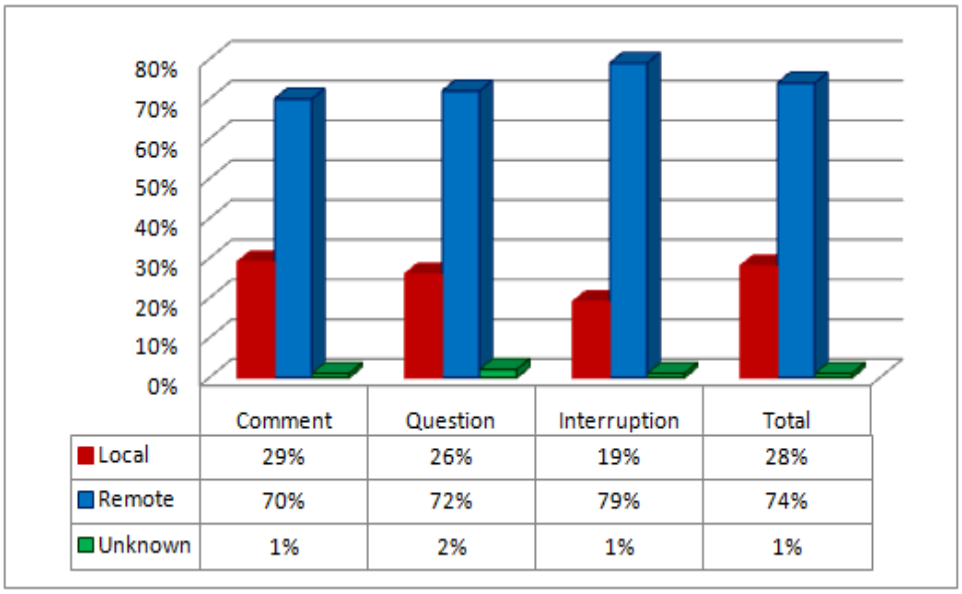
Combined student interaction data. The total number of student interaction behaviors was calculated by adding the number of comments, questions, and interruptions made by local and remote students in each observation for each instructor. These totals were then divided by the number of students in each population to provide a per capita result for each behavior. The individual interaction behavior raw data totals were combined to provide a grand total of interaction behaviors for local and remote populations, which were then divided by the number of students in each population to provide a per capita result. The data for interaction behaviors engaged in by students whose location could not be determined is also provided in raw form, but a per capita analysis cannot be conducted on these data points. Combined student interaction behavior data is presented in Table 16 and visually represented in Figures 8 and 9.

Table 16

Combined Student Interaction Behaviors

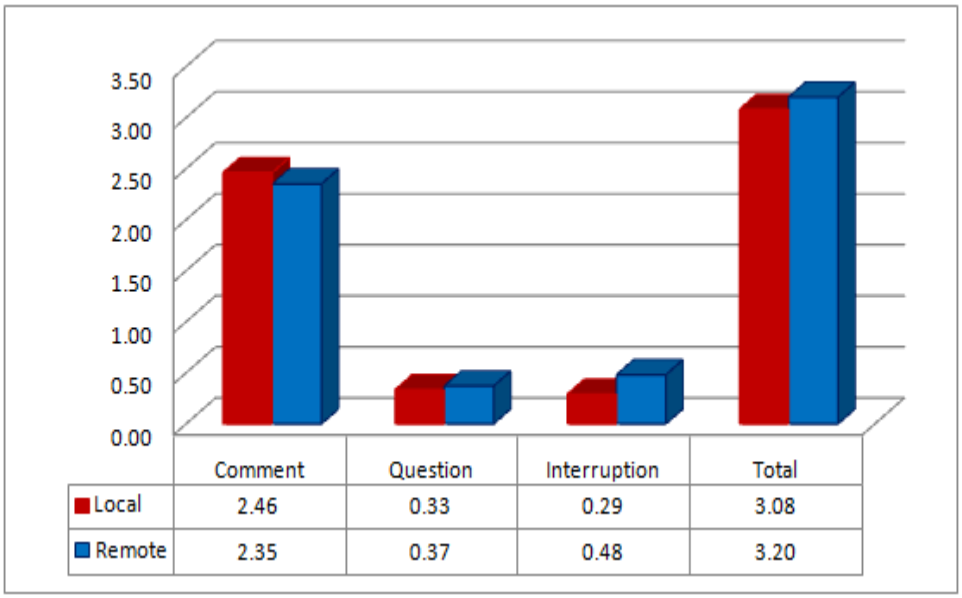
Behavior	Population	*n*	Percentage	Per capita
Comment	Local	118	29%	2.46
	Remote	282	70%	2.35
	Unknown*	3	1%	n/a
	Total	403		
Question	Local	16	26%	0.33
	Remote	44	72%	0.37
	Unknown*	1	2%	n/a
	Total	61		
Interruption	Local	14	19%	0.29
	Remote	58	79%	0.48
	Unknown	1	1%	
	Total	73		
Total	Local	148	28%	3.08
	Remote	384	72%	3.20
	Unknown	5	1%	
	Total	537		

Note. A per capita analysis could not be performed on students whose location was unknown.



	Comment	Question	Interruption	Total
Local	29%	26%	19%	28%
Remote	70%	72%	79%	74%
Unknown	1%	2%	1%	1%

Figure 8. Combined student interaction behaviors by population: percentage data.



	Comment	Question	Interruption	Total
Local	2.46	0.33	0.29	3.08
Remote	2.35	0.37	0.48	3.20

Figure 9. Combined student interaction behaviors by population: per capita data.

Statistical analysis. Table 17 presents descriptive statistics for student interaction behaviors across all instructors for the local and remote populations.

Table 17

Descriptive Statistics for Student Interaction Behaviors by Population Across All Instructors

Site	*n*	Minimum	Maximum	*M*	*SD*
Local	5	5.00	63.00	29.60	24.2
Remote	5	30.00	123.00	76.80	41.0

Across all instructors, the results of the Hedges' *g* show that there is more than one standard deviation (*SD* = -1.266) between the local population (*M* = 29.6, *SD* = 24.2, *n* = 5) and remote population (*M* = 76.8, *SD* = 41.0, *n* =5) favoring the remote population.

Comparison between instructor interaction and student interaction behavior. Student interaction behavior was also compared to instructor interaction behavior at the population level to investigate any differences that exist between the frequencies of each. Descriptive statistics for this comparison are provided in Table 18.

Table 18

Descriptive Statistics for Instructor Interaction Behaviors as Compared to Student Interaction Behavior by Population Across All Instructors

Interaction Behavior	*n*	Minimum	Maximum	*M*	*SD*
Instructor to local population	5	15.00	51.00	32.40	16.9
Instructor to remote population	5	23.00	128.00	71.80	43.24
Local student population	5	5.00	63.00	29.60	24.2
Remote student population	5	30.00	123	76.80	41.03

Across all instructors, the results of the Hedges' *g* show that there is less than one standard deviation (*SD* = 0.121) between the instructor interaction behavior (*M* = 32.4,

SD = 16.9, *n* = 5) and the interaction behavior of the local student population (*M* = 29.6, *SD* = 24.2, *n* = 5) favoring the instructor.

Across all instructors, the results of the Hedges' *g* show that there is less than one standard deviation (*SD* = -0.107) between the instructor interaction behavior (*M* = 71.8, *SD* = 43.24, *n* = 5) and the interaction behavior of the local student population (*M* = 76.8, *SD* = 41.03, *n* = 5) favoring the remote student population.

Percentage and per capita analysis. While noticeable differences were observed in the raw student interaction data, with the remote populations engaging in more than two and half times as many interaction behaviors as the local population, little difference exists in the interaction behaviors of the local and remote populations from a per capita basis. Local students made a total of 118 comments or 2.46 per capita, while remote students made 282 comments and 2.35 per capita. Local students asked a total of 16 questions across the observations, or 0.33 each. Remote students asked a total of 44 questions, representing 0.37 per remote student on average. The difference in interruptions is a bit more pronounced, with local students interrupting 14 times, or 0.29 per capita and remote students interrupting 58 times, or 0.48 per capita. From an overarching standpoint, a difference of 0.12 behaviors is found in remote and local per capita interaction behaviors, with the local population engaging in 3.08 behaviors per student and the remote population engaging in 3.20 behaviors per student.

Student interaction data by instructor. An analysis is provided of student interaction behaviors for each of the participating instructors to examine any differences that may exist between how each instructor interacted with local and remote populations,

and with the individual sites in each of their courses. These results are presented in Tables 19 and 20. When a site was not included in an instructor's course the corresponding cells for that site are listed as "n/a."

Table 19

Total Student Interaction Behaviors by Site for Each Instructor

Instructor	Raw	Percentage	Per capita
Clark			
Red	0	0%	0.00
Blue*	42	37%	8.40
Green	44	39%	8.80
Purple	16	14%	2.29
Yellow	9	8%	1.80
Yates			
Red	15	27%	3.75
Blue	3	5%	0.75
Green	20	36%	5.00
Teal	9	16%	1.80
Purple*	8	14%	0.44
West			
Red	21	18%	7.00
Blue	25	21%	6.25
Green*	5	4%	1.00
Teal	0	0%	0.00
Purple	28	23%	2.15
Yellow	26	22%	5.20
Orange	15	13%	15.00
Parker			
Blue	8	9%	1.60
Green	12	13%	3.00
Purple*	63	68%	5.73
Brown	3	3%	1.00
Yellow	7	8%	2.33
Davis			
Red	33	21%	16.50
Blue	0	0%	0.00
Green	20	13%	1.43
Teal*	30	19%	3.33
Purple	36	23%	1.89
Yellow	23	15%	5.75
Orange	11	7%	11.00

Note. * Local site for that instructor.

Table 20

Total Student Interaction Behaviors by Population for Each Instructor

Instructor	Raw	Percentage	Per capita
Clark			
Local	42	37%	8.40
Remote	69	61%	3.83
Unknown	2	2%	n/a*
Total	113		
Yates			
Local	8	14%	0.44
Remote	47	84%	2.76
Unknown	1	2%	n/a*
Total	56		
West			
Local	5	4%	1.00
Remote	115	96%	4.11
Unknown	0	0%	n/a*
Total	120		
Parker			
Local	63	68%	5.73
Remote	30	32%	2.00
Unknown	0	0%	n/a*
Total	93		
Davis			
Local	30	19%	3.33
Remote	123	79%	2.93
Unknown	2	1%	n/a*
Total	155		

Note. * N/A: Site was not included in instructor's course.

Professor Clark. The local population engaged in 42 interaction behaviors or 37% of the total behaviors, with the remote population interacting 69 times during the observations, or 61% of the total. The per capita data for these two populations finds the local site averaging 8.4 behaviors per capita, with the remote students averaging only 3.83 per capita. This disparity becomes far less pronounced when examining the data for

individual sites, however. The remote green site had 44 behaviors across the observations, or 39% of the total, with the local blue site nearly equal at 42 behaviors and 37% of the total. Combined, these two sites account for 76% of all student interaction behaviors. The purple and yellow sites fall far behind with 16 and 9 behaviors respectively, or 14% and 8% of the total student interaction behaviors. The red site students did not interact at any time during the observations. These rankings hold in the per capita data as well, with the green site garnering an average of 8.8 behaviors per student and the blue site nearly equal at 8.4 per student on average. The gap between these two sites and the next closest sites, purple and yellow, is essentially proportional, with the purple site averaging 2.29 behaviors per student and the yellow site averaging 1.8 interaction behaviors per student.

Professor Yates. The local population engaged in a total of 8 interaction behaviors, or 14% of the total across the observations, with the remote population engaging in nearly six times as many at 47 behaviors, or 84%. Because the local and remote populations are essentially equal in size, this disparity is also found in the per capita data, with the local population averaging 0.44 behaviors per student and the remote population averaging more than six times that number at 2.76 behaviors per capita. When examining the data for individual sites, the difference between interaction behaviors among the local and remote sites remains constant. The remote green and red sites engaged in the most behaviors at 20 and 15 respectively, accounting for a combined 63% of the total interaction behaviors between them. The remote teal and local purple sites engaged in essentially equal numbers of interaction behaviors at 9 and 8

respectively, or 16% and 14%. Only the remote blue site engaged in fewer interaction behaviors than the local purple site, at 3 behaviors or 5% of the total. On a per capita basis, the green site again garners the highest number of interaction behaviors at 5.00 per student on average. The gap between the green and red sites is a bit more pronounced in this measure, with the red site students averaging 3.75 behaviors each. The teal site averaged 1.80 behaviors per student, with the blue site at 0.75 behaviors per student and the purple site 0.44 behaviors per student.

Professor West. A noticeable difference exists in the data for local and remote populations for this instructor. The remote population engaged in vastly more interaction behaviors—115—than the local population's 5, or 96% for the remote population and only 4% for the local. Because the local population is much smaller than the remote, this difference is somewhat mediated in the per capita data, with the remote population averaging 4.11 behaviors per capita and the local population averaging 1.00. This difference is also quite pronounced when looking at the data for the individual sites in the course. The remote sites dominate the interaction behaviors with the purple site engaging in 28 behaviors, the yellow site 26, the blue site 25, the red site 21, and the orange site 15 behaviors as compared to the local green site's 5 behaviors. The remote teal site students were silent during all observation sessions. On a per capita basis, the single orange site student has the highest number of behaviors at 15.00. Among sites with more than one student, the red, blue, and yellow sites are nearly equal at 7.00, 6.25, and 5.20 behaviors respectively. The purple site averaged 2.15 behaviors per student, with the local green site averaging only 1.00 per student.

Professor Parker. As was the case in instructor interaction behavior, Professor Parker's student data is an outlier in this study in that the local population exceeds the remote population in interaction behaviors. The local population is noticeably more active with 63 interaction behaviors as compared to the remote population's 30. This disparity is not altered in the per capita data, with the local population averaging 5.73 behaviors per student and remote population averaging 2.00. The data for the individual sites shows that the local purple site dominated the student interaction behaviors with 63 behaviors or 68% of the total, with the closest site being the remote green site at 12 behaviors or 13%. The blue and yellow sites were nearly equal at 8 and 7 behaviors and 9% and 8% respectively. The brown site engaged in the least behaviors at 3, or 3% of the total. Because the local purple site had at least twice as many students as any other individual site, the per capita data reduces the gap between sites to some extent. The purple site remains the site with the highest number of average behaviors at 5.73. The green site remains as second most with 3.00 per capita behaviors. But the yellow site surpasses the blue site in the per capita data at 2.33 and 1.60 respectively. The brown site engaged in the lowest per capita behaviors at 1.00.

Professor Davis. The raw data for Professor Davis's courses indicates a noticeable gap between local and remote population activity, with the remote population engaging in four times as many interaction behaviors at 123 and 79% of the total interaction as the local population's 30 behaviors and 19%. However, this difference is mitigated greatly in the per capita data with the local population averaging slightly more behaviors per student at 3.33 than the remote population's per student average of 2.93.

There were two student interaction behaviors where the student's location could not be determined. The data for the individual sites presents a much more detailed picture, with the remote purple and red sites, and the local teal site engaging in the most interaction behaviors, at 36, 33, and 30 respectively. These three sites account for 63% of the total student interaction behaviors. The remote yellow and green sites had 23 and 20 behaviors respectively, or 15% and 13% of the total. The orange site had 11 behaviors, or 7% of the total. The blue site was silent during all observation sessions. The per capita does not match the raw data, however. With only two students at the red site and only one student at the orange site, these remote sites garner the highest per capita average of 16.50 and 11.00 respectively. Of sites with more than two students, the yellow site averaged 5.75 behaviors each. The local teal site averaged 3.33 behaviors, with the purple site averaging 1.89 behaviors per student. The green site's students averaged 1.43 behaviors each.

