A GROUNDED THEORY STUDY TO EVALUATE THE USE OF COMMUNITY-BASED TECHNOLOGIES TO ENHANCE THE EDUCATIONAL EXPERIENCE FOR DEAF AND HARD OF HEARING STUDENTS IN HIGHER EDUCATION

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ABSTRACT

The purpose of this qualitative study was to evaluate the effectiveness of using Community-based Technologies (CBT) to enhance the educational experience for deaf and hard of hearing (DHH) students in higher education. Using a grounded theory approach, the study was built upon the previous theories of Community of Practice and Zone of Proximal Development. Both theories illustrate the importance of interaction on the human performance. For this study, the research questions focused on DHH students’ interaction, academic achievement, and overall satisfaction in higher education. Online questionnaire and online interviews were used to conduct the research. The findings support the previous literature that: 1) social interaction whether for academic or personal purposes; online or face-to-face is essential for DHH students; 2) CBT can provide more social interaction to support learning especially for DHH students because they are reliant on text-based technologies; 3) DHH students prefer direct and independent way of communicating with others. These three findings led to generate Ibrahim’s theory that shows CBT can be a tool to increase DHH students’ interaction with peers, instructors, and the academic content. Therefore, the enhancement of their interaction can positively influence their satisfaction and persistence in higher education. Also, these findings suggest conducting more studies about how to improve DHH students’ use of CBT for educational purposes, especially because the data showed that they use it more with peers than with teachers.
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CHAPTER 1. INTRODUCTION

In order to welcome students with disabilities into mainstream classrooms and comply with the requirement of laws specifically Section 504 of the Rehabilitation Act and the American Disability Act, postsecondary education institutions have adopted the idea of inclusion and have enhanced the understanding of the requirements to provide more adjustments for these students, along with a variety of teaching strategies. One of these adjustments is using the available technological tools to facilitate courses for all students, including students with disabilities. These tools can be presented in traditional F2F classes, in online settings, and as an extension of the F2F classroom. However, the successful implementation of these technologies depends on many factors, such as the instructor, learning design, and students’ use of the technology. This chapter introduces the main concept of social interaction and its impacts on students’ performance, satisfaction, and persistence.

Previous research has sought to locate the potential factors of academic success for students in general and for students with disabilities in particular. One of many factors is students’ social interaction with their peers inside and outside the classroom because having appropriate interaction among students can influence their success, relationships, satisfaction, and persistence in school (Arnold & Paulus, 2010; Crawford, 1996; Friend Wise, Padmanabhan, & Duffy, 2009; Hrastinski, 2009; Palloff & Pratt, 2007; Riddle, 1999; Rovai, 2002; Schwier, 2011; Woodie, 2007). There is a theoretical correlation between social interaction and an individual’s level of cognitive performance and educational experience (Aiello & Douthitt, 2001; Burton, Lockee, & Potter, 2010; Eckert, Goldman, & Wenger, 1997; Hatfield, 1995; Keefe, 2003; Lang, 2002; Tinto, 1975; Wenger & Snyder, 2000; Zajonc, 1965). In 1898, Triplett, a psychologist at Indiana University, discussed the importance of human interaction on performance using the social facilitation theory. He suggested that social encouragement, comparison, distraction, and automaticity has possible effects on performance (Aiello & Douthitt, 2001; Strube, 2005; Zajonc, 1965). According to this theory, when other people are
around and the task is easy, one can perform it better than when one is alone; however, if
the task is hard and other people are around, an individual’s performance may be worse
than if the person were alone (Aiello & Douthitt, 2001; Zajonc, 1965). Nonetheless, Lev
Vygotsky, a constructivist and educational theorist, proved that social interaction
profoundly enhances human cognitive development. He discussed students’ interactions
as an impetus for learning and a tool for more achievement and more independency (Cox-
Davenport, 2010; Riddle, 1999; Thompson, 1999).

In general, the more interaction students have, the more likely they are to achieve
their goals, learn effectively, and increase their determination to complete a degree
(Antia, Sabers, & Stinson, 2007).