Summary of student interaction data. In general, the remote populations in these courses tended to have the greatest number of interaction behaviors and accounted for 79% or more of the total interaction behaviors in all but two cases. On a per capita basis, the results were more mixed, with Professors Clark, Yates, and Davis's remote populations having higher per capita results and Professors Parker and Davis's local populations engaging in more behaviors per capita. When looking at individual sites, remote sites were almost always the most active in both raw data and per capita data. Additionally, the local sites were among the least active sites in Professor Clark, Yates and West's courses in both the raw and per capita examinations. The exceptions are

Professor Parker whose local site engaged in the greatest number of interaction behaviors across both raw and per capita analyses, and Professor Davis whose local site fell in the middle of the sites both in raw and per capita analyses.

Immediacy Behavior Results Across All Instructors

Analysis of verbal immediacy behavior data began with an examination of behaviors across all instructors. The total numbers of behaviors directed toward the local population, the remote population, and to the class as a whole were calculated using each instructor's behaviors directed to those groups. Generally, an immediacy behavior directed to the class as a whole would be a comment praising the entire class for contributions at the conclusion of a discussion. All instructors' behaviors directed to the local site in their respective classes were added together to obtain a grand total of behaviors directed to local populations. This process was replicated for the remote sites to obtain a grand total of behaviors for the remote population, and again for the behaviors that were directed to entire classes. As can be seen in Table 21, a total of 432 immediacy behaviors were recorded. There were 11 behaviors directed to students whose locations could not be determined, listed as unknown in the table. To assist in consistent analysis of the data, these 11 behaviors were removed, providing an adjusted total of 421 immediacy behaviors.

Table 21

Total Immediacy Behaviors Across All Observations and All Instructors

Population	Total behaviors	Percentage of immediacy	Per capita behaviors
Local students	108	25%	2.25
Remote students	309	72%	2.58
Unknown*	11	3%	
Everybody	4	1%	0.02
Totals	432		
Adjusted total	421		

Note. * Eleven behaviors were directed to students whose locations could not be determined, listed as unknown in the table. To assist in consistent analysis of the data, these 11 behaviors were removed, providing an adjusted total of 421 immediacy behaviors.

As was the case with interaction behaviors, immediacy behaviors were considered to be directed to a particular site if the site's name or the name of a student at a site was mentioned by the instructor in the verbal utterance. If no site or student name was mentioned, or if the utterance included a reference to the entire class, the behavior was considered to be directed to the class as a whole. During the observations no immediacy behaviors were directed to the remote students as a group.

A total of 108 immediacy behaviors were directed to the local population, 309 immediacy behaviors were directed to the remote population, 11 behaviors were directed to students whose location could not be determined, and 4 behaviors were directed to the class as a whole. To obtain the percentage that these values represent, the number of behaviors that was directed to a population was divided by the total number of behaviors. These results are also provided in Table 21. Immediacy behaviors directed to the local population accounted for 25% of all instructor interaction behaviors across the observations, with 72% being directed to remote populations.

Statistical analysis. Table 22 presents descriptive statistics for instructor immediacy behaviors across all instructors for the local and remote populations.

Table 22

Descriptive Statistics for Instructor Immediacy Behaviors by Population Across All Instructors

Site	*n*	Minimum	Maximum	*M*	*SD*
Local	5	10.00	39.00	21.60	13.4
Remote	5	24.00	121.00	61.80	43.1

Across all instructors, the results of the Hedges' *g* show that there is more than one standard deviation (*SD* = -1.38) between the local population (*M* =21.6, *SD* = 13.4, *n* = 5) and remote population (*M* = 61.8, *SD* = 43.1, *n* = 5) favoring the remote population.

Percentage analysis. Looking at the percentages, immediacy behaviors based on student location essentially match the population sizes. The local students comprised 29% of the population and received 25% of the immediacy behaviors. The remote population comprised 71% of the population and received 72% of the behaviors.

Per capita analysis. As with interaction behaviors, the number of students in each population was divided by the total number of interactions directed to that population to provide a per capita examination of the data, finding the average number of behaviors each student received. This analysis is included in Table 21. Just as the percentages revealed no disparity between populations, the per capita data demonstrates a fairly even distribution of immediacy behaviors based on student location with the local population receiving 2.25 behaviors per capita and the remote population receiving 2.58.

Individual Instructor Immediacy Behavior Results

Frequency and per capita data for each instructor's immediacy behaviors is provided in Table 23 and visually represented in Figures 10 and 11.

Table 23

Total Immediacy Behaviors: Raw Data

Instructor		Local	Remote	Everybody	Unknown	Total
Clark	Raw data	10	32	1	6	49
	Percentage	20%	65%	2%	12%	
	Per capita	2.00	1.78	0.04		
Yates	Raw data	14	38	0	5	57
	Percentage	25%	67%	0%	9%	
	Per capita	0.78	2.24	0.00		
West	Raw data	12	121	0	0	133
	Percentage	9%	91%	0%	0%	
	Per capita	2.40	4.32	0.00		
Parker	Raw data	39	24	0	0	63
	Percentage	62%	38%	0%	0%	
	Per capita	3.55	1.60	0.00		
Davis	Raw data	33	94	3	0	130
	Percentage	25%	72%	2%	0%	
	Per capita	3.67	2.24	0.06		

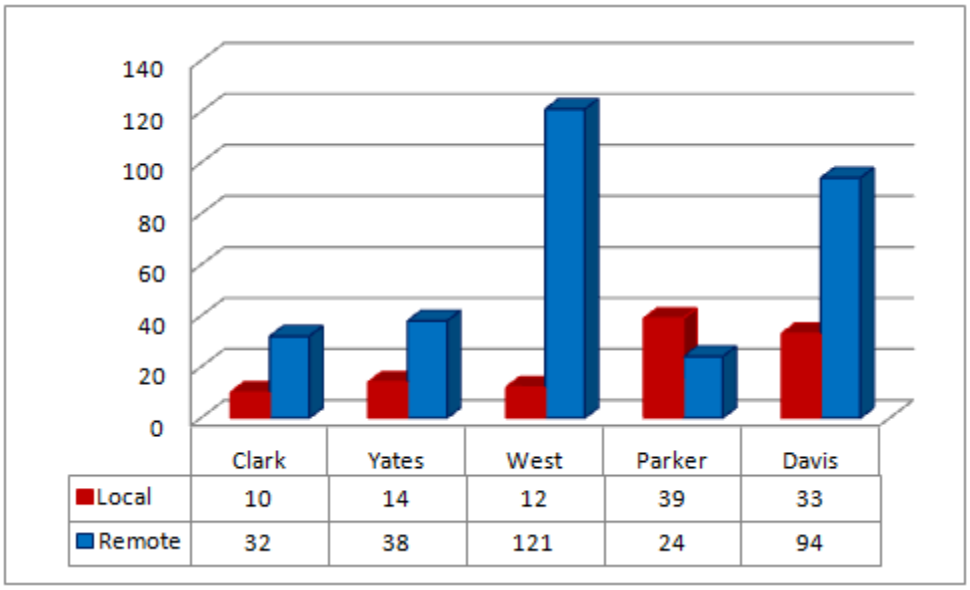


Figure 10. Immediacy behaviors by population: raw data.

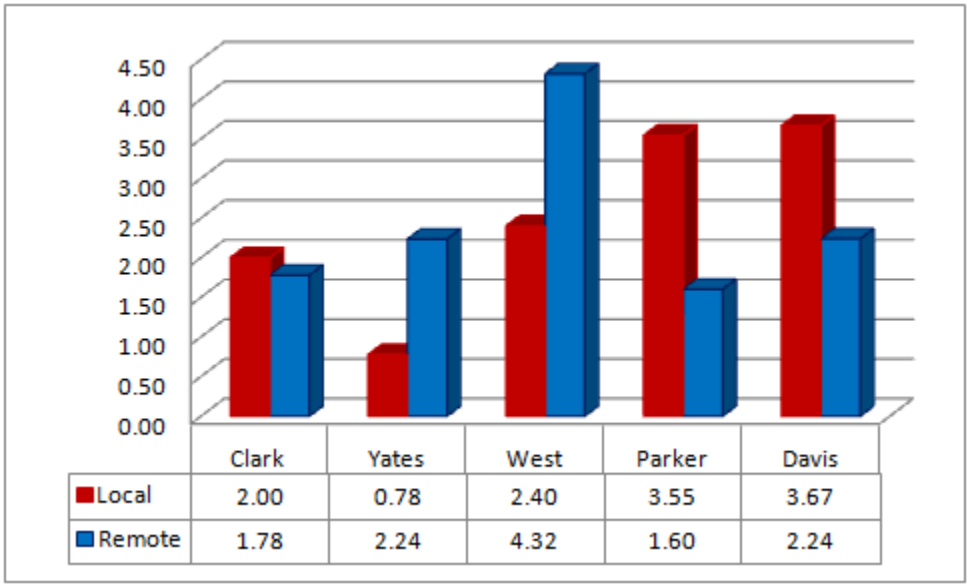


Figure 11. Immediacy behaviors by population: per capita data.

Total immediacy behaviors across all populations ranged from 49 occurrences engaged in by Professor Clark to 133 engaged in by Professor West. The immediacy

behaviors directed to local students ranged between 10 by Professor Clark to 39 by Professor Parker. The range for behaviors directed to remote students is from 24 by Professor Parker to 121 by Professor West.

With the exception of Professor Parker, the remote population received the most immediacy behaviors, in most cases two to three times as many as were directed to the local population. Professor West is an exception to this with essentially 10 times as many immediacy behaviors directed to the remote population as to the local one. Professor Parker is an outlier in the data, with more immediacy behaviors directed to the local population.

The per capita analysis reveals a much smaller difference between local and remote populations, but the local populations tended to receive somewhat more immediacy behaviors on a per student average than the remote populations in three of the instructors' data. Three of the instructors directed more immediacy behaviors to the local population. Professor Clark's local population received 2.00 per capita behaviors as compared to the remote population's 1.78. Professor Davis's local population received 3.67 behaviors per capita as compared to 2.24 for the remote population. Professor Parker's local population received more than twice as many behaviors at 3.55 as the remote population at 1.60.

Two of the instructors directed more immediacy behaviors to the remote population than the local one. Professor West's remote population received more immediacy behaviors at 4.32 as compared to the local population's 2.40. Professor

Yates's remote population received nearly three times as many immediacy behaviors at 2.24 as compared to the local population's 0.78 behaviors per capita.

Analysis of Instructor Use of Student Name

The instructors in this study referenced the inability to see remote students clearly enough to identify them by name. In fact, Professor Clark stated that she believes that she does not call her remote students by name as often as her local students and expressed dismay about this situation that is shared by her colleagues. The use of a student name is a specific immediacy behavior collected for this study, and therefore the instructors' concerns can be empirically tested. In order to investigate whether or not the professors are in fact not using remote student names as often as local student names, an analysis of this specific immediacy behavior was conducted. The results of that analysis are presented in Table 24 and visually represented in Figures 12 through 15.

Table 24

Instructor Use of Student Name

Instructor(s)		Local population	Remote population	Unknown	Total
Across all instructors	Raw data	35	82	9	126
	Percentage	28%	65%	7%	
	Per capita	0.73	0.68	n/a*	
Clark	Raw data	2	4	6	12
	Percentage	17%	33%	50%	
	Per capita	0.40	0.22	n/a*	
Yates	Raw data	9	14	3	26
	Percentage	35%	54%	12%	
	Per capita	0.50	0.82	n/a*	
West	Raw data	6	47	0	53
	Percentage	11%	89%	0%	
	Per capita	1.20	1.68	n/a*	
Parker	Raw data	10	2	0	12
	Percentage	83%	17%	0%	
	Per capita	0.91	0.13	n/a*	
Davis	Raw data	8	15	0	23
	Percentage	35%	65%	0%	
	Per capita	0.89	0.36	n/a*	

Note. A per capita analysis could not be performed on students whose location was unknown.

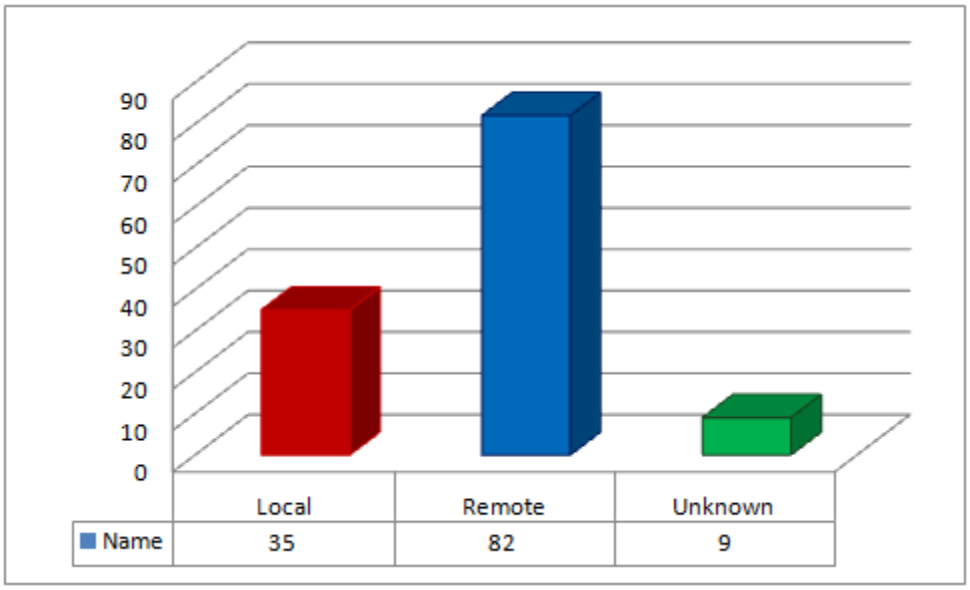


Figure 12. Instructor use of student name: raw data.

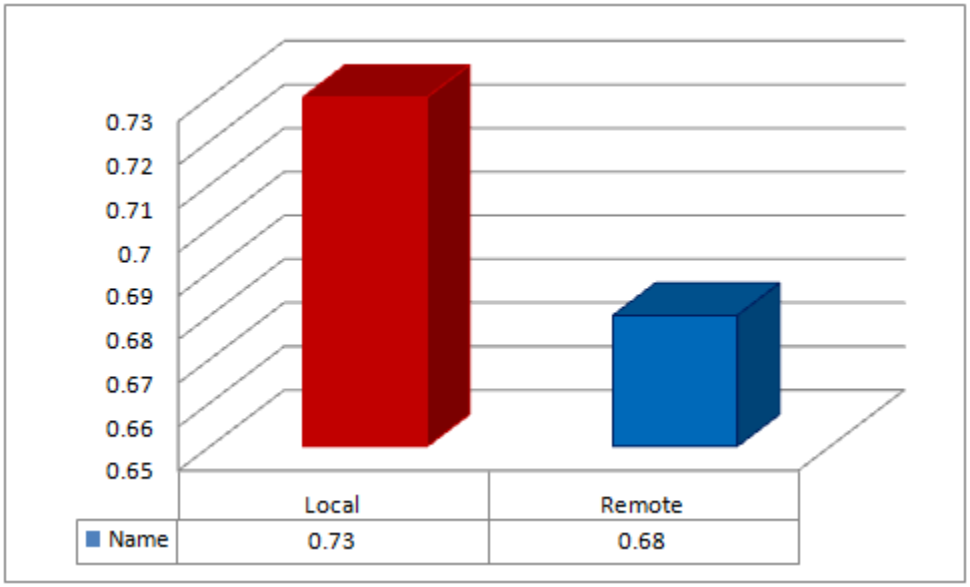
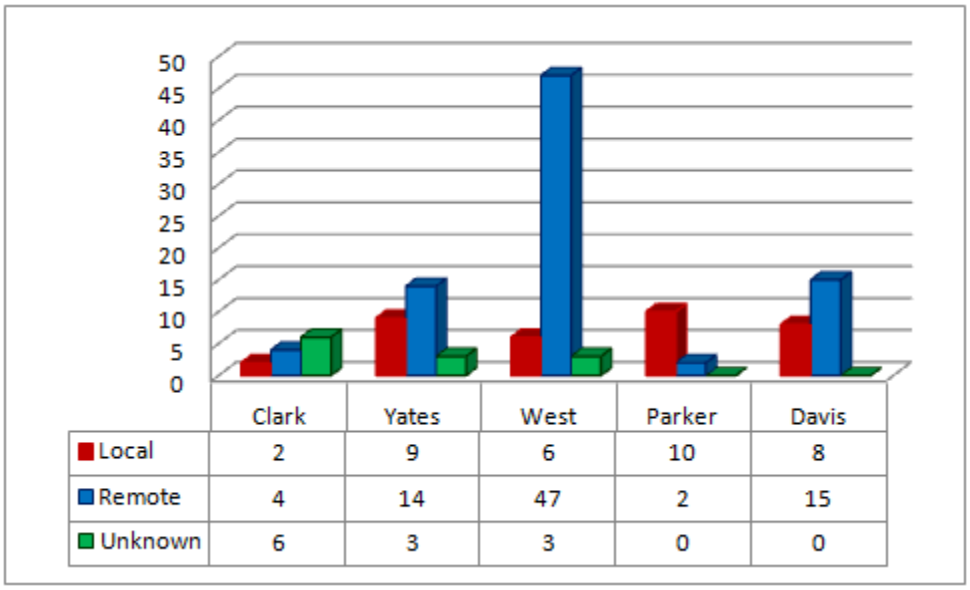
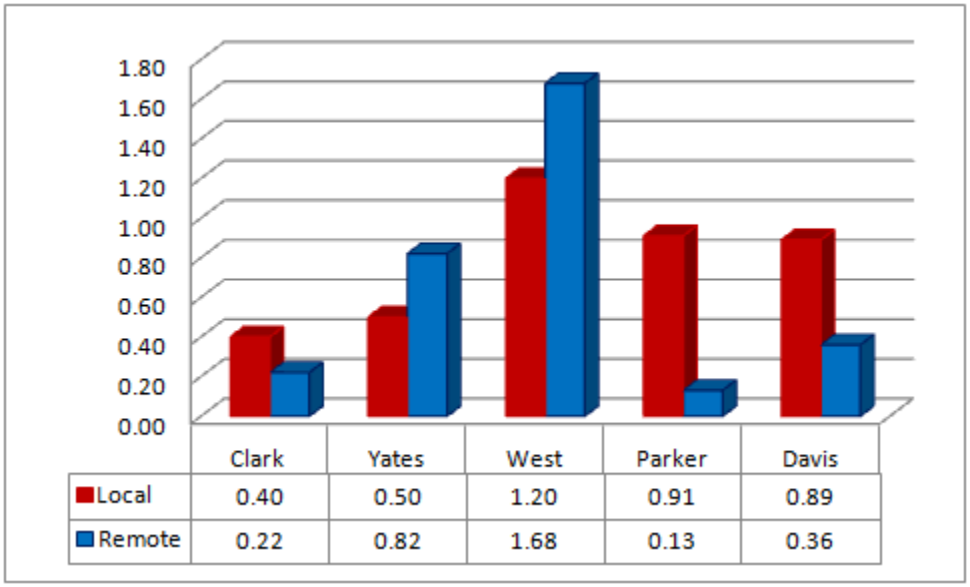


Figure 13. Instructor use of student name: per capita data.



	Clark	Yates	West	Parker	Davis
Local	2	9	6	10	8
Remote	4	14	47	2	15
Unknown	6	3	3	0	0

Figure 14. Individual instructor use of student name: raw data.



	Clark	Yates	West	Parker	Davis
Local	0.40	0.50	1.20	0.91	0.89
Remote	0.22	0.82	1.68	0.13	0.36

Figure 15. Individual instructor use of student name by population: per capita data.

Professor Clark. The raw, percentage, and per capita data for Professor Clark's immediacy behaviors are presented in Table 25 and visually represented in Figure 16.

Table 25

Professor Clark's Immediacy Behaviors by Site

	Total behaviors		
Site	Raw	%	Per capita
Blue*	10	20%	2.00
Purple	12	24%	1.71
Red	0	0%	0.00
Green	18	37%	3.60
Yellow	2	4%	0.40
Remote	0	0%	0.00
Everybody	1	2%	0.04
Unknown	6	12%	n/a**
Totals	49		

Note. * Local site. ** A per capita analysis could not be performed on students whose location was unknown.

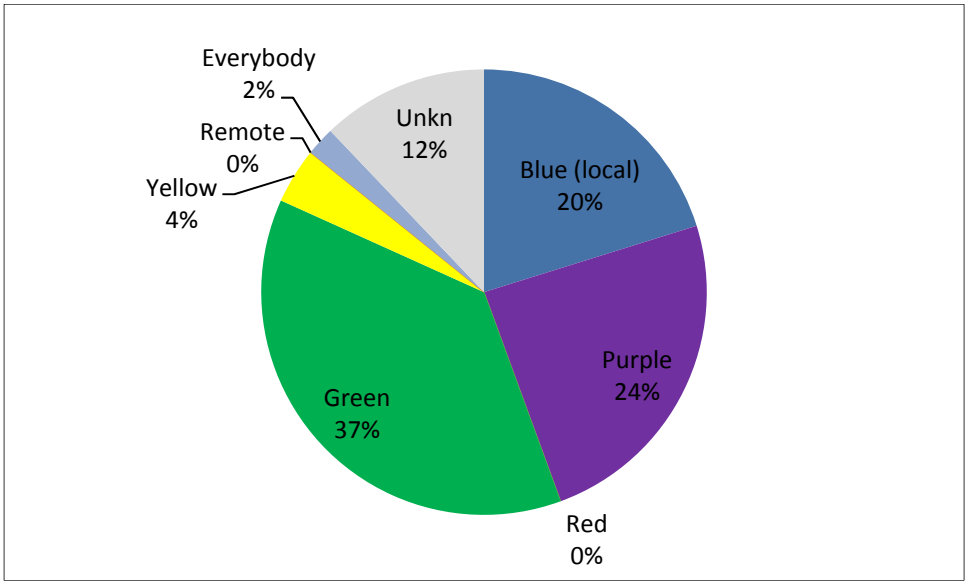


Figure 16. Professor Clark's immediacy behaviors by site: raw data percentages. "Unkn" = "unknown.

The remote green site received the greatest number of total immediacy behaviors at 18, or 37% of the total. The remote purple and the local blue sites were nearly equal at 12 and 10 behaviors or 24% and 20% respectively. Together, these three sites account for approximately 81% of the total immediacy behaviors in Professor Clark's observations. The remaining 19% is divided between an unknown student at 6 behaviors and 12% of the total, and the yellow site and the class as a whole which received 2 and 1 behaviors respectively, or 4% and 2% each. Professor Clark did not engage in any immediacy behaviors with the red site at any time during the observations.

Professor Yates. The raw, percentage, and per capita data for Professor Yates's immediacy behaviors are presented in Table 26 and visually represented in Figure 17.

Table 26

Professor Yates's Immediacy Behaviors by Site

Site	Total behaviors		
	Raw	%	Per capita
Blue	1	2%	0.25
Purple*	14	25%	0.78
Red	6	11%	1.50
Green	25	44%	6.25
Teal	6	11%	1.20
Remote	n/a	n/a	n/a
Everybody	0	n/a	n/a
Unknown	5	9%	n/a
Totals	57		

Note. * Local site.

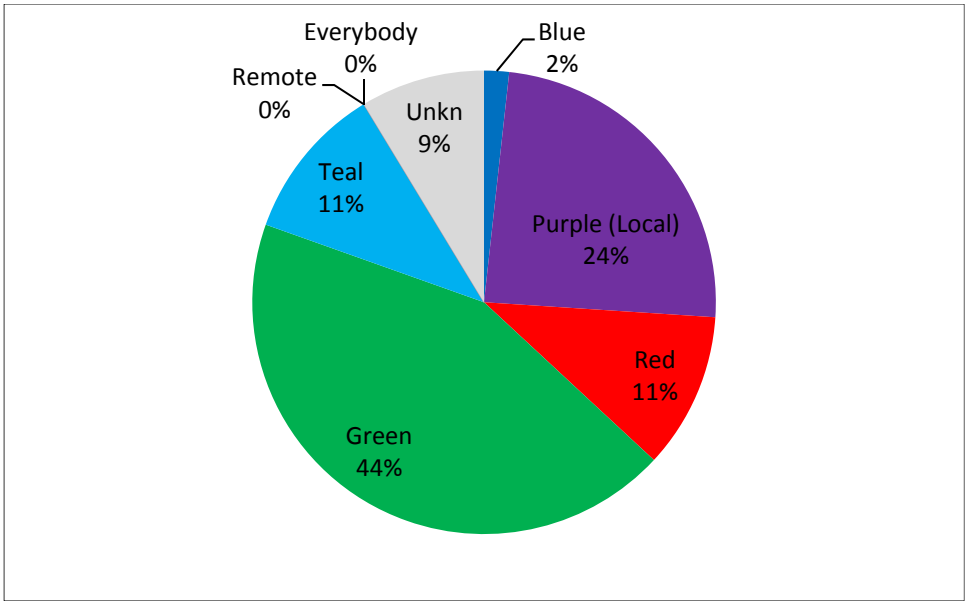


Figure 17. Professor Yates's immediacy behaviors by site: raw data percentages. "Unkn" = "unknown.

Professor Yates engaged in a total of 57 immediacy behaviors across the observations. The remote green site had the highest number of total immediacy behaviors at 25 or 44%, followed by the local purple site at 14 or 25%. Combined, these two sites comprise 69% of all total immediacy behaviors. The red and teal sites both garnered 6 total immediacy behaviors, or 11% each and 22% combined. A total of 5 immediacy behaviors were directed to students whose location could not be determined, and the blue site had one immediacy behaviors directed to it. The per capita analysis provides a somewhat different order of sites from highest to lowest number of total immediacy behaviors. The green site remains at the highest end of the scale at 6.25. But the red and teal sites surpass the purple site's 0.78 behaviors per capita at 1.5 and 1.2 respectively. The blue site remains at the lowest end of the scale at 0.25.

Professor West. The raw, percentage, and per capita data for Professor West's immediacy behaviors are presented in Table 27 and visually represented in Figure 18.

Table 27

Professor West's Immediacy Behaviors by Site

	Total behaviors		
Site	Raw	%	Per capita
Blue	36	27%	9.00
Purple	31	23%	2.38
Red	24	18%	8.00
Green*	12	9%	2.40
Teal	3	2%	1.50
Yellow	21	16%	4.20
Orange	6	5%	6.00
Remote	0	0%	0.00
Everybody	0	0%	0.00
Unknown	0	0%	
Totals	133		

Note. * Local site.

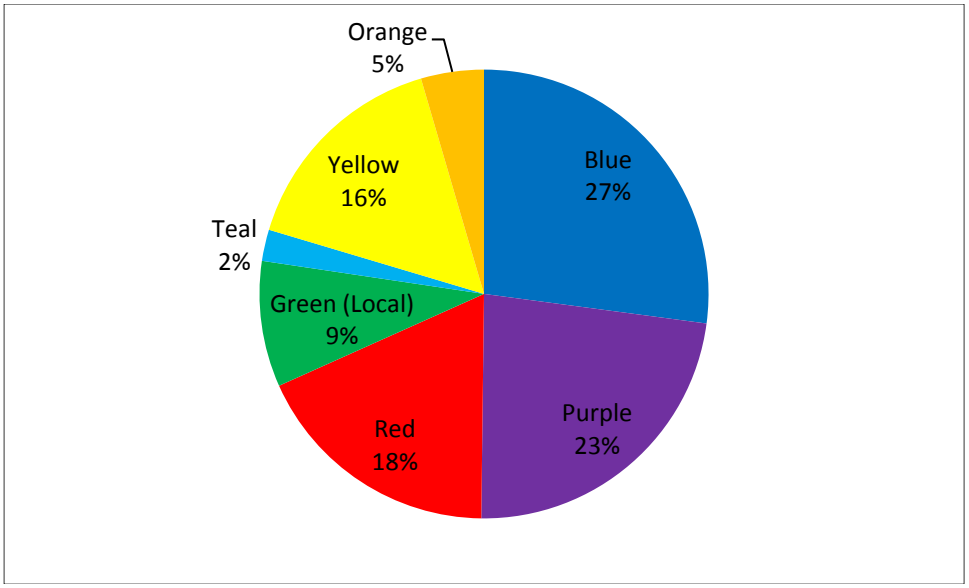


Figure 18. Professor West's immediacy behaviors by site: raw data percentages.

Professor West engaged in 133 total immediacy behaviors across the observation sessions. The remote blue and purple sites had the largest number of total immediacy behaviors directed to them, at 36 and 31 respectively, or 27% and 23%. The red and yellow sites had the next largest amounts, at 24 and 21, or 18% and 16% respectively. The local green site had 12 total immediacy behaviors, or 9%. The orange site had 6 behaviors or 5% and the teal site had the least at 3, or 2% of the total. From a per capita standpoint, the blue site remains the site with the greatest number of total immediacy behaviors at 9.0. The red site received 8.0 per capita behaviors, and the orange site received 6.0, raising both sites in this analysis. The yellow site received 4.2, with the green site receiving 2.4. The purple site, which got the second most immediacy behaviors in the frequency data, received nearly the least in the per capita data at 2.38. The teal site remains the site with the fewest immediacy behaviors at 1.5.

Professor Parker. The raw, percentage, and per capita data for Professor Parker's immediacy behaviors are presented in Table 28 and visually represented in Figure 19.

Table 28

Professor Parker's Immediacy Behaviors by Site

	Total behaviors		
Site	Raw	%	Per capita
Blue	7	11%	1.40
Purple*	39	62%	3.55
Green	9	14%	2.25
Yellow	5	8%	1.67
Brown	3	5%	1.00
Remote	0	0%	0.00
Everybody	0	0%	0.00
Unknown	0		
Totals	63		

Note. * Local site.

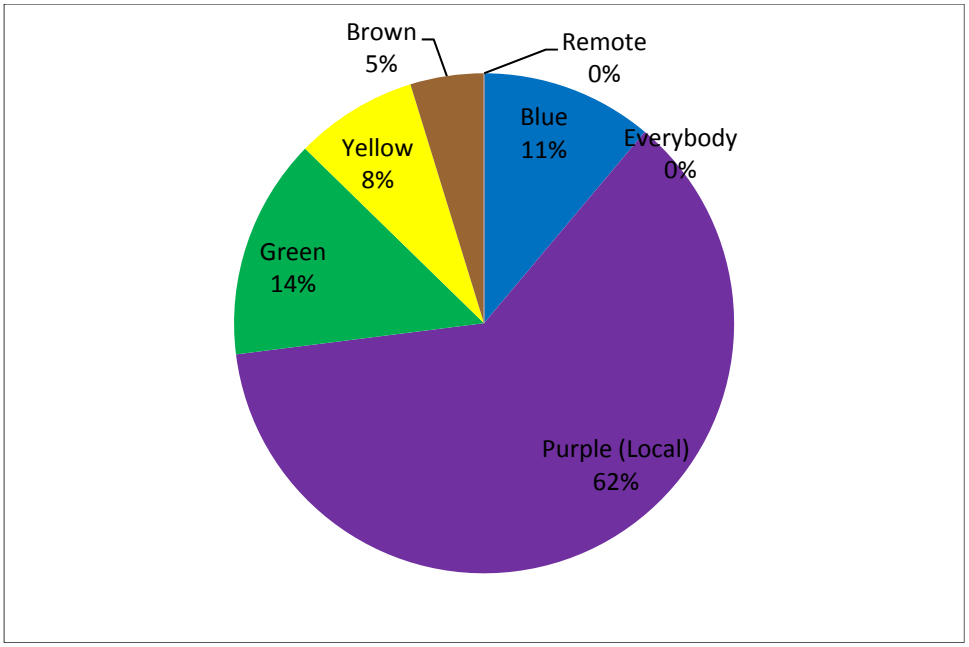


Figure 19. Professor Parker's immediacy behaviors by site: raw data percentages.