Researchers continue to study these concepts and to emphasize the importance of
social interaction and sense of community (Burton et al., 2010; Eckert et al., 1997;
Hatfield, 1995; Keefe, 2003; Palloff & Pratt, 2007; Su, Bonk, Magjuka, Liu, & Lee,
that the presence of others can either increase or reduce a person’s performance level
because the group can either enhance concentration, attention, and satisfaction or cause
disturbance, depending on the nature of the task. The relationship between social
satisfaction and persistence in postsecondary education has also been well studied. A
review of 20 years of research found that in the literature, interaction with peers and
instructors and participation in activities definitely affect students’ persistence in
postsecondary education (Pascarella & Terenzini, 1979, 1991; Richardson, 2005;
Richardson & Swan, 2003; Terenzini, Theophilides, & Lorang, 1984). Researchers have
also concluded that in an online setting, social presence, faculty immediacy, and teaching
presence are the main reasons for student retention (Mandernach, Gonzales, & Garrett,
2006; Rovai, 2002). All of the previous research enriches our understanding of the
relationship between students’ interactions and their achievements.

Deaf and hard of hearing (DHH) students are no different from others; interaction
is very important for them. Even if they have some form of socialization amongst
themselves, more interaction in the mainstream is a must for helping them feel part of the
larger society and reducing the sense of isolation. As researchers concluded that online
interaction has significant benefits for DHH students because it helps them to
communicate better with other peers and instructors and express ideas (Long, Marchetti, and Fasse (2011). For this reason, technology is a valuable, appropriate, and cooperative tool for enhancing their educational experience (Lang, 2002). The research has shown that, similar to other students, DHH students’ rates of attrition increase if they feel isolated, and that it is important to offer a cooperative and fully inclusive environment for DHH students, which positively affects their achievement and leverages their academic outcomes. Consequently, interaction among students and instructors can affect DHH students’ persistence as well (Lang, 2002).

**Statement of the Problem**

Because most individuals now have a great deal of technology in their lives, it has become easier for instructors to use technology as a new channel for communicating, teaching, and learning (Fulford & Sakaguchi, 2002). However, it is important to choose tools that offer plenty of interaction as well as more accessible education (Burgstahler, Corrigan, & McCarter, 2004). Some researchers have specifically discussed the obstacles that confront DHH students in higher education and that lead them to drop out after the first year (Albertini, Kelly, & Matchett, 2011). Several studies have indicated that the main obstacle for DHH students is their dissatisfaction with their social interaction in the classroom (Antia et al., 2007; Albertini et al., 2011; Smith, 2004; Stinson, Liu, Saur, & Long, 1996; Stinson & Walter, 1997).

Research in education has focused on ways that instructors can improve the learning environment and accessibility for students, including that for students with disabilities in general and DHH students in particular. These include ideas for best practice, collaborative learning, distance education, online tools, and many others (Beldarrain, 2006; Edmonds, 2004).

In spite of these endless possibilities for more engagement, most students in higher education continue to be taught through lecture, notes, and discussion (Reupert, Hemmings, & Connors, 2010). The failure to provide equal learning opportunities and include all students may lead to a feeling of isolation and attrition among students with disabilities in higher education. Research has indicated that the high rate of attrition
among DHH students in higher education after the first year is still a significant concern (Albertini et al., 2011; Stinson & Walter, 1997).

Consequently, it is vital to study how teachers can employ a vast array of strategies to enhance learning opportunities for inclusive classrooms. In this research, the concentration will be on community-based technologies. This type of platform allows users to create a profile, participate in discussions, collaborate with others, share resources, and leave constructive comments. Many tools are seamlessly integrated into community-based technologies that allow students to select their preferred mode of communication and interaction. Such platforms, which can be accessed through computers or smartphones, may consist of course management systems or available social media, such as FaceBook, Ning, Twitter, and so on.

**Purpose**

The purpose of this qualitative research is to evaluate the effectiveness of using community-based technologies (CBT) to increase DHH students’ participation in classes; collaboration with their instructors, peers, and academic content; academic achievement; and persistence in completing their degrees. It is important to gain a theoretical perspective about social interaction, social learning theories, and communities of practice because these theories are essential for underpinning students’ social satisfaction, which in turn helps them to be successful (Crawford, 1996; Wenger, McDermott, & Snyder, 2002).

Grounded theory approach will provide a solid foundation for building on theoretical concepts of social learning theories in order to explain the effectiveness of using CBT for DHH students’ participation and interaction. Previous research exists to identify the relationship between students’ interaction and their success. This study specifically will explore DHH students’ interactions via CBT and the relationships among their interaction, achievement, and satisfaction.

**Research Questions**

The purpose of this study requires answers to the following questions: What is the relationship between using CBT and the development of satisfactory social interactions in
higher education for DHH students? How do DHH students perceive the role of CBT in their academic achievement and satisfaction with higher education? What are the types of impact of using CBT on DHH students’ overall satisfaction in higher education? The results from this study may assist other educators who want to increase DHH students’ human interactions, achievements, and satisfaction with their learning experience.

**Significance of the Study**

Students with disabilities are often not appropriately considered in the design of learning opportunities in higher education (Burgstahler, Corrigan, & McCarter, 2004). However, their enrollment in higher education is increasing (Billies, Buchkoski, Kolvitz, Sanderson, & Walter, 2003; Hadjikakou & Hartas, 2008; Woodcock, Rohan, & Campbell, 2007).

This study is important because the previous literature indicates that DHH students leave school with a minimum amount of knowledge owing to the obstacles they confront (Richardson, Marschark, Sarchet, & Sapere, 2010). The main obstacle DHH students encounter with their hearing peers is communication difficulties (Martin & Bat-Chava, 2003). Previous research reveals a dearth of literature about DHH students in higher education; thus, there is a demand for more research about students with hearing loss, especially because major changes have taken place in the field (Schroedel, Watson, & Ashmore, 2003; Spencer & Marschark, 2010). This study may contribute to developing a greater knowledge about the experience of DHH students in higher education, their academic outcomes, and the effects of community-based technologies.

**Summary of Methodology**

Grounded theory is an appropriate method for investigating social issues and complex phenomena (Charmaz, 2006; Jones & Alony, 2011; LaRossa, 2005; Strauss & Corbin, 1998). According to Glaser (1978), grounded theory involves “[g]enerating theory and doing social research as two parts of the same process” (as cited in Strauss & Corbin, 1994, p. 273). Researchers have noted that grounded theory moves beyond description in order to generate or discover a theory from participants and data. It also allows all participants in a study to witness the development of the theory (Creswell,
In order to study social phenomena properly and to understand it better, Strauss and Corbin (1998) introduced six elements of social processes, which they called the six Cs: causes, contexts, contingencies, consequences, covariances, and conditions. LaRossa (2005) further explained that constant analysis and comparative methods make grounded theory a distinguished qualitative method.

In educational technology, whereas many studies have been conducted on using social media in postsecondary institutions, few have focused on the experience of students with disabilities (Asuncion et al., 2012). As a result, it is important to add a contribution to the literature about the relationship between social media, which will be called community-based technologies (CBT) in this research, and students with specific disabilities (Asuncion et al., 2012). For the purpose of this study, a grounded theory design was used a) to evaluate the effectiveness of using CBT for DHH students in postsecondary education and b) to generate a theory regarding the relationship between community-based technologies and DHH students’ interaction with, achievement in, and satisfaction with postsecondary education. Questionnaires and interviews were used to collect data from former or current DHH students in an inclusive postsecondary educational setting where CBT are used to deliver the academic content and to increase the level of interaction. All the research questions are addressed by way of an analysis of the participants’ responses to the questionnaires and in the interviews.

**Role of the Researcher**

The role of the researcher in qualitative studies appears in every step. Therefore, my role in this study has been central to the process. My relationship with DHH started when my nephew was diagnosed with a moderate hearing loss when he was 1-year-old. I grew up witnessing the difficulties he faced daily when trying to communicate with us. He struggles in school due to his inability to communicate with teachers and peers. Recently, he left school in the age of 15-year-old because of his uncontrolled aggression when he felt left out or couldn't understand the context. Also, when I was a teaching assistant at University of Hawai‘i at Mānoa, there was a deaf student who was excellent in communicating through social media. He was one of the best contributors in the class online community. He didn’t participate in the classroom through the sign language
interpreter as much as he did online with his peers or instructors. Moreover, my background as a student in educational technology and disability studies motivates me to study the benefits of using CBT for DHH students in an inclusive postsecondary education setting. My background also helps me to understand the students’ acceptance or rejection of any technological tool. However, there was a possibility that my previous knowledge would contribute to the occurrence of bias during the interpretation process. To ensure better validity, peer review was sought through the research process, constant comparison was made to reduce the researcher’s bias and subjectivity, and random responses from other participants on Facebook were observed to increase the validation and representation of the results. Possible bias is also addressed later in this dissertation (Baltar & Brunet, 2012; Charmaz, 2006; Corbin & Strauss, 1990; Creswell, 2007; Jones & Alony, 2011; Strauss & Corbin, 1990). The data collection for this study was conducted through online questionnaires and online interviews. I did not have a prior relationship with most of the participants; however, two deaf graduates whom I know helped me to recruit more participants who might fit the research criteria. In addition, I was not able to interact with the participants face to face. I depended on online tools to obtain information from the participants, whether for the questionnaires or the interviews. The interaction with the research participants was carried out by means of text-based conversation; this strategy, unfortunately, resulted in less emotional interaction with the participants, but it did not pose a serious problem for obtaining the information required for the study.