Professor Parker engaged in a total of 63 immediacy behaviors across the observations. The local purple site garnered by far the most of these behaviors at 39 or 62% of the total. The remote green and blue sites had the next most at 9 and 7, or 14% and 11% respectively. The yellow site had 5 immediacy behaviors directed to it, or 8%. The brown site had 3, or 5% of the total immediacy behaviors. Although the local purple site is much larger than the any of the remote sites, it still received the greatest per capita behaviors at 3.55. But the per capita data is not quite so unevenly distributed, with the gap between this site and the others being smaller than in the percentage data. The green site had 2.25, with the yellow site garnering 1.67 per capita immediacy behaviors. The blue site received 1.40 and the brown site received 1.0 average immediacy behaviors per student.

Professor Davis. The raw, percentage, and per capita data for Professor Davis's immediacy behaviors are presented in Table 23 and visually represented in Figure 16.

Table 29

Professor Davis's Immediacy Behaviors by Site

	Total behaviors		
Site	Raw	%	Per capita
Blue	0	0%	0.00
Purple	31	24%	1.63
Red	23	18%	11.50
Green	22	17%	1.57
Teal*	33	25%	3.67
Yellow	10	8%	2.50
Orange	8	6%	8.00
Remote	0	0%	0.00
Everybody	3	2%	0.06
Unknown	0	0%	0.00
Totals	130		

Note. * Local site.

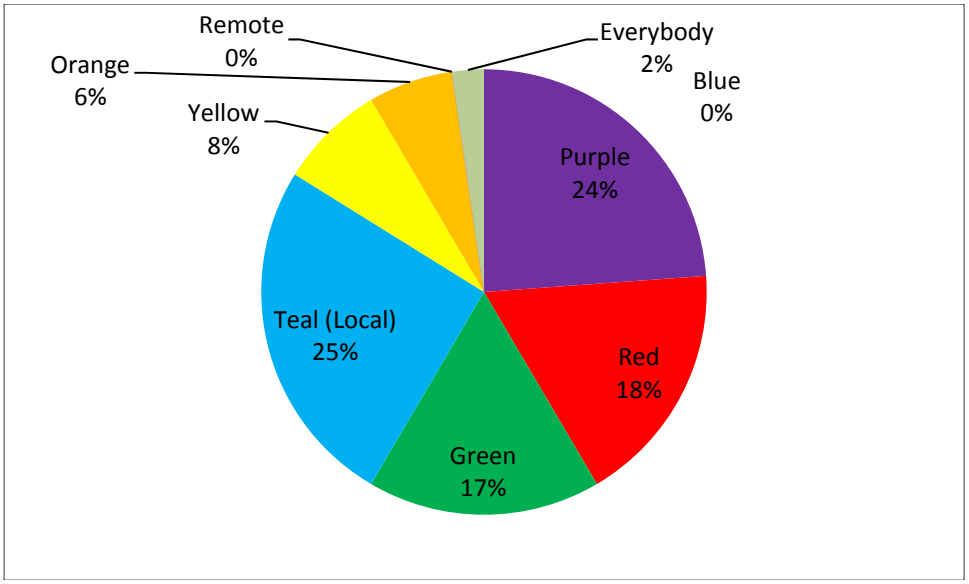


Figure 20. Professor Davis's immediacy behaviors by site: raw data percentages.

Professor Davis engaged in a total of 130 immediacy behaviors during the observations, which were fairly evenly distributed among the sites in the classes. The local teal site received 33 total immediacy behaviors or 25% of the total. The remote purple site received nearly the same amount at 31, or 24%. The red and green sites received approximately the same amount at 23 and 22 behaviors respectively, or 18% and 17%. The yellow site received 10 immediacy behaviors or 8% and the orange site received 8 behaviors or 6% of the total. Professor Davis directed 3 immediacy behaviors to the class as a whole, or 2% of the total. The distribution of per capita behaviors is somewhat less even, however. The red site's 2 students received 11.5 behaviors on average, with the orange site's single student receiving 8.0. The teal site's 9 students received an average of 3.67 each. The yellow site's 4 students received 2.50 per capita immediacy behaviors, with the purple site's 19 students receiving an average of 1.63

each. The green site's 14 students received an average of 1.57 immediacy behaviors each, with the class as a whole receiving 0.06 behaviors per capita.

Comparison between instructor immediacy and student interaction behavior. Instructor immediacy behavior was compared to student interaction behavior at the population level to investigate any differences that exist between the frequencies of each. Descriptive statistics for this comparison in provided in Table 30.

Table 30

Descriptive Statistics for Instructor Immediacy Behaviors as Compared to Student Interaction Behavior by Population Across All Instructors

Immediacy Behavior	*n*	Minimum	Maximum	*M*	*SD*
Instructor to local population	5	1.00	39.00	21.60	13.40
Instructor to remote population	5	24.00	121.00	61.80	43.10
Local student population	5	5.00	63.00	29.60	24.20
Remote student population	5	30.00	123.00	76.80	41.03

Across all instructors, the results of the Hedges' *g* show that there is less than one standard deviation (*SD* = -0.369) between the instructor immediacy behavior directed to the local student population (*M* = 21.6, *SD* = 13.4, *n* = 5) and the interaction behavior of the local student population (*M* = 29.6, *SD* = 24.2, *n* = 5) favoring the local student population.

Across all instructors, the results of the Hedges' *g* show that there is less than one standard deviation (*SD* = -0.322) between the instructor interaction behavior directed to the remote student population (*M* = 61.8, *SD* = 43.1, *n* = 5) and the interaction behavior

of the remote student population (M = 76.8, SD = 41.03, n = 5) favoring the remote student population.

Summary of instructor immediacy behavior analysis. In summary, the analysis of immediacy behaviors demonstrates a very even distribution by population: Immediacy behaviors based on student location essentially match the population sizes. The local population comprises 29% of the total population and received 25% of immediacy behaviors. The remote population accounts for 71% of the total population and received 72% of the total immediacy behaviors. From a per capita standpoint, immediacy behaviors across the instructors is also quite even with the local population receiving 2.25 per capita behaviors and the remote population 2.58.

When comparing individual instructors' population data, four of the instructors engaged in more immediacy behaviors with remote students on a frequency basis, with one directing more to the local population. On a per capita basis three of the five engaged in more behaviors with the local students, with the local students receiving more behaviors in a range of 0.22 behaviors for Professor Clark to more than twice the number of behaviors directed to remote students by Professor Parker. Professors Yates and West both engaged in more immediacy behaviors with their remote students, ranging from approximately 80% for Professor West to nearly three times as many as the remote students for Professor Yates.

Interaction Category Results

Instructor behaviors were coded according to their category and analyzed to provide additional data in answer to the research question concerning differences in

interaction with local and remote populations interactions based on student location. Data was collected on the content of interaction behaviors, with a total of four possible categories available, each of which included statements made to the entire class or simply not specifically directed to any particular site or person. The social category included questions and comments that establish a social connection between the instructor and the student. The procedural category concerned the expectation and scheduling of the course. Material interaction behaviors concerned course content. Technical interactions concerned the use of technology to transmit the course and any difficulties experienced in doing so. This data is presented from a population standpoint.

Social Interactions

The results for the instructor's social interactions are presented in Tables 31, 32, and 33. Across all instructors, the results of the Hedges' *g* show that there is less than one standard deviation (*SD* = -0.69) between the local population (*M* = 2.20, *SD* = 1.64, *n* = 5) and remote population (*M* = 7.6, *SD* = 9.86, *n* = 5) favoring the remote population.

A total of 55 social interaction behaviors were recorded across the observations. Across all instructors, the results of the Cohen's *d* show that there is slightly less than one standard deviation (*SD* = -0.94) between the local population (*M* = 2.2, *SD* = 1.64, *n* = 5) and remote population (*M* = 7.6, *SD* = 9.86, *n* = 5) favoring the remote population.

The local population received 20% or 0.23 per capita. The remote population received 69% or 0.32 per capita. The class as a whole received 6 or 11% of the total social interactions. Three of the five instructors engaged in very few social interactions, with Professors Clark and Parker having a total of 4 social behaviors each, and Davis

having only 2. Professors Yates and West engaged in 19 and 26 social behaviors each, with the majority of those being directed to the remote sites at 12 and 23 respectively.

Table 31

Descriptive Statistics for Instructor Social Behaviors by Population Across All Instructors

Site	*n*	Minimum	Maximum	*M*	*SD*
Local	5	0.00	4.00	2.20	1.64
Remote	5	0.00	23.00	7.60	9.86

Table 32

Instructor Social Interaction by Population

Population	Raw data	Percentage	Per capita
Local population	11	20%	0.23
Remote population	38	69%	0.32
Everybody	6	11%	0.04
Unknown	0	0%	n/a
Total	55		0.58

Table 33

Individual Instructor Social Interaction by Population

Instructor		Local	Remote	Everybody	Unknown	Total
Clark	Raw data	3	1	0	0	4
	Percentage	75%	25%	0%	0%	
	Per capita	0.60	0.06	0.00	n/a	0.66
Yates	Raw data	3	12	4	0	19
	Percentage	16%	63%	21%	0%	
	Per capita	0.17	0.71	0.11	n/a	0.99
West	Raw data	1	23	2	0	26
	Percentage	4%	88%	8%	0%	
	Per capita	0.20	0.82	0.06	n/a	1.08
Parker	Raw data	4	0	0	0	4
	Percentage	100%	0%	0%	0%	
	Per capita	0.36	0.00	0.00	n/a	0.36
Davis	Raw data	0	2	0	0	2
	Percentage	0%	100%	0%	0%	
	Per capita	0.00	0.05	0.00	n/a	0.05

Procedural interactions. The results of the instructor's procedural interactions are presented in Tables 34, 35, and 36. Across all instructors, the results of the Hedges' *g* show that there is more than one standard deviation (*SD* = -1.65) between the local population (*M* = 3.8, *SD* = 3.3, *n* = 5) and remote population (*M* = 12.2, *SD* = 5.6, *n* = 5) favoring the remote population.

A total of 103 procedural interaction behaviors were recorded across all instructors. Across all instructors, the results of the Cohen's *d* show that there is more than one standard deviation (*SD* = -1.89) between the local population (*M* = 3.8, *SD* = 3.3, *n* = 5) and remote population (*M* = 12.2, *SD* = 5.6, *n* = 5) favoring the remote population.

The majority of the instructors' procedural interactions were directed to the remote population from both a percentage and per capita standpoint. The remote population received 61 behaviors or 59% of the total procedural interaction, or 0.51 on average per remote student. The entire class received more procedural behaviors than the local population, at 23 behaviors and 22% of the total, and 0.14 per capita. The local population received 19 behaviors or 18% of the total number of behaviors for this category, or 0.40 per capita. Professor Clark directed 67% of her procedural interactions to the remote population, with Professors Yates, West, Parker, and Davis directing 61%, 63%, 42%, and 71% of their procedural interactions to the remote population respectively. From a per capita standpoint, the local population received the highest number of procedural behaviors in Professors Clark, West, and Parker's courses with 0.60, 8.0, and 0.82 respectively. However, at a per capita figure of 0.79, the local students in Professor West's class received nearly the same number as the remote students. The remote population received the most per capita behaviors in Professors Yates and Davis's courses, at 0.65 and 0.24 respectively. Professor Davis directed no procedural interaction behaviors to her local population.

Table 34

Descriptive Statistics for Instructor Procedural Behaviors by Population Across All Instructors

Site	*n*	Minimum	Maximum	*M*	*SD*
Local	5	0.00	9.00	3.80	3.8
Remote	5	8.00	22.00	12.2	5.6

Table 35

Instructor Procedural Interaction by Population

Site	Raw data	Percentage	Per capita
Local population	19	18%	0.40
Remote population	61	59%	0.51
Everybody	23	22%	0.14
Unknown	0	0%	n/a
Total	103		1.04

Table 36

Individual Instructor Procedural Interaction by Population

Instructor		Local	Remote	Everybody	Unknown	Total
Clark	Raw data	3	8	1	0	12
	Percentage	25%	67%	8%	0%	
	Per capita	0.60	0.44	0.04	n/a	1.09
Yates	Raw data	3	11	4	0	18
	Percentage	17%	61%	22%	0%	
	Per capita	0.17	0.65	0.11	n/a	.093
West	Raw data	4	22	9	0	35
	Percentage	11%	63%	26%	0%	
	Per capita	0.80	0.79	0.27	n/a	1.86
Parker	Raw data	9	10	5	0	24
	Percentage	38%	42%	21%	0%	
	Per capita	0.82	0.67	0.19	n/a	1.68
Davis	Raw data	0	10	4	0	14
	Percentage	0%	71%	29%	0%	
	Per capita	0.00	0.24	0.08	n/a	0.32

Material interactions. The results of the instructors' material interactions are presented in Tables 37, 38, and 39. Across all instructors, the results of the Hedges' *g* show that there is less than one standard deviation (*SD* = -0.70) between the local

population (*M* = 22.20, *SD* = 15.6, *n* = 5) and remote population (*M* = 41.6, *SD* = 31.8, *n* = 5) favoring the remote population.

A total of 447 material behaviors were recorded across the instructors. Across all instructors, the results of the Cohen's *d* show that there is less than one standard deviation (*SD* = -0.82) between the local population (*M* = 22.2, *SD* = 15.6, *n* = 5) and remote population (*M* = 41.6, *SD* = 31.8, *n* = 5) favoring the remote population.

At 47% the remote population received the most from a percentage standpoint, with the class as a whole receiving 28% and the local population 25%. Per capita the local population received the highest number of behaviors at 2.31 per student as compared to the remote population's 1.73 per student. Four of the five instructors directed the highest percentage of material behaviors to the remote population, with Professor Clark directing 42% to the remote population, Professor Yates 58%, Professor West 66%, and Professor Davis 57%. The exception to this is Professor Parker who directed the highest percentage of material interaction behaviors to the class as a whole, at 51%. From a per capita standpoint four of the instructors directed the highest number of material behaviors per capita to the local populations, at 3.60 for Professor Clark, 3.36 for Professor Parker, and 4.44 for Professor Davis. Professor West directed slightly more behaviors to the local population at 2.20 as compared to the remote population's 2.14 per capita behaviors. Professor Yates directed more behaviors per capita to her remote population at 0.88.

Table 37

Descriptive Statistics for Instructor Material Behaviors by Population Across All Instructors

Site	*n*	Minimum	Maximum	*M*	*SD*
Local	5	5.00	40.00	22.20	15.6
Remote	5	12.00	87.00	41.60	31.8

Table 38

Instructor Material Interaction by Population

Site	Raw data	Percentage	Per capita
Local population	111	25%	2.31
Remote population	208	47%	1.73
Everybody	127	28%	0.76
Unknown	1	0%	n/a
Total	447		4.80

Table 39

Individual Instructor Material Interaction by Population

Instructor		Local	Remote	Everybody	Unknown	Total
Clark	Raw data	18	34	24	0	76
	Percentage	24%	42%	32%	0%	
	Per capita	3.60	1.89	1.04	n/a	6.53
Yates	Raw data	5	15	5	1	26
	Percentage	19%	58%	19%	4%	
	Per capita	0.28	0.88	0.14	n/a	1.30
West	Raw data	11	60	20	0	91
	Percentage	12%	66%	22%	0%	
	Per capita	2.20	2.14	0.61	n/a	4.95
Parker	Raw data	37	12	52	0	101
	Percentage	37%	12%	51%	0%	
	Per capita	3.36	0.80	2.00	n/a	6.16
Davis	Raw data	40	87	26	0	153
	Percentage	26%	57%	17%	0%	
	Per capita	4.44	2.07	0.51	n/a	7.03

Technical interactions. The results of the instructors' technical interactions are presented in Tables 40, 41, and 42. Across all instructors, the results of the Hedges' *g* show that there is less than one standard deviation (*SD* = -0.644) between the local population (*M* = 2.4, *SD* = 1.95, *n* = 5) and remote population (*M* = 4.6, *SD* = 3.9, *n* = 5) favoring the remote population.

A total of 49 technical interactions took place during the observations. Across all instructors, the results of the Cohen's *d* show that there is less than one standard deviation (*SD* = -0.75) between the local population (*M* = 2.4, *SD* = 1.95, *n* = 5) and remote population (*M* = 4.6, *SD* = 3.9, *n* = 5) favoring the remote population.

The remote population received the highest percentage and the highest per capita behaviors for this category, at 47% and 0.19 per capita. The entire class received 29% of technical interaction behaviors, with the local population receiving 24% or 0.15 per capita. Professor Parker engaged in no technical interactions, and Professors Clark and Davis engaged in only a few at five and six respectively. Professor Yates directed three technical behaviors to her local population or 23% of the total, with 54% being directed to the remote population and 23% being directed to the class as a whole. Professor West directed 20% of his technical behaviors to the local population, with 40% being directed to the remote population and 40% being directed to the class as a whole.

Table 40

Descriptive Statistics for Instructor Material Behaviors by Population Across All Instructors

Site	*n*	Minimum	Maximum	*M*	*SD*
Local	5	0.00	5.00	2.40	1.95
Remote	5	0.00	10.00	4.60	3.90

Table 41

Overall Instructor Technical Interaction by Population Across All Instructors

Population	Raw data	Percentage	Per capita
Local population	12	24%	0.25
Remote population	23	47%	0.19
Everybody	14	29%	0.08
Unknown	0	0%	n/a
Total	49		

Table 42

Individual Instructor Technical Interaction by Population

Instructor		Local	Remote	Everybody	Unknown	Total
Clark	Raw data	1	3	1	0	5
	Percentage	20%	60%	20%	0%	
	Per capita	0.20	0.17	0.04		0.41
Yates	Raw data	3	7	3	0	13
	Percentage	23%	54%	23%	0%	
	Per capita	0.17	0.41	0.09	n/a	0.66
West	Raw data	5	10	10	0%	25
	Percentage	20%	40%	40%	0%	
	Per capita	1.00	0.36	0.30	n/a	1.66
Parker	Raw data	0	0	0	0	0
	Percentage	n/a	n/a	n/a	n/a	
	Per capita	n/a	n/a	n/a	n/a	n/a
Davis	Raw data	3	3	0	0	6
	Percentage	50%	50%	0%	0%	
	Per capita	0.33	0.07	0.00	n/a	0.40

Summary of Quantitative and Qualitative Results

In summary, the instructors who participated in this study find teaching in the multi-point videoconferencing environment to be challenging, requiring more planning and organization, and presenting some barriers to developing relationships with remote students. Interaction in this milieu is seen as being more complex with visual aspects of the environment creating some difficulty in engaging in interaction with remote students. The instructors employ several strategies to facilitate and manage active interaction with their remote students, and few differences between local and remote students were observed in their interaction and immediacy behaviors in gross observation. However, their ability to connect with their remote students effectively remains a concern for them.

The quantitative analysis of interaction and immediacy behaviors suggests that these instructors are interacting with local and remote students fairly equally despite the increased complexity of the environment. In general, the instructors interacted with remote sites essentially as frequently as or more frequently than they did with the local site. Similarly, students at remote sites tended to be more active, interacting with the instructor more frequently than local students, with the local sites among the least active in three of the instructors' courses. The analysis of instructor immediacy behaviors reveals a very even distribution of behaviors for most instructors. A category analysis demonstrates that most instructor interaction behaviors are either procedural or material in content, with the remote population receiving slightly more procedural interactions and the local population receiving more material ones.

V. DISCUSSION

The purpose of this study was to examine how professors teaching in a multi-point videoconferencing instructional environment interacted with students in the local and remote classrooms. The research questions answered by this study included:

1. Is there a difference in instructional interactions between the professor and students based on student location, i.e. proximate or remote location?
2. Is there a difference instructor immediacy behaviors based on student location, i.e. proximate or remote location?

This chapter presents an analysis of the qualitative and quantitative results in answer to the study's research questions. Main findings from data analysis will be presented and discussed. Additionally, the results will be compared to the prevailing literature of the field to examine where the interaction and immediacy behaviors of these instructors matches and differs from findings of past research, and possible explanations for differences from the literature that are found. The chapter concludes with implications for both practice and for future research.

Main Findings

1. The instructors' experiences teaching in this videoconferencing environment mirror the literature in the complexity of the teaching experience, an increased difficulty in establishing and maintaining relationships with students at remote

sites and interacting with them, and the cognitive toll teaching in this kind of environment takes on an instructor.

2. No clear difference existed in instructor interaction with local and remote populations.
3. The remote student population in this study interacted more frequently than the local one.
4. These instructors tended to engage in more positive and personal (immediacy) behaviors with the remote student population than the local one.
5. Students who received the most positive and personal (immediacy) behaviors from the instructor interacted the most.
6. Instructor interaction and immediacy are a function of student interaction, not student location.

Interview Results as Compared to the Literature

A comparison between the literature on instructor experiences in a videoconferencing environment and the comments of the instructors who participated in this study reveals some striking similarities. First, the complexity and demands of teaching in videoconferencing are made clear by Carville and Mitchell (2000) when they discuss the toll that it may take on the instructor, with instructors in their study describing themselves as drained after each class session. The demands may include such things as difficulty in seeing the faces of individual students at remote locations, interacting with students at multiple locations, a lack of nonverbal communication cues from remote students, and developing personal relationships with remote students. Professor West

describes an environment that is more complex than a traditional face-to-face classroom. Professor Clark's experience has been nearly identical to the literature, stating that not only is this her most challenging teaching assignment but also relating that the cognitive demands of teaching via videoconferencing caused her to be unable to sleep after class sessions when she started in the consortium.

The literature asserts that the introduction of technology between an instructor and students at remote sites increases the difficulties teachers face when attempting to interact with students at a distance, creating a gap between them both in terms of communication and relationship development. The instructors in this study referenced these difficulties, noting that interactions with remote students are noticeably more difficult than with local ones. As Professor Clark said, it can be "incredibly difficult" to have the same kind of individual interactions with her remote students that she can easily have with those who are in the same room with her. Professor Davis echoed this experience, stating that she finds it easier to interact with students she can approach directly. Establishing and maintaining relationships with remote students seems to be of particular concern for the instructors in this study, and also in the literature of the field. Raffelini (2006) discussed a sense of exclusion and inequity that remote students report. Skopek and Schuhmann (2008) go so far as to suggest that remote students may feel neglected by their instructors. If remote students report a lack of equal connection to their instructors, what do the instructors perceive? Professor Yates provided a view from behind the instructor's desk when she expressed her worry that she is unable to connect to her remote students as effectively and that her remote students do not get as much from

either her or from the course. Just as remote students may have difficulty connecting with their teacher, Professor West discussed his difficulty in connecting with remote students through a camera lens. Professors West, Clark, and Davis each discussed being unable to identify individual students at remote sites, finding that it is harder to get to know the students at those distant locations.

This inability to identify remote students was mentioned by several instructors, as was the impact they perceived it having on their ability to establish a social and pedagogical connection with their remote students. A reduced ability to see and hear students at remote sites is mentioned in the literature as a concern for the level of interaction, as well as the feedback that instructors typically use to judge student comprehension and engagement. As Umphrey et al. (2008) note, the literature holds that the face-to-face setting is rich with opportunities for rapid feedback and nonverbal cues that are missing in the videoconference environment. This filtering of nonverbal cues through the inherently leaner mechanism of videoconferencing is mentioned by several authors, and the instructors in this study talked at some length about the lack of nonverbal cues present in their videoconferencing classrooms. Professors West, Clark, and Davis each echoed Culnan and Markus' (1987) finding that because nonverbal communication present in student facial expression and body language is lost in videoconferencing, managing interaction with remote students is more challenging. Measuring the engagement and comprehension of remote students is seen as being very, very difficult without the nonverbal cues that are easily seen in the face-to-face classroom. The ability to quickly scan students' faces to judge their level of involvement and comprehension is

lost, as is the ability to gauge instructional pace, making managing instruction and interaction more difficult.

Similarly, and from a somewhat more mechanical standpoint, the technology may limit what instructors are able to do in the classroom. Professor Parker discussed her inability to see what her remote students are doing when they practice physical techniques, which therefore presents challenges to her ability to provide them with effective feedback. And, as Carville and Mitchell (2000) note, it is often necessary for instructors to remain in one place while teaching in this kind of environment. This matches the experience of several professors in this study, who referenced in inflexibility of camera placement and expressed the need to remain in one place while teaching in order to be seen on camera, and therefore by their remote students.

The experiences these instructors reported concerning teaching in this videoconferencing environment tend to match the literature of the field. But interestingly, their actual interaction behaviors tend to conflict with those findings. This will be the focus of the next section of discussion.

Quantitative Results as Compared to the Literature

What follows is a comparison between interaction and positive/personal (immediacy) behaviors in videoconferencing that might be expected from a reading of the literature with those that were observed in this study. Both instructor and student behaviors will be examined.

The Use of Both Percentage and Per Capita Analysis

These instructors manage a complex set of interaction, pedagogical, and technological factors while teaching student groups that vary greatly in size. In general, these instructors view their classes as an amalgamation of one local and multiple remote sites. They employ a number of strategies to facilitate and encourage interaction with their remote sites, paying attention to the amount and quality of the interaction they have with each, careful not to allow any one site to dominate the discussion. When a site has many students, the per capita data for that site will inherently be less as compared to smaller sites. Conversely, when a site contains only two or three students the per capita analysis will tend to reveal a much higher average number of behaviors for each. This may provide a somewhat limited view of interaction when examined by itself. As an example, if Professor Davis were to direct an equal number of behaviors per capita to the students at each site, interaction would be dominated by the purple site's 19 students and the green site's 14, causing interaction with all other sites to seem decidedly unbalanced. Therefore, the percentage of interaction at each site for each instructor is a valid measure of the interaction with the class as a whole. This is not to say that the per capita analysis is a less valid measure, but rather to argue that it is not inherently a more powerful one. Both must be considered in order to gain a well-rounded view of interaction in this complex instructional environment.

Level of Interaction

The level of interaction in this multi-point videoconferencing environment provides the first aspect of comparison between what might have been expected and the

study's actual findings. A reading of the literature concerning instructor and student interaction frequency paints a fairly bleak picture, at least as compared to the face-to-face classroom environment. Taken as a whole, the literature suggests that by its very nature videoconferencing promotes less interaction between teachers and students. Umphrey et al. (2008) find that the face-to-face instructional environment is fertile ground for rapid feedback, nonverbal cues, and a high degree of personal focus, but the leaner medium of videoconferencing reduces the interactive experience. Jung (2006) agrees, stating that the introduction of technology between teacher and student may restrict interaction. Bates (1995) and Muirhead (2001) both discuss a problematic lack of interaction in videoconferencing that spans more than a decade, and Roblyer and Ekhaml (2000) note serious doubt that videoconferencing can provide the same degree of interaction as is found in the more traditional classroom. Therefore, it would be expected that interaction behaviors in this study would be infrequent, or at a minimum that interaction between the instructor and remote students would be less than with local students.

The results of this study arguably conflict with that assumption. In this study a total of 699 instructor interaction behaviors and 537 student interaction behaviors were observed, for a grand total of 1,236 discreet interaction behaviors in 450 minutes of instruction. From a simple averaging standpoint, this accounts for one interaction behavior approximately every 22 seconds. Rather than infrequent, interaction in this environment with these instructors and students is far more active than might be expected from what is generally accepted in the field. Further, interactions between the instructor and local students comprised 310 total interaction behaviors, while interaction between

the instructors and remote students totaled 743 behaviors. The remote population in this study not only did not receive fewer interaction behaviors from instructor than the local population, but in fact received noticeably more. Clearly, something about this environment and the people who teach and learn in it is different. Those differences will be explored in the following sections of this chapter.

Expectations of Instructor Behavior

Equity in the frequency and quality of instructional interaction in videoconferencing is of concern in the literature. The body of literature holds that engaging both local and remote students equally is a significant challenge to instructors, resulting in inequalities in instructor interaction behaviors and widening the gap between the instructor and students who are located at a distance. Instructors interact more often with local students than with those who are at remote sites (Chakraborty & Victor, 2005; Knipe & Lee, 2002; Murphy, 1999; Raffelini, 2006; Simonson et al., 2009; Skopek & Schuhmann, 2008). The content of that interaction also receives some focus in the literature, finding that instructor interactions tend to be more procedural with remote students and at a lesser cognitive level. Conversely, their interaction with local students is not only more social but also exists at a deeper cognitive level (Frietas et al., 1998; Offir et al., 2004).

As Peterson (2004) notes, interactions between instructor and remote students are generally viewed as strained and inauthentic. This lack of authenticity and naturalness in interaction at a distance may be due in part to an associated reduction in instructors' more personal or encouraging behaviors and comments, which are also seen as suffering in the

videoconferencing environment. A decrease in visual and vocal cues available in videoconferencing and an associated increased difficulty in identifying students at remote sites serve to cause instructors to be more formal and less encouraging with their remote students, thereby reducing the sense of connectedness and communication quality experienced by those remote students (Carville & Mitchell, 2000; Harris & Sherblom, 2008; Umphrey et al., 2008).

Given these predominant findings, it would certainly be reasonable to anticipate the following interaction and immediacy behaviors of instructors in this study. They should be expected to exhibit the following behaviors:

- interact more often with the local population than the remote population,
- interact more often with the local site than any of the remote sites,
- have more social and material interactions with the local population,
- have more procedural and technical interactions with the remote population, and
- direct more positive and personal (immediacy) behaviors to the local population than to the remote population.

Observed Instructor Behavior

Predominantly, observed instructor interaction and immediacy behaviors did not agree with expectations based on previous research. Specifically, a summary of the instructor interaction and immediacy behaviors includes:

- there was no clear difference between instructor interaction with local and remote populations,

- instructors interacted with at least one remote site as often as or more often than the local site,
- there is no clear difference in instructor procedural interactions with local and remote populations,
- instructors engaged in more material interactions with the local population, and
- instructors engaged in more positive and personal (immediacy) behaviors with the remote population.

Interaction Behaviors

The results of instructor interaction analysis were mixed. The statistical analysis supports the conclusion that the instructors interacted substantially more frequently with the remote population. And when looking at the percentages of instructor interaction behavior directed to the local and remote populations across all instructors, we find that the remote population receives significantly more interaction behaviors from these instructors. Because the remote population is so much larger than the local one, this may be expected and by itself does not indicate an inequity in instructor interaction. This discrepancy disappears in the per capita analysis. The local and remote population received nearly the same number of behaviors per student on average. In general a similar result is found in the data for each individual instructor, with a distinct advantage to the remote population in percentage and an equally distinct advantage for the local population in the per capita analysis. From both a statistical and percentage standpoint, instructor interaction behaviors are clearly more focused on the remote population. From

a per capita standpoint, most instructors engaged in more interaction behaviors with their local students. Therefore, when data is examined across all analysis measures for the instructors as a group and as individuals, no clear difference is found in their interaction patterns with the local and remote populations. While equivocal, this finding conflicts with current literature. Rather than demonstrating a clear predilection to interact with local students more often than those who are located at remote sites, it reveals a far more equal distribution of instructor interaction behaviors.