**Limitations**

A limitation of this study is that the population in this study does not represent all DHH students because it is challenging to reach all of them due to strict privacy policies in the office of student support services at different universities. Therefore, the findings cannot be generalized. The data were collected online from former or current DHH students in an inclusive postsecondary educational setting. The questionnaire also has two open-ended questions, and the interpretations vary. Furthermore, the findings are not measurable owing to the students’ different technological skills and hearing loss. Finally,
I was not able to meet the students face to face; this situation somewhat hindered the communication process and the interpretation.

**Definition of Key Terms**

**Social networking site:** Boyd and Ellison (2008) define this as follows:

Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site (p. 211)

**Community-based technologies (CBT):** In this research, CBT will be used to indicate the type of platform that allows users to create a profile, participate in discussions, collaborate with others, share resources, and leave constructive comments. A number of tools are seamlessly integrated into community-based technologies that allow users to select their preferred mode of communication and interaction. This platform, accessible through computers or smart phones, can include course management systems (like Blackboard, Moodle, and eCollege) or available social media (such as Facebook, Ning, and Twitter).

**Sense of community:** “… members of a community are informally bound by what they do together—from engaging in lunchtime discussions to solving difficult problems—and by what they have learned through their mutual engagement in these activities” (Wenger, 1998, p. 1). Rovai (2002) suggests “the most essential elements of community are: mutual interdependence among members, sense of belonging, connectedness, spirit, trust, interactivity, common expectations, shared values and goals, and overlapping histories among members” (p. 4).

**Hybrid course:** Combination of online instruction and traditional F2F instruction (Lim, Kim, Chen, & Ryder, 2008).

**Summary**

Chapter 1 introduces the main concept of social interaction and discusses its impacts on students’ performance, satisfaction, and persistence. It gives an overview of
the research purpose, research questions, and the significance of the study. Chapter 2 covers the literature review that is related to the study. It discusses the previous social learning theories and other elements related to DHH students. The research methodology is presented in Chapter 3. It provides a thorough description of the qualitative study with a grounded theory design, the role of the researcher, participants and context, instrumentation, data collection, and data analysis. The final section is “Verification,” which describes the strategies the researcher employed to ensure the trustworthiness and validity of the research. The research findings and results are presented in Chapter 4, and Chapter 5 discusses the conclusions and their relation to the research questions, and the generation of theory for contributing to the field of educational technology. Further studies are discussed as well in the final chapter.

The appendices follow the five main chapters. Appendix A contains all consent forms and Institutional Review Board approval, Appendix B contains the questionnaire, and Appendix C presents the Coding Table.
CHAPTER 2. REVIEW OF LITERATURE

This chapter reviews the literature that relates to the study and research questions. It discusses previous social learning theories, DHH statistics in education, laws for students with disabilities, the differences between deaf and hard of hearing students, social interaction and sense of community, DHH and technology, social networking sites, and similar studies.

The concept of the current study is based on Vygotsky’s learning theory and Wenger’s community of practice theory. The researcher found these theories enlightening for investigating the importance of social interaction for DHH students in higher education. They are also useful for evaluating the effectiveness of using community-based technologies to help DHH students participate, communicate, and collaborate more effectively with their instructors, peers, and academic content. These theories also help in examining the effect of using these technologies on students’ satisfaction, persistence, and achievement.

Theoretical Background

Social learning theorists support a learning environment in which social interaction between students and instructors occur to enhance student achievement and satisfaction. Social learning theorists explain that learning can happen simultaneously and effectively when students share their experience and previous knowledge in the community (Crawford, 1996; Hrastinski, 2009; Riddle, 1999; Rovai, 2002; Thompson, 1999). According to Moore (1989), the interaction in the classroom setting consists of three types: interaction between student and instructor, student and content, and student and peers. McMillan and Chavis (1986) discussed the term “community,” and they concluded that community means a place where participants share the same space or a relationship between participants who share common boundaries, such as schools. They proposed that community has four elements: the first is “membership,” which is the feeling of belonging or personal relatedness. The second is “influence,” the influence that
members can have over the group or the influence that the group has on members. The third element is the “integration and fulfillment of needs,” referring to the needs that the group can fulfill for its members. The fourth element is “shared emotional connection,” the feeling of belonging and caring because of the participants’ commitment to share their knowledge and previous experience. These four elements should occur in the community in order to create a strong rapport between the community and its members. These elements will help the community to achieve its goal successfully and to satisfy the members’ needs through their interaction together (McMillan & Chavis, 1986).

Lev Vygotsky (1978) and Etienne Wenger (1998) theorized that social interaction is an important factor in the learning process (Vygotsky, 1978; Wenger, 1998; Wenger et al., 2002). Lev Vygotsky believed that learning is better when there is social interaction and theorized that learners perform better and do more tasks when collaborating with others who have a high degree of knowledge, skills, and experience. He also asserted that social learning leads to more cognitive development. He called this phenomenon the Zone of Proximal Development (ZPD) and defined it as “the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky, 1978, as cited in Riddle, 1999, p. 1). The level of cognitive development can be augmented when people share their previous relationship, experience, and activity. Therefore, human interaction can leverage thinking skills and expand knowledge (Crawford, 1996; Riddle, 1999; Thompson, 1999). According to him, social interaction can help to establish a good rapport among students that can affect their learning experience. Students in online courses also need to have social interaction in order to enhance their academic experience. What Vygotsky discussed a few decades ago remains valid in education today because social interaction is an element that can’t be ignored in any type of course delivery either F2F, online, or hybrid courses (Riddle, 1999).

Recently, Wenger (2006), an educational theorist and practitioner, has focused on social learning systems. In the 1990s, Jean Lave and Etienne Wenger coined the term “community of practice.” Though the term itself is recent, it explains a phenomenon that has always occurred in human societies. In his official website about a community of
practice (COP), Wenger defined it as “[g]roups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.” Like other learning theorists, Wenger believed that learning cannot be separated from interaction and that this interaction has an influence on students’ learning (Eckert et al., 1997; Hrastinski, 2009; Rovai, 2002; Rovai & Downey, 2010). A COP is a social network in which participants have common interests; therefore, they are able to share knowledge, experiences, and beliefs with each other. Wenger (1999) also defines participation as “[a] process of taking part and also to the relations with others that reflect this process” (p. 55). According to Lawthom and Chataika (2012), a COP is an experience through participation.

A social network that helps its participants to develop and learn can occur in any space, including online communities. Thus, recent researchers have been inspired by social learning theories, especially in terms of online learning (Crawford, 1996; Pempek, Yermolayeva, & Calvert, 2009; Riddle, 1999; Snyder, 2009; Stacey, Barty, & Smith, 2012).

A sense of community has also existed among people with disabilities for many years. Nowadays, an individual with disabilities may join an online community to read, share, respond, or learn without being isolated. This sort of online community for people with disabilities is important for bringing them together with their peers. In addition, the online community can be used for school purposes to bridge gaps among all students, including those with disabilities, and increase interaction with the instructor (Lawthom & Chataika, 2012). Moreover, the concept of COP has become important in knowing and learning. Many organizations in different sectors are adapting the idea of COP in order to improve their performance (Lawthom & Chataika, 2012; Wenger, 2006).

The previous theories explain the significance of interaction among students and its effects on their academic experience. They also demonstrate the necessity of creating a community in order to increase the participants’ performance. Therefore, the researcher of this study will evaluate the benefits of using CBT to increase DHH student interaction and its influence on their achievement, satisfaction, and persistence.
Deaf and Hard of Hearing Statistics in Education

The World Health Organization in February 2013 estimated the number of DHH individuals in the world as 360 million (WHO, 2013). The National Center for Education Statistics at the U.S. Department of Education indicated that 10.8% of undergraduates in 2007–08 reported having a disability (U.S. Department of Education, 2012). According to the National Center for Education Statistics (as cited in Lang (2002), the number of DHH students in postsecondary programs in the United States was estimated at more than 25,000. However, only 8% of postsecondary students who have mild hearing loss disclosed their hearing loss (Richardson, Long, & Woodley, 2004). Most deaf and many hard of hearing students go to Gallaudet University and The National Technical Institute for the Deaf (NTID) at the Rochester Institute of Technology (RIT). Approximately 500 DHH students register in RIT each quarter (Marchetti, Foster, Long, & Stinson, 2012). The number of college students who are DHH has increased dramatically since 1987, although many of these students leave college before they earn a degree (Kochhar-Bryant, Bassett, & Webb, 2008; Marschark, 2007; Stinson & Walter, 1997). The available support services attract more DHH students to attend mainstream postsecondary programs even though there is still a demand to have a better inclusive environment (Kersting, 1997; Lang, 2002). Moreover, there is a dearth of research on the impact of support services on DHH academic achievement (Lang, 2002).