When the interaction data for each instructor is examined with regard to interaction at the site level, we find that the assumption that the professors would interact more often with their local site than any of the remote sites is not supported. While the local site does tend to be among the sites that received the most interaction behaviors by percentage, most often it does not get the highest percentage. The per capita data also reveals a tendency to interact more equally with students in the local and remote sites than might be expected. In four of the five instructors' data at least one remote site received more per capita behaviors than the local site, with as many as four remote sites having a higher per capita result than the local site in Professor Yates's class. Additionally, the differences between the local site and at least one remote site tend to be fairly small, indicating a far more equal distribution of instructor interaction behavior than the literature would predict. Rather than a clear bias toward the local site, most instructors tended to interact more frequently with two or three sites in their classes, one of which was generally the local site. This is in clear conflict with the literature's

assertion that remote students do not receive as much attention or interaction from the instructor as the local students.

Immediacy Behaviors

Instructor positive and personal (immediacy) behaviors also differ from what should be expected when reading the literature of the field, and to a greater degree than interaction behaviors. Rather than being more personal and encouraging with their local population, a clear tendency to direct more immediacy behaviors to the remote population is found in the results of this study, both across all instructors and when instructor data is examined individually. Statistically, a substantial difference is found across all instructors in instructor immediacy behavior that favors the remote population. From a percentage and a per capita standpoint, the remote population also received more immediacy behaviors, although across all instructors the difference in per capita behaviors is approximately one third of one behavior each. When looking at data for each instructor the per capita data is less clear, with the locals receiving more behaviors in three of the five instructors and the remote population more in the remaining two. The differences between instructors are marked. In Professors Parker's data the locals received more than twice the immediacy behaviors as the remote students. In Professor Davis's data the difference is 65%. Similarly, Professor Yates's remote students received nearly three times more immediacy behaviors than her local students. Professor West's local students received approximately 80% less immediacy behaviors than the remote students did. While these instructors demonstrated differing personal styles in their more personal and encouraging behaviors, overall they tended to direct more immediacy

behaviors to the remote population. This conflicts with what would be anticipated from reading immediacy literature in videoconferencing (Harris & Sherblom, 2008; Johnson & Roman, 2003; Umphrey et al., 2008).

Social, Procedural, Material, and Technical Interaction Behaviors

The literature holds that the technology used in videoconferencing tends to stifle the more social aspects of instructional interaction, causing teachers to be less social with their remote students than their local ones. This data in this study was not sufficient to either support or refute this assumption. Three of the five instructors engaged in four or fewer social interaction behaviors during the observations. It is true that the two who did engage in social behaviors overwhelmingly directed them to the remote population. However, there were only 55 social interactions across all instructors. While this may seem to indicate that the environment is cold from a personal standpoint, it is important to remember that 30-minute segments were randomly selected from weeks' worth of instruction. Most of the segments concerned the presentation and discussion of course content, and were generally taken from class sessions in progress. It is therefore reasonable to assume that social interactions would be less frequent than at the beginning or end of a class session, or during a class break. Nevertheless, no conclusion can be drawn concerning social interaction behaviors in this study. Similarly, technical interactions were few in this study and are therefore inconclusive.

The literature suggests that instructors engage in more procedural interactions with remote students and more material interactions with local students. But did these

instructors follow that expected pattern? Once again, the percentage and per capita data tend to provide different answers to that question.

The remote population received a higher percentage of procedural interactions, not only across all instructors but also in each individual instructor's data. Procedural interaction was directed to the entire class more often than to the local population, with no procedural interaction directed to the local population in Professor Davis's course. Therefore it might be argued that the greatest amount of procedural interaction was directed to the remote population. But the per capita data is much more evenly distributed. In Professors Clark and Parker's courses the local population received more procedural interaction than the remote, each by approximately 0.15 behaviors. Professor Yates directed more per capita data to her remote population, which is particularly interesting given that her local and remote population were essentially equal in size. The difference between per capita behaviors in Professor West's course is essentially equal. With the percentage data being quite clear and the per capita data being far less clear, no distinct difference in procedural interaction behaviors emerges.

The material interaction behaviors present a clearer difference, although again not across both measures. Once again, the remote population received the highest percentage of material interactions, at nearly twice that of the local population. The class as a whole received a higher percentage of material interactions as well. Nearly half of all material interactions were directed to the remote students, with only one quarter of them being directed to the local population. However, the per capita data shows a clear difference with the local population receiving 34% more per student than the remote population.

So, while material interaction was spread reasonably evenly across the entire class, the instructors' material interaction behaviors do match what is suggested by the literature so far as a demonstrated tendency that favors local students.

Expectations of Student Behavior

While instructor behaviors were the focus of this study, data was collected on student behaviors to provide a clearer picture of interaction in this environment. A number of assumptions concerning the behaviors of the students in this study can be made from a reading of the literature, most particularly concerning the interaction behaviors of the remote students. The literature suggests that the use of cameras, microphones, and display devices has an impact on the comfort level of students located at sites distant from the instructor. Students located in these remote locations are seen as being very aware of the technology, which in turn impacts their communication and interaction behaviors (Carville & Mitchell, 2000; Stenerson, 1999). A predominant finding in the literature is that the distance between themselves and the instructor and the use of technology causes remote students to feel isolated, less involved in the class and with the instructor, less able to ask questions, and less able to participate in discussion (Knipe & Lee, 2002; Murphy, 1999; Raffelini, 2006; Simonson et al., 2009; Skopek & Schuhmann, 2008). From this literature, it is reasonable to expect that remote students in this study would interact less often than their local counterparts in general, and specifically ask fewer questions.

Observed Student Behavior

The interaction behaviors of student populations in this study tend to follow the same patterns as the interaction of their instructors. In four of the five instructors' data the remote population interacted with the highest percentage, with the only exception being Professor Parker whose local population was more active. Again the interaction percentages do not match the sizes of the populations. However, there is more consistency in the students' percentages of interaction as compared to population size than there is in the instructors' data. In Professor Clark and Parker's courses the local students' interaction percentage exceeds that expected due to the size of their population, while the remote students' interaction is less than expected for the size of their population. In Professor Yates and West's classes the reverse is true, with the local students' interaction percentage less than their population size would suggest, and the remote population's expected interaction percentage exceeding the size of the population. In Professor Davis's class, the local and remote population interaction percentage essentially matches the population sizes. This variation in results is also found in the student populations' per capita data. Once again, the remote students interact more frequently on average in two instructor's classes, Professors Yates and West. In both cases, the remote population interacted four or more times as often per capita as the local population. In Professors Clark and Parker's classes, the local students interacted on average approximately three times as often as the remote population. In Professor Davis's course, the difference between the local and remote population averages is less than one half of one behavior per student.

Consequently, from an environmental standpoint it can be argued that no definitive difference was found in the interaction of local and remote student populations. What is clear is that student interaction behavior was not directly impacted by the students' location, whether local or remote. If the remote students felt isolated and less able to participate, as the literature suggests, then it would be reasonable to expect that at a minimum the per capita interaction data for that population would reflect a much lower average per student. Similarly, if local students felt pressured to interact because the instructor was in the same room with them, it would be reasonable to expect their per capita data to be noticeably higher than the remote students'. This is not the case. Instead, these students do not demonstrate any clear or definitive influence on their interaction behavior based on whether they were in the same room with the instructor or not. Differences between their interaction percentages and averages are more likely a function of other variables, such as instructor interaction behaviors and/or student characteristics.

What is particularly striking about this finding is that noticeable technical difficulties were experienced during the observation sessions. The audio in several sessions was distorted, at times badly enough for speech to be unintelligible. There were instances of a lack of synchronization between the audio and the video that were distracting, and the connection to individual remote sites was lost several times in some of these observations. If remote student communication and interaction patterns are reduced by technology that is working perfectly, then it is reasonable to assume that technology problems like these would result in an even greater reduction in their

interaction. It would seem to follow that the greater the technical distortion or disturbance, the greater the negative impact on remote student interaction behavior. But the remote students in the courses examined for this study tended to interact more frequently than their local counterparts regardless of technological difficulties. This suggests that the use of technology did not directly impact remote student interaction behavior in this study.

Instructor Interaction Behavior Based on Student Behavior, Not Student Location

Perhaps the most significant finding of this study is that instructor interaction and immediacy behaviors are far more closely tied to student interaction behavior than to student location. The literature suggests that the way that instructors interact with students is not only impacted by whether the student is sitting in the same room or not, but may be determined by it (Carville & Mitchell, 2000; Raffelini, 2006; Umphrey et al, 2008). This is simply not the case in this study. When comparing the instructors' interaction and immediacy behaviors with those of the students at each site in the course, a very clear picture emerges. The instructors interacted most often with the sites that interacted most often with them. It is true that there is generally not an equal ratio between instructor and student behaviors, and that rank orders do not match exactly in each case. It is also true that some student sites have higher interaction results than the frequency of instructor behaviors they received, as is the case in Professor West's data. In his case, the yellow site was among the highest in student interaction despite being farther down the list in instructor interaction behavior. Similarly, the red site in Professor Davis's class had more student interaction behaviors than instructor behaviors. The

explanation for student sites engaging in more interaction behaviors than they received may lie in the actions of one or more assertive students at those sites. Just as is the case in a more traditional classroom, an unusually vocal or assertive student does not necessarily wait for an instructor invitation to speak. But across the environment there is a striking similarity between the sites that received the most instructor interaction behaviors and those that had the highest student interaction behaviors. This clearly conflicts with the expectations of the literature. Not only did no study reviewed for this research reveal a similar result, no discussion of this kind of result was found. The studies that included multiple remote sites tended to view data only from a population perspective, and did not investigate differences between sites. That may account for some of this difference—but may not account for all of it.

Data Collected and Analyzed

These instructors simply do not fit neatly into the scenario presented in the literature, and neither do their students. Perhaps this is because the scenario's script is incomplete. Most studies focus on perceptual data gleaned from interview and survey. In fact, if this study had stopped at the faculty interview stage a conclusion similar to what is found in the literature might have been drawn. While this type of survey and interview data is critical to our understanding of teaching and learning in videoconferencing and is of interest in this study as well, without an analysis of observable behavior our understanding tends to be limited. Additionally, when observable behaviors were the focus of a study, statistical and percentage analysis tended to be the only measures used to analyze data. A per capita analysis was not generally

presented. This study used all three measures to examine the interaction behaviors of instructors and students in a complex instructional environment. The resulting differences between the measures of analysis serve to provide a picture of the environment that is at once less clear cut and more detailed in the differences it discovers. If only a statistical or percentage approach were used, the differences between the results and the literature would be more pronounced than they are.

Possible Explanations for Differences Between Literature and Results

As can be seen in the comparison of this study's results to the literature, a number of areas of agreement exist. Most prominently, the professors describe an instructional environment and teaching experience that noticeably mirrors the literature of the field. But it is also evident that their interaction and immediacy behaviors tend to differ from that literature. Put plainly, what they said about teaching in videoconferencing matches the literature, but what they did while teaching in it did not. So, if these instructors have similar experiences, why are their behaviors different? A number of reasons can be suggested to answer that question.

Number of Remote Sites and Size of Remote Population

As Cavanaugh (2001), Knipe and Lee (2002), and others point out, much of the research into videoconferencing's use in distance education focuses on a single remote site. While some research has taken place in a multi-point environment, much of it has not. This study looks at an environment with multiple remote sites. No course had less than four remote sites, with one course including six remote sites. Teaching is a complex mixture of presentation, pacing, discussion facilitation, gauging of student verbal and

nonverbal response, and adaptation based on the realities of the classroom. The use of instructional and videoconferencing technologies increases the demands on the instructor's attention, simply because it becomes necessary to attend to a computer, a user's interface, the selection of inputs for display devices, cameras, microphones, sound systems, and various technical difficulties that may be experienced or merely anticipated. With so many things vying for and dividing the instructor's attention, the instructor's focus may be naturally drawn to the students sitting in front of him or her far more than it is to one or even two remote sites seen only on a monitor. But when there are four, five, or six remote sites, the sheer number of them might tend to demand more attention from the instructor. Put simply, it is harder to overlook five remote sites than it is only one. Additionally, the remote populations of these courses tended to be much larger than the local populations. Overall, fully 71% of these students were located at remote sites. Two of the five courses had remote sites that comprised more than 80% of the total students in the class. As an example, Professor West had 5 students sitting in the classroom with him and 28 students at remote sites. Just as it is reasonable to suggest that more remote sites will draw more instructor attention, it is also reasonable to suggest that more remote students will as well. When most of the students in the class are located with the instructor, the few that are seen on a video monitor may fade into the background more easily. But when the vast majority of students are at remote locations, it stands to reason that the instructor's attention will be drawn to them more often. The number of remote sites, and the size of the remote populations, may well be part of the explanation for why

these instructors tended to interact far more equally with their remote populations than the literature suggests they would.

Use of Interaction Strategies Designed for the Environment

The importance placed on interaction in the teaching and learning process is evident in the literature, and as Offir and Lev J. (2000) argue, strategies to encourage interaction between teachers and students must be both designed into the lesson and consistently fostered by the instructor. While Muirhead (2001), Chakraborty and Victor (2005), and others find only weak levels of interaction in distance education, a number of strategies have been identified in the literature that seem to increase interaction frequency and quality. Such strategies identified by Peterson (2004) and Carville and Mitchell (2000) include using student discussion, purposefully alternating between local and remote sites in question direction, calling students by their names, and looking directly into the camera lens while teaching. This is an area where the instructors' behaviors in this study not only agree with the literature, but also extend it. Each professor used a form of question direction and interaction management to ensure responsiveness from remote sites and students. These ranged from what may be seen as the more reactive approach of responding to student interaction patterns during class by drawing in less active sites and quieting dominant ones, to the far more scripted approach of determining in advance which questions will be directed to each site. And, in keeping with the literature, each professor utilized small group discussion to engage students with both each other and course content more actively and effectively. But these instructors also made use of interaction strategies and applications that are specifically designed for this

environment to engage their remote students and promote interaction with them. The use of a posting section in the web conferencing application during lecture provides the students not only with an organized place to keep notes during their group discussion, but also the opportunity to view the notes of other groups. As Professor Yates noted, this feature provides the instructor with a unique opportunity to read the postings of each group as they are written and use that information to gauge student comprehension and guide discussion with the entire class. And perhaps more important from an interaction standpoint, this information can be used to engage more specifically and actively with each group in the class. Professor Clark's use of polling at the beginning of each class session provides an example of interaction applications that are designed specifically to engage remote students. It is true that local students may log into the class web conferencing application and respond to the poll, and each remote student does not necessarily respond to each poll. Nevertheless, the use of this application is geared toward engaging the remote students more actively with the course's material and expectations. Given the higher level of interaction with remote sites than is generally found in the literature, the use of these strategies does seem to have been successful in increasing instructor interaction with students at distant locations.

Dedicated Support

Another aspect of the consortium environment that may differ noticeably from other videoconferencing courses is the provision of dedicated technical support during class sessions. A technician monitors each class session from a central location and assumes responsibility for ensuring that each site is connected and remains connected

during the class, monitoring transmission quality and working to correct any technical difficulties that may be experienced. The instructors are aware of the technician monitoring, and often direct questions and requests for assistance to the technician during lecture. The instructors still control the camera selection and camera angles at the originating site. But it is not necessary for them to attend too closely to the more technical aspects of transmitting the class. Relying on this support, they are able to devote more of their attention and cognitive energy to their teaching and to their interactions with each student and site. Technical support of teachers and students in videoconferencing is not generally discussed in reporting study findings, and cannot be compared as an aspect of this study. Therefore, dedicated technical support cannot be directly linked to the differences in instructor and student interaction behaviors found in this study. But it can be noted that the use of this kind of dedicated support is not common enough in education as to be a given.