Laws for Students with Disabilities

The US Congress has played a fundamental role in assuring free and appropriate public education for students with disabilities, including postsecondary education (Marschark, 2007). Indeed, for several decades, people fought for disability rights and made dramatic changes in law, policy, and legislation, which opened the doors for DHH students to attend mainstream educational institutions, including postsecondary (Richardson, Marschark, Sarchet, & Sapere, 2010). For K12 education, in 1975, the law mandated that all students with disabilities must have appropriate public education under the Individual with Disabilities Education Act (PL 94-142), which was amended by the Education of the Handicapped Amendments of 1986 (PL99-457) (Marschark, 2007).
The Individuals with Disabilities Education Act (PL 101-476), known as IDEA, was passed in 1990 and amended in 2004 to confirm that students with disabilities should be prepared for further education, employment, and independent living (U.S. Department of Education, 2004). This congressional action resulted from the realization that only about 50% of children with disabilities attending public schools were getting the support fundamental for academic success. The main rationale of IDEA was to integrate children with disabilities into classrooms to make them independent and ready for further education in the future, although the law was not clear on how they could obtain access to the support services for their educational success.

Thus, previous laws have mandated access to education and support for children with disabilities so that they will be ready for postsecondary education, and legislation has encouraged provision of a suitable environment for students with disabilities in postsecondary education. The Americans with Disabilities Act (ADA) and Section 504 play an important role in postsecondary education. Section 504 of the 1973 Rehabilitation Act and Title II of the ADA prohibited any kind of discrimination on the basis of disabilities. The laws require all schools, universities, community colleges, and vocational school that receive federal financial assistance—whether public or private—to provide accessible programs in dorm rooms and classrooms, equal admission opportunities, assistive technology, qualified interpreters, and other services, such as captioning and large print. Clearly, these laws protect students with disabilities’ right to access educational programs as do other students without disabilities and enable them to gain a degree (PACER Center, n.d.; Richardson et al., 2004; U.S. Department of Education, 2011; U.S. Department of Labor, n.d.). However, students with disabilities in postsecondary programs should meet the academic requirements and the technical standards for admission or participation (U.S. Department of Education, 2011). The United States Department of Education also published an addendum in 2010 that requires schools receiving federal funding to provide appropriate accommodations or modifications when technologies are used in order to ensure that these technologies benefit all students equally and effectively (as cited in Asuncion et al., 2012).

Overall, laws are designed to assure that schools provide equal access to education and the learning content in order to promote achievement (Cavender, 2010). There is also
a demand for implementing these laws and emphasizing them by removing all barriers for all students so that students with disabilities may enroll in postsecondary education and increase their level of satisfaction. This notion supports the idea of an inclusive environment in which all students are equal and all adjustments can benefit most of the students (Moore, Gorra, Adams, Reaney, & Smith, 2012).

**An Overview of Issues for Students who Are Deaf and Hard of Hearing**

Previous research has found that DHH students encounter major difficulties and learn less than their peers in a mainstream education (Richardson et al., 2010). However, very few studies differentiate between the way DHH students learn in a school setting even though deaf students and hard of hearing students learn in different ways (Schroedel et al., 2003). According to the World Health Organization website,

Hard of hearing” refers to people with hearing loss ranging from mild to severe. They usually communicate through spoken language and can benefit from hearing aids, captioning and assistive listening devices. People with more significant hearing losses may benefit from cochlear implants. “Deaf” people mostly have profound hearing loss, which implies very little or no hearing. They often use sign language for communication. (WHO, 2013)

In general, many DHH students have some difficulties in English proficiency. However, their ways of communication are different depending on their level of hearing loss and their preferences. For example, many deaf students in the United States communicate through American Sign Language (ASL) or lip reading, whereas hard of hearing students may communicate with assistance from a hearing aid, FM amplification system, ASL, or lip reading. Many DHH students will need professional interpreters and/or note takers in a classroom where the other students are not DHH. As discussed earlier, different communication modes should be provided to meet the legal requirement for creating equal access to DHH students (Marchetti et al., 2012; Schroedel et al., 2003).

Regarding the proper terms to use in referring to DHH, Middleton et al. (2010) has explained that the term “deaf” is widely used to refer to people who have from moderate to severe hearing loss. However, the word “Deaf,” with a capital “D”, is often used to refer to that part of the deaf population that depends completely on sign language
or for whom it is their preferred mode of communication. Being Deaf is not perceived as a medical condition so much as membership to a culture that has its own language and customs. In general, the term “deaf” is used to refer to people with deafness or hearing loss (Middleton et al., 2010). According to the National Association of the Deaf (NAD), the DHH population has the right to choose their preferred term of reference. Most of the organizations for the deaf, including the National Association of the Deaf (NAD), use the term “deaf and hard of hearing” (DHH). Many DHH people prefer the words “deaf” or “hard of hearing” instead of “hearing impaired” because the later term focuses on their disabilities, and it has a connotation that something is wrong and should be fixed (National Association of the Deaf, 2013).

**Social Interaction and Sense of Community**

Social interaction becomes a source for students’ learning when their social networks provide emotional and intellectual assistance, personal encouragement, and support. Students experience an increased sense of community when they are part of a network; they also have reduced stress and the ability to learn better (Osterman, 2000; Wenger et al., 2002). Students can participate by sharing ideas, expressing emotions, discussing different topics, and forming teams. There are three indicators of social presence: emotional expression, open communication, and group cohesion (Garrison, Anderson, & Archer, 1999).

Previous research and theory have explained the significance of students’ interaction on their achievement and satisfaction. They have linked a sense of community to such student outcomes as success, motivation, social interaction, engagement, academic achievement, and persistence (Carton, 1984; Crawford, 1996; Eckert et al., 1997; Lawthom & Chataika, 2012; G. L. Long, Marchetti, & Fasse, 2011; McMillan & Chavis, 1986; Moore, 1989; Osterman, 2000; Pascarella & Terenzini, 1979; Riddle, 1999; Thompson, 1999; Tinto, 1975; Vygotsky, 1978; Wenger, 1998). Osterman (2000) showed that some researchers predict that the lack of interaction in a school setting can decrease students’ motivation and lead to poor performance. However, effective
participation and a feeling of belonging are important aspects of a good community where students connect to the community, interact, and help others (Hrastinski, 2009).

Today, the integration of computer and communication technologies has changed the way we learn. They have increased the possibility of learning and social interaction, thereby enhancing a sense of community and bringing students together. By using these technologies, students can work together and share their experiences either face-to-face (F2F) or online. Some teachers use these technologies in regular classes and others use them in online classrooms or as an extension of F2F classrooms.

These new technological inventions have made social learning theories more popular because many studies have been done to apply them to the online setting. These studies also discuss how valuable these theories are for building a successful learning community. For example, researchers have observed that Vygotsky’s theory has evolved and has affected the rationale behind using computer technologies as a means to interact with others and to make a learning environment more powerful (Crawford, 1996; Riddle, 1999).

Crawford (1996) explored the opportunities of using technology in teaching mathematics from the Vygotskian perspective. The teacher’s aim for the project was to investigate the effectiveness of using technologies in a collaborative environment. The study included 4–5 year olds. The teacher introduced the new math program and explained that they were able to seek help if they needed. There was a record for each child regarding time, knowledge, discussion, and the child’s initiatives. Most of the students chose to spend time on the activity at least once a week. Students formed a "computer club" to work more on their activity and to use technological materials after school in an informal setting. The girls in the study, in particular, had no previous experience with collaborative activity in school. They were anxious about making mistakes, and hesitant to ask or participate. In the computer club, girls became more confident in playing and in creating their projects. They were able to share their history, their existing knowledge, and their ideas. Crawford concluded that Vygotsky’s theory of human development remains valuable in the information age (Crawford, 1996).

Online communities are no different from others in that participants need to have a sense of community in order to be part of the community. Current research focuses on
effective ways to build a strong community online by using social learning theories and available technology tools. Such studies have found that participation is a key factor for online learning. It can nourish the online community because it is the only way the students get together (Heilman, 2007; McInnerney & Roberts, 2004; Piezon & Donaldson, 2005). Participation and learning are connected to each other in the learning process, especially online. Through participation, students can share their ideas, knowledge, and experience in order to solve problems or create projects. They can also derive support at all times from their network, and they can interact in an informal setting. Therefore, good participation may affect students’ learning, satisfaction, achievement, and retention (Davies & Graff, 2005; Hrastinski, 2009; Palloff & Pratt, 2007). In one study, researchers at the State University of New York used an online instructional program called SUNY Learning Network (SLN) to study the aspects of effective online learning. The goal of SLN was to provide the best asynchronous communication for the students. From the 1406 completed surveys, researchers concluded that the main factors in effective online learning are interaction with the instructor, participation in the classroom, and interaction with peers (Fredericksen, Pickett, Shea, Pelz, & Swan, 2000). Furthermore, Johnson, Johnson, and Stanne (as cited in Hrastinski, 2009) did a meta-analysis of 164 studies on cooperative learning and concluded that collaboration among students positively affects their achievement, including their grades and performances. Consequently, Wenger et al.’s (2002) work focused on learning as social participation. The researchers explained that participants can construct their identities and knowledge through participation. According to them, a community of practice (COP) is a social learning environment where participants share common interests and collaborate with others through contributing to the practices of their community. The authors also illustrated that participation consists of action and feeling. In the online setting, interaction is also critical to participants because it enhances their sense of community and learning (Rovai, 2002), especially considering that learning in higher education occurs mostly outside the classroom (Chapman, Ramondt, & Smiley, 2005; Hrastinski, 2009).