Programmatic Differences

There are also programmatic differences that may account for some of the differences between the literature and the results of this study. Much of the literature in the area examines the use of videoconferencing for instruction to extend the reach of the single institution that provides it. But often the courses examined exist within an instructional program that is predominantly based in face-to-face instruction. The special education teacher education program used for this study is a consortium of five university programs in a very specific subject area. It is a cogent and complete graduate program that is based entirely on a synchronous distance education model. The use of the

videoconferencing and web conferencing technologies is not only a core aspect of the program, but in fact make it possible. Additionally, this area of special education curriculum is generally a small part of larger education or special education departments at the university level. As most of the participants noted, the consortium makes it possible to continue academic programs at each university that might otherwise not be sustainable. But unlike many academic programs and even those that use distance education as a foundation, professors at each of the participating universities are far more than simply members of the department. Each is considered to be a co-owner of the consortium and its program. Regular monthly consortium meetings bring these professors together to manage the program, discuss issues faced by the consortium, and plan for its future. They are also actively involved in evaluating the current technological environment and planning for its improvement. As a result, the professors have a distinct sense of ownership of the program, its mission, and its technology that is arguably far greater than is generally found in instructional faculty in higher education. The consortium was created to address a pressing need within the state to increase the number of teachers who are appropriately trained to work with students who have severe disabilities. Each of these professors is an experienced special educator with an extensive background in severe disabilities, and each has a strong sense of responsibility to the community of students who require these types of services. It is quite likely that their sense of ownership of the consortium, their interest in the sustainability of the coursework at their own universities, and their sense of commitment to an inherently

distance-based professional need have combined to cause them to be more aware of their remote students and to take a more active approach to interacting with them.

Limitations

This study included five instructors who teach graduate-level courses in severe disabilities in a single graduate program and a single videoconferencing environment. Each instructor was not only an experienced professor, but also experienced in teaching in this environment. Instructors teaching in other videoconferencing environments, with lesser experience levels, teaching other subject areas, or at other instructional levels were not included. This limits the generalization of findings to other environments and instructors.

While nonverbal aspects of communication play an important role in instruction, a primary limitation of this study concerns the necessity for a heavy reliance on the study of verbal interaction behaviors. The use of recorded class sessions and environmental elements such as lighting did not permit a reliable and consistently replicable collection of data on nonverbal instructor behaviors across the milieu. Nonverbal instructor behaviors were able to be observed reliably enough to generate gross observations, but these behaviors were not able be studied in the same depth as verbal instructor behaviors. Therefore the impact of nonverbal behaviors interaction was not able to be examined.

Finally, student characteristics present limitations. The universities included in this consortium do not share common admissions criteria for their programs in this area. As a result, the students taking classes in the consortium are academically more diverse than would be the case in a single university program. Additionally, students do not

progress through this graduate program in a cohort model, but instead enroll in courses in accordance with more individualized needs and schedules. As a result, students in a single course may have very different levels of experience with the technology itself. Some remote sites may be comprised of students who have taken several courses in this or other videoconferencing environments, while other remote sites contain students for whom this is the first class in any videoconferencing classroom. As the literature suggests, the presence of cameras, microphones, display devices, and sound systems may impact student comfort in the videoconferencing classroom as well as their behavior during class sessions. It is reasonable to assume that student interaction behavior may change as they become more accustomed to the technology used to transmit these classes. However, no data was collected concerning student characteristics or their experience level with videoconferencing. While student behaviors are not the focus of this study, the professors interacted with these students during the course of teaching these class sessions. The diversity of student populations and videoconferencing experience levels may have had an impact on the interaction behaviors of the instructors to a degree that is unable to be reliably determined.

Implications for Practice

This study found a greater frequency of instructor interaction and immediacy behaviors with remote students and remote populations than might be expected in the literature. Remote student behavior was also found to be more frequent than might be suggested by past research. Given this, the results of this case study seem to point to a number of implications for practice for instruction using a videoconferencing modality.

Use of Interaction Strategies

The use of instructional strategies designed to encourage interaction between the instructor and the remote students should be consistently employed. As the literature suggests, students at remote sites may feel intimidated by the electronic equipment used in videoconferencing, which may inhibit their interaction behavior. Further, the literature is quite clear that students at distant sites often feel isolated from and even neglected by the instructor (Carville & Mitchell, 2000; Harris & Sherblom, 2008; Kidd & Stamatakis, 2006; Raffelini, 2006; Woods & Baker, 2004). Strategies that are designed to draw remote students into class discussion and encourage their response can break down some of the barriers presented by the technology. Directing questions to specific locations and alternating those questions among the various sites in the class would seem to enhance the likelihood that remote students will respond. The literature suggests that remote students feel less able to contribute and are hesitant to interrupt instructors. In order to address this, instructors are encouraged to frequently ask for feedback from specific sites rather than the class as a whole. The difference between "Does anybody have any questions?" and "Does anybody at the red site have any questions?" may be the difference between active remote student participation and non-participation. While this strategy may take more class time to implement, it may be done in an alternating fashion to establish a connection with remote locations without significantly increasing time spent on eliciting feedback.

Additionally, actively seeking remote student feedback on course content and expectations via an electronic discussion board or electronic polling application may

permit students to respond both verbally and in written form and provide them with additional methods to interact with the instructor. Frequent use of small group discussion promotes student-to-student interaction, and when accompanied by an electronic posting area for discussion notes, provides the instructor with additional opportunities to interact meaningfully with students at remote sites.

Remote Student Access to the Instructor

As can be seen in the comments from the instructors in this study, local students often have greater access to the instructor before and after class, during breaks and group discussion, and outside the classroom. As instructors in this study related, this creates an unequal relationship by virtue of proximity. It may also serve to enhance remote students' sense of isolation. Strategies to increase remote student access to the instructor before, during, and after class should be sought. At the end of class, students often approach the instructor with questions and concerns. At the conclusion of class sessions, inviting questions specifically from remote students and ensuring that any they have are addressed first may encourage those students to bring the questions to the instructor, and may narrow the gap between the instructor and the remote students. When small group discussion is used with location-based groups, instructors should join a remote group if possible. This will enable them to provide a level of interaction and access often denied remote students. Additionally, muting the microphones at all sites during small group discussion prevents the instructor from observing the thought process and group dynamics of students at remote sites. Joining into remote groups will provide the instructor opportunities to engage with remote students that they do not enjoy otherwise.

Use of Camera Angles and Lighting to Promote Engagement and Connection

The loss of nonverbal portions of instructional communication may have a negative impact on both instructor interaction and student response. The use of a wider camera angle on the instructor may increase a sense of distance the remote students have from the instructor, and remove nonverbal aspects of communication that remote students may need to remain fully engaged with lecture and discussion. The camera angle used for Professor Parker was wider than on the other instructors in this study, and her remote population was less responsive. While it cannot be concluded that this is the sole reason for this result, the camera angle used may have been a contributing factor. A closer view of the instructor should be used to ensure that remote students have an adequately detailed view of the instructor's face. Similarly, the use of wide camera angles at remote sites provides a view of all or nearly all students in a location and may permit the instructor to see a remote student raising his or her hand to contribute. But it also erases almost all forms of nonverbal communication. Use of wide camera angles at remote sites should be interspersed with closer views of students. Consistently zooming the camera onto remote students when they speak should be employed as often as possible. Additionally, poor lighting degrades video quality noticeably and further reduces instructors' and students' ability to clearly see facial expressions, body language, and other forms of nonverbal communication. Care should be taken to ensure that the lighting in each facility is designed to produce a quality video image and that this lighting is routinely used during each class session.

Remote Student Display

Instructors are unlikely to respond to remote students if they do not see them, or if they must make a deliberate effort to look at remote student displays. Again, Professor Parker's class serves as an example. The remote student display in the classroom used for her course was located outside her normal field of vision when teaching, requiring her to specifically look at the display to see her remote students. And her interaction with remote sites was lower than that of her colleagues. The location of remote student displays should be designed with care to ensure that it is placed within the instructor's natural eye gaze and that it is large enough to see multiple remote sites as clearly as possible. This will allow the instructor to see the remote sites more easily and without specific effort, leading to more active engagement with students who are located at a distance.

Multiple Remote Sites and Large Remote Populations

The existence of multiple remote sites in a videoconferenced class may serve to draw the instructor's attention more evenly across the entire class and its students. While a single remote site may be overlooked during the complex process of teaching in an electronically enhanced environment, multiple remote sites are less likely to fade into that background. If an instructional goal is to ensure active interaction with and participation from students at remote sites, the results of this study seem to suggest that incorporating multiple remote sites is an effective strategy. Similarly, when half or more of the class's enrollment is located at remote sites, it seems likely that instructors will tend to target interaction with that majority of their students, and therefore by default will direct more

interaction behaviors to remote students. Because the remote population in this study was so much larger than the local one and the interaction with and from remote students was more than would be expected in the literature, the study's results would suggest that a large remote population may increase interaction with remote students.

Active Emphasis on Immediacy Behaviors

From a statistical perspective, when student interaction behaviors were compared with instructor interaction and positive/personal (immediacy) behaviors, a more substantial difference was found in instructor immediacy behavior data. This suggests that immediacy behaviors seem to have generated more student interaction behaviors than interaction behaviors did. Additionally, these instructors directed more positive and personal behaviors to remote students than local ones, and the remote students interacted at higher rates than the local students did. Therefore, it is reasonable to conclude that if the instructional goal is to increase remote student interaction, instructors should actively include frequent positive and personal behaviors with their remote students.

Creating a Sense of Ownership

A unique aspect of the special education teacher education program examined in this study is that of faculty ownership. The professors involved in the program have a deep and shared sense of ownership of the program, the technology, and the statewide professional need the coursework is designed to fulfill. Arguably this sense of personal ownership is rare in higher education, and perhaps rarer still in distance education programs. Teaching in videoconferencing is challenging and can be fraught with frustration. But as these professors related in their interviews, their shared responsibility

for the program and its students encourages them to continue in a teaching assignment that they view as being far more complex and challenging than more traditional classes. It also encourages them to continue seeking improvements to both their usage of the technology and their interaction with all of their students. While not all videoconferencing-based distance education programs can offer the same level of personal and programmatic ownership found in this consortium, faculty ownership and involvement should not be overlooked. Academic programs are managed by academic administrators. Videoconferencing facilities are for all intents and purposes owned by the technical support staff that manages them. The instructor teaching in the videoconferencing classroom may have a sense of ownership of his or her class, but little else. While this may not differ from the traditional classroom, the environment inside the videoconferencing classroom is anything but traditional. The literature calls for more emphasis on effective interaction with remote students. But a traditional approach to faculty input and involvement in this complex environment is unlikely to produce the desired results. To be sure, the interaction strategies employed by the professors in this study facilitated an unusually high level of interaction. But their ownership and involvement also play a role in these results. Actively and regularly drawing faculty into the design of videoconferencing facilities and evaluation of technology will serve to improve both the facilities and their usage. Encouraging regular discussions among faculty who use those facilities may develop a sense of community around the videoconferencing instruction they are providing.

Recommendations for Future Research

The results of this study were different from what would be expected from a reading of the literature in a number of respects, raising areas for future investigation. While the participating instructors described a teaching environment that matches what is found in the literature, their interaction behaviors did not. The study differed from many found in the literature in that it included multiple remote sites and remote populations that not only at least equaled that of the local populations but were often much larger. Since both numerous remotes sites and large remote populations existed in this study, it is not possible to conjecture which variable may have had a greater impact on instructor interaction behaviors. Further research is needed to determine whether more remote sites or more remote students have a greater impact on instructor interaction and immediacy behaviors. With regard to research into the impact of numerous remote sites on instructor interaction behaviors, attention should be paid to any effective limits that may exist. Research may focus on the number of remote sites that instructors can generally manage without reverting to a predominantly non-interactive teaching style.

The literature calls for developing effective strategies to encourage and enhance interaction between instructors and remote students. The professors in this study used a number of strategies to accomplish this goal, some of which are mentioned in the literature and some of which are not. The use of web conferencing and collaborative tools during videoconferenced instruction is a fairly new phenomenon, and one that bears more investigation to determine the most effective methods for utilizing these applications to increase remote student interaction.

The placement of the remote student display may have played a role in the interaction behaviors of these instructors. One instructor's remote student display was located outside her normal eye gaze in the classroom, and this instructor interacted least often with her remote students. The placement and size of remote student displays may play a significant role in teacher interaction and immediacy behaviors in instruction that is provided via videoconferencing. Experimentation that places the remote student display at various locations within and without the instructor's field of vision may yield useful information about the most effective room configuration for videoconferencing classes. The size of remote student displays may also be investigated for the same purpose to determine if the placement or the size of the display plays a larger role in encouraging higher levels of interaction between the instructor and remote students. Similarly, the widest camera angle was used for the instructor whose class had the least in remote student interaction behaviors. It is possible that the remote students' interaction behaviors were impacted by the instructor's camera angle. The instructor who used the closest camera angle also had the highest rate of remote student response. While many factors play into the interaction behaviors of both students and teachers, future research should investigate the impact of instructor camera angle on student responsiveness. Are closer camera angles on the instructor related to higher levels of student interaction behaviors? Is the reverse true?

Teachers tend to rely heavily on student nonverbal communication to gauge student engagement and comprehension, as well as to adjust pacing and content presentation based on how the students appear to be reacting. But the video quality,

lighting, and camera angles used in this and other videoconferencing environments often filter out those visual details, providing a much leaner and therefore more challenging teaching medium. Both the literature and the professors in this study discussed this as a disadvantage of videoconferencing. The active use of interaction strategies designed for a less visually rich environment may effectively bridge that gap. But advances in technology are making higher resolution video possible. Future research should be done to determine the effects of higher resolution videoconferencing and more detailed visual images on interaction behavior.

Data was not collected on student characteristics for this study, and therefore any impact that differences among the student population may have had on their interaction behavior was not able to be determined. Tracking differences in interaction between students who have more experience in videoconferencing as compared to those who have little may provide insight into the role of student technological experience in student interaction behaviors. In a similar vein, all the instructors who participated in this study are experienced in teaching in this videoconferencing environment, although none of them received specific training in teaching techniques designed for this milieu. The adage that experience is a good teacher would seem to apply here, but to what extent? Future research may compare the behaviors of instructors experienced in teaching in this environment to those who have little experience but much higher levels of training prior to beginning teaching in it.

Chapter Summary

Qualitative and quantitative data were examined to gain an understanding of the teaching experience in the multi-point videoconferencing environment used in a five-university consortium program in severe disabilities at the graduate level. Differences between instructor interaction and immediacy behaviors were examined and compared to student interaction data. The findings are that while the participating professors describe a teaching environment that matches what is found in the literature, their behaviors did not. Rather than demonstrating a tendency to both interact more with the local population and to be more immediate with them, these instructors tended to demonstrate no clear difference in interaction behaviors based on student location—and were in fact more personal and positive with the remote population. A variety of possible explanations for these differences are offered, as are implications for practice in instruction provided via videoconferencing. Recommendations for future research in this area focus on the impact of multiple remote sites, the sizes of local and remote populations, and the configuration of technology in classrooms used for this type of instruction.

APPENDIX A. E-MAIL MESSAGE REQUESTING PARTICIPATION

Dear _____,

I am a doctoral candidate and am conducting dissertation research on instructor interaction behaviors in the multi-point videoconferencing instructional environment. As a faculty member who has taught in the consortium using the videoconferencing system, I would like to request your participation in my study.

Much of the research in videoconferencing used for instruction tends to examine student perception, with far fewer studies of the faculty experience and even fewer that examine actual behaviors in the classroom. Much of it also looks at environments with only one remote site. The consortium classroom is unique in that you as a teacher are asked to manage interaction with multiple sites in a very complex classroom environment. I believe that a descriptive case study of instructor interaction behaviors in this environment will expand on our understanding of what instruction in this environment is really like.

As a participant in the study, you will be asked to do four things:

1. read and complete a consent form indicating your willingness to participate in this study
2. complete a brief form that collects information on who you are and what your level of technology usage and comfort levels are
3. participate in one interview concerning your experiences teaching in this environment and what it is like to manage interactions with students who are located in the classroom with you, and those who are located at remote sites
4. allow me to access archived recordings of classes you have taught in the consortium so that I can collect data on instructional interactions that took place in those class sessions.

You will not be asked to do anything else as a result of your participation.