Palmer, Holt, and Bray (2008) investigated the impact of participation in online discussions on student course performance. This case study consisted of 86 enrolled
undergraduate students in an online engineering management class. Students were asked to reflect on course materials by writing at least five new postings over the course of the semester. The data were analyzed quantitatively and qualitatively. The quantitative method analyzed students’ number and length of postings, number of messages read, etc., and the qualitative method analyzed the content of the postings. The researchers concluded that students who posted new threads had better course performance and that there was a significant correlation between students’ grades and new posts, as those who posted new threads had better grades. It was noted that posting new threads requires more effort and knowledge. Researchers have indicated that interactions between students and teachers, as well as interactions between students and their peers, may help students to construct new ideas (Palmer, Holt, & Bray, 2008).

**Deaf and Hard of Hearing People and Technology**

Nowadays, technology has changed the way we communicate and has reduced the effects of distance. It has been incorporated into our lives seamlessly, and most of us are eager to obtain the best and newest inventions. From the telegraph to smart phones, consumers have welcomed all the different technologies and applications in order to have better communication (Cavender, 2010). Several new inventions have become part of our daily routine and have also affected our lifestyles. DHH people, like everyone else, surf the same technological waves and incorporate different technologies and applications into their lives. DHH people have particularly embraced technologies that use text for communication. For example, they have used the teletypewriter (TTY), pagers, instant messaging, email and video conferencing tools, and social media to enhance their communication; it is important to note also that DHH communities were early adopters of text messaging (Cavender, 2010; Mitchell & LaForce, 2010). Deaf people can also now communicate simultaneously with others using visual-based technologies such as videoconferencing tools (Lucas, Mirus, Palmer, Roessler, & Frost, 2013). Simpson (2009) suggested that technology infrastructures should ensure equal access for everyone including people with disabilities in order to benefit from all communication services that help them to participate equally in employment, educational, governmental and other settings.
This rapid development in new technologies fosters positive changes in education that include the way students learn, collaborate, and communicate. Nowadays, it is vital to acknowledge the need to improve academic achievement within the growth of technologically sophisticated environments. In the 21st century, education not only should provide rigorous academic content but also should prepare students to master new skills and new technologies, and should involve students in more exciting learning opportunities (Eckstein, 2009). Postsecondary students, in particular, should master communication technologies and understand effective ways to communicate, collaborate, and participate with others in order to be ready for the job market.

A proper educational plan should help students to be knowledgeable, contemporary, independent, and accountable. Therefore, most postsecondary education institutes deliberately seek ways to provide a safe and supportive environment through knowledgeable professors, advanced facilities, best curriculums, and new technologies in order to offer appropriate educational experiences for all students, including students with disabilities. Educators are providing ways to use intelligent technologies and alternative forms of communication in the classrooms to enhance learning and encourage students in more collaboration and interaction via these communication technologies (Bork, 1992; Larkin-Hein, 2001).

Researchers have examined the impact of real-time text in supporting deaf students’ learning in postsecondary classrooms. One study compared three support services for deaf students in a postsecondary classroom: sign language interpretation, real-time text (C-Print), or both (Marschark et al., 2006). The researchers provided different services because deaf students’ language skills may vary. The study included 95 deaf students and 32 hard-of-hearing students at Rochester Institute of Technology (RIT). Two instructors were recruited to provide introductory courses. Each student saw a 15-minute lecture, and both the interpretation and transcription were provided spontaneously. To measure their knowledge about the topics, the students had to answer six questions in the pretest. Posttests contained 15 questions developed with the assistance of the instructors. All questions were multiple-choice. The study indicated that students who received real-time text (C-Print) alone scored higher than those receiving either interpreting alone or interpreting with C-Print. When C-Print was provided with
interpretation, students reported that it was difficult to decide which source to use. On the other hand, C-Print helped students to read all the vocabulary and to access the classroom content equally. Students also found it easy to locate the information they had missed from the presentation