You will be sent two copies of an Informed Consent Form and a Faculty Profile form in the mail along with a self-addressed stamped envelope. If you would be willing to participate in this study, please complete these forms and return them to me. If you would like to discuss the study, the consent procedures, or anything else about the study, please contact me at [contact information redacted].

Thank you, Kathy Bohnstedt

APPENDIX B. FACULTY PROFILE FORM

Name_____

Academic Credentials
1. Please list the highest degree you have earned:

_____

2. Please list any degrees that you are currently pursuing, including any Post Docs:

_____

3. Circle your consortium university
[University names redacted]

4. Are you:
Full-time faculty Adjunct Faculty

Teaching Experience
1. How many years have you taught?
Primary _____
Secondary_____
Undergraduate _____
Graduate _____

2. How many semesters have you taught in the consortium via the videoconferencing technology?_____

3. How many different courses have you taught in the consortium via the videoconferencing technology?_____

Use of Instructional Technology
1. How long have you been using the following technologies in your teaching?
Presentation technologies like projectors and computers _____
Presentation software like PowerPoint _____
Learning management systems like Blackboard _____
Web conferencing tools like Adobe Connect _____

2. How would you rate your level of expertise using instructional technology in teaching?
__Novice __Somewhat Experienced __Experienced __Very Experienced
__Expert

3. How comfortable are you using instructional technology while teaching?
__Very comfortable __Comfortable __Uncomfortable __Very uncomfortable

Use of Distance Education Technology
Have you used videoconferencing for meetings or other uses outside the classroom?

Do you currently teach courses via videoconferencing outside the consortium environment?
__Yes __No

Have you ever taught classes via videoconferencing outside the consortium environment?
__Yes __No

Have you ever taken a class taught via videoconferencing as a student? __Yes __No

APPENDIX C. PROFESSOR INTERVIEW PROTOCOL

Introduction: I would like to talk with you about your experiences teaching in the consortium distance education environment. I'm most interested in what the experience is like for you as a teacher and any impact you think the environment has on instruction. I'd like for you to lead me through your experiences with this topic and talk with me about whatever you see as important about teaching in this environment.

This interview will be recorded so that I can more accurately capture your comments and experiences. But, if you would rather that I not record it I will not do so. Is recording the interview acceptable to you?

Let's start by talking about the teaching environment.

1. How would you describe your teaching experience using the distance technology?
2. How do you think a more traditional classroom setting and this environment compare?

Let's move into talking about how you teach in this environment.

1. What do you like about teaching this way?
2. What don't you like about it?
3. What's it like teaching students who aren't in the same location as you are?
4. Have you changed anything about the way you teach because of teaching in this environment?

Let's take a minute to talk about how you interact with your students.

1. How important is teacher-student interaction during class time?
2. How does interaction work in this environment? Walk me through an example of interaction during class.
3. Are there any differences in the way that local and remote students interact with you?
4. Are there any differences in the way that you interact with local and remote students?
5. Do you have any specific strategies for managing interaction with local and remote students?
6. How do you think your local and remote students perceive you?

Impact of room configuration

1. Do you like the way the room you use is set-up? What works? What doesn't?
2. How would you describe the visual aspects of the room? Can you see what you need to see when you need to see it?
3. How would you describe the audio aspects of the room? Can you hear what you need to hear when you need to hear it?

Perceptions of the different rooms taught in if more than one

1. If you have taught in more than one room in the consortium, were the rooms you used different from each other? If so, what aspects of each did you like? What didn't you like as much?

Is there anything else that you'd like to talk about concerning your experience teaching in this environment?

APPENDIX D. GROSS OBSERVATION DATA COLLECTION FORM

Gross Observation Data Collection Form

Course_____ Date_____ Originating Site_____

Remote sites

Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no

Video Quality
__excellent
__fair
__poor

Audio Quality
__excellent
__fair
__poor

Camera Angles

1. Instructor camera angle used most often
   __Wide __Medium __Close-up
2. Camera zooms in on remote students when they are speaking
   __usually __sometimes __rarely __at professor request only
3. Camera pans to show local students when they are speaking
   __usually __sometimes __rarely __at professor request only

General Observations of Instructor Behaviors

1. Overall approach to students
   __no difference between local and remote students
   __more favorable to local students
   __more favorable to remote students
2. Encourages students to contribute/draws them into the class and discussions
   __no difference between local and remote students
   __more often with local students
   __more often with remote students
3. Engages in social interactions with students
   __no difference between local and remote students
   __more often with local students
   __more often with remote students

Instructor Behaviors During Interactions

1. Interacts with local and remote students
   __about the same amount __more with local students __more with remote students
2. Directs questions to students:
   __everybody more often __local students more often __remote students more often
3. Gives time to answer questions
   __about the same __more time given to local students __more time given to remote students
4. Responds to student requests to contribute
   __about the same __more often/quickly with local students __more often/quickly with remote students
5. Interrupts students
   __about the same __more often/quickly with local students __more often/quickly with remote students
6. If local and remote students contribute at the same time, demonstrates:
   __no preference __preference for local student __preference for remote student

Non-Verbal Instructor Immediacy Behaviors During Interactions

1. During lecture, looks in the direction of: the camera, the local students, the computer monitor
   __about equally __more at local students __more at the camera __more at the computer

2. Looks in the direction of local student while he/she is speaking
   __usually __sometimes __rarely __never

3. Looks in the direction of the camera while a remote student is speaking
   __usually __sometimes __rarely __never

4. Looks in the direction of the remote student display while a remote student is speaking
   __usually __sometimes __rarely __never

5. Engages in positive reinforcing behaviors while student is speaking
   Local students __always __often __rarely __never
   Remote Students __always __often __rarely __never

6. Uses gestures while talking with students
   Local students __always __often __rarely __never
   Remote Students __always __often __rarely __never

7. Uses vocal variety when talking with students
   Local students __always __often __rarely __never
   Remote Students __always __often __rarely __never

Verbal Instructor Immediacy Behaviors During Interactions

1. Uses general praise for student contribution
   __no difference between local and remote students
   __more often with local students
   __more often with remote students

2. Uses specific praise for student contribution
   __no difference between local and remote students
   __more often with local students
   __more often with remote students

3. Expands on or elaborates on student contribution
   __no difference between local and remote students
   __more often with local students
   __more often with remote students

3. Thanks students for contributing
   __no difference between local and remote students
   __more often with local students
   __more often with remote students

4. Uses inclusive pronouns when talking to students
   __no difference between local and remote students
   __more often with local students
   __more often with remote students

APPENDIX E. VERBAL INTERACTION BEHAVIOR DATA COLLECTION FORM

Verbal Interaction Behavior Data Collection Form

Course_____ Date_____ Instructor_____

Instructor Location_____ Researcher_____

Remote sites

Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no
Site____ Number students_____ Student facial features clearly seen _yes __no

**If not all students at a site can be seen on camera, list the number that can be seen and the total number at the site. As an example, if a site has 5 students, but only 4 can be seen, list 4/5.

Video Quality	Audio Quality	Transmission Quality
__excellent	__excellent	__excellent
__fair	__fair	__fair
__poor	__poor	__poor

Camera Angles

1. Instructor camera angle used most often
   __Wide __Medium __Close-up
2. Camera zooms in on remote students when they are speaking
   __usually __sometimes __rarely __at professor request only
3. Camera pans to show local students when they are speaking
   __usually __sometimes __rarely __at professor request only

Notes

Page 1 of ____

Site Codes	Instructor interaction codes (I)	Student interaction codes (S)	Categories
Site codes redacted	C = Comment ? = Asks question →= Calls on D = Delays student + = Positive response - = Negative response W = Wait time I = Interrupts N = Uses student name ( ) = Site of student whose name is used	C = Comment ? = Asks question I = Interrupts	S = Social P = Procedural M = Material T = Technical

Examples

$I_{?EM}$ would indicate Instructor asked a question of everybody about material

W_{10} would indicate that there was 10 seconds of silence

$I_{C?EM}$ would indicate the instructor answered a question (comment), then asked another question of everybody about material

$I_{?EM}\ W_{10}\ G_C\ I_{+n(G)}$ = instructor asked question of everybody about material, 10 second silence, GMU student answer, instructor positive response using student's name

Page _____ of _____

APPENDIX F. VERBAL INTERACTION BEHAVIOR DEFINITIONS

Initial Interaction Information

Course: the official course designation provided by the university
Date: the date the course was taught
Instructor: the person or persons teaching the class
Instructor location: the site code where the instructor or instructors are located while teaching
Researcher: the person observing and coding the class
Site: the code for the sites where students are located
Number of students: the largest number of individuals at each site during the class session
Student facial feature clearly seen

- Refers only to the default or most often used camera angle in remote classrooms, not to the use of zooms or pans when remote students speak
- Yes means that environmental aspects of the classroom like lighting, contrast, camera angle and location of students in the classroom permit students' faces and facial expressions such as smiling to be discerned. In the case where students sit in rows in the remote classroom, the majority of students' faces must be able to be discerned.
- No means that students' faces and facial expressions such as smiling cannot be discerned. In the case where students sit in rows in the remote classroom, the majority of students' faces are not able to be discerned.

Video quality

- Excellent means that the video is not generally noticeable and has either no or very few pixilations, pauses or other disturbances that blur the video image. The video image across sites is sharp and individuals can be seen clearly.
- Fair means that the video is noticeable, there are disturbances that blur, pause or otherwise disturb the video that are less than 5 seconds in length, or the video image is blurry throughout the class session. The video quality does not impair the observer's ability to see individuals.
- Poor means that the video pixelates, blurs or pauses frequently, the video image is very blurred and impairs the observer's ability to clearly see individuals.

Audio quality

- Excellent means that the audio is not generally noticeable, individuals can be clearly heard and understood with no or very few distortions or pauses. No one asks that something be repeated due to audio difficulties.

- Fair means that there the audio is noticeable. There are distortions or pauses that may or may not interfere with the observer's ability to understand spoken word or hear individual speakers clearly. A combination of distortions, pauses and individuals requesting repetitions due to audio difficulties do not exceed 10 times per class session.
- Poor means that the audio is noticeable often. There are distortions or pauses that may or may not interfere with the observer's ability to understand spoken word or hear individual speakers clearly. A combination of distortions, pauses and individuals requesting repetitions due to audio difficulties exceeds 10 times per class session.

Transmission quality

- Excellent means that the transmission or recording is not generally noticeable. There are either no or few instances when the audio and the video are not in synch with each other.
- Fair means that there the transmission or recording is noticeable. There are instances when the audio and video are not in synch but they are brief do not interfere with the observer's ability to understand spoken word and identify the speaker. Transmission difficulties do not exceed 10 times per class session.
- Poor means that the transmission or recording is noticeable often, there are frequent instances when the audio and video are not in synch that interfere with the observer's ability to understand spoken word and/or identify who is speaking. Transmission difficulties exceed 10 times per class session.

Camera angles

- Wide means that the instructor's entire body can be seen
  - Instructor standing in front of the classroom where his/her entire body can be seen
- Medium means that the instructor's torso is visible
  - Instructor may be seated, with tabletop being visible
- Close-up means that only the instructor's head and shoulders are visible
  - Instructor may be seated, but the tabletop is not visible

Camera zooms on remote students when they are speaking

- Usually means that camera zooms on speaking remote students consistently with few exceptions. This would apply to at-home students who use a webcam and whose face appears in close-up or medium views
- Sometimes means that camera zooms are inconsistent but do occur
- Rarely means that the camera consistently does not zoom on speaking students with few exceptions
- at professor request only means that the camera is only zoomed on speaking students after the professor has verbally requested it

Camera pans on local students when they are speaking

- Usually means that camera moves to display speaking local students consistently with few exceptions
- Sometimes means that camera pans are inconsistent but do occur

- Rarely means that the camera consistently does not pan on speaking local students with few exceptions
- at professor request only means that the camera is only panned on speaking local students after the professor has verbally requested it

Interaction #

- is a series of one-on-one interactions between people in the class that concern the same piece of social, procedural, content or technical information
- may be between instructor and students, or among students
- begins with a request for contribution
  - request may come from instructor or student
  - may be directed to the instructor by a student
  - may be directed to any or all of the students in the class by instructor or student
  - may be in the form of a question or comment
- the number refers to the interaction's sequence during the entire class session

Start time for interaction

- the time code on the video at the first word of a request for contribution

End time for interaction

- the video time code when the discussion about the topic of the interaction is completed
- interaction ends when
  - the instructor's verbally transmitted intent to continue with lecture
  - the instructor continues the lecture
  - silence that takes place at the end of an interaction, but before the instructor resumes lecture, is included in the interaction

<u>Categories of Interactions</u>

Social

- teacher interacts with student to develop a social connection
- includes questions, comments and statements that are of entirely personal nature, not having to do with the content, procedure or technology of the class
  - How are you?
  - How was your weekend?
- may be inserted in a procedural or material interaction
  - instructor says "Hi" when student asks for permission to ask question

Procedural

- verbal interaction between instructor and student for purpose of passing factual information about the management, schedule and expectations of the course
  - the test is on Tuesday
  - the readings for this week are…
  - your paper has to be 10-15 pages

Material

- lecture or interactions concerning the content of the course

Technical

- verbal interactions between the instructor, students, and/or technical support staff concerning any technology-related aspect of the class
- refers to interactions about technology and instructor directions to students or technical staff about the technology
- details concerning the time, duration and nature of technical problems that cause the instructor to stop teaching or that interfere with the transmission of the class to all sites should be noted on the data collection form, with the verbal interactions about those problems being coded as interactions

Instructor interaction codes

Comment

- provides information concerning social, procedural, material or technical categories
- provides content in response to question
- provides more information or more detail to student contribution
- discusses contribution in additional context
- connects response to contribution of another person
- provides examples related to contribution
- provides information to address errors, inaccuracies or incompleteness in contribution
- restates another's contribution to make it easier to understand
- is distinguished from lecture by direct relation to contribution of a student

Asks question

- requests information from students
- may be directed to specific students, specific sites, or to groupings of sites

Delays student

- indicates that question or comment will be addressed at a later time
- may be specific or unspecific time

Interrupts

- verbally speaks while another person is speaking to
  - address content
  - engage in other verbal interaction behaviors (with exception of reinforcing behaviors)
  - to address student behavior
- may or may not cause other person to stop speaking

Positive response behaviors

- commends or expresses approval of student for contributing
- expresses approval of what student contributed
- thanks student for contributing

Negative response behaviors

- expresses disapproval or unfavorable judgment of student contribution or student behavior
- disagrees with student contribution

Wait time

- silence during interaction following a request for contribution that exceeds 2 seconds in length
- does not include silences that occur during lecture, student presentation or group work

Name

- Speaking a specific student's first name or surname

Calls on

- occurs only in response to multiple sites or multiple students indicating a desire to contribute or answer a question, i.e. the code $?^2$, which indicates multiple people asking questions simultaneously
- instructor verbally speaks the name of a site or the name of an individual student to indicate that a student may speak
- pointing at, nodding head towards or otherwise nonverbally indicating that a student at a site may speak
- if instructor begins a request for contribution with the name of a student or a site, this will be considered asking a question of that site or student, not calling on that site or student
- Designation is action of calling on, then who was called on
  - $I \rightarrow G_N$ would indicate calling on a specific student at the GMU site and using the student's name

<u>Student interaction codes</u>

Comment

- provides information concerning social, procedural, material or technical categories
- provides content in response to question
- provides more information or more detail to another's contribution
- discusses another's contribution in additional context
- connects response to contribution of another person
- provides examples related to contribution
- provides information to address errors, inaccuracies or incompleteness in another's contribution
- restates another's contribution to make it easier to understand
- may concern the student's own experience or student's understanding of course content
- includes answering questions from instructor or other students and providing information without prompting from instructor or other students

Asks question

- requests information
- may be directed to the instructor or to other students or sites
- may include references to student's own experience or understanding of course as a part of the question

Interrupts

- verbally speaks while another person is speaking to
  - address content
  - engage in other verbal interaction behaviors
- may or may not cause other person to stop speaking

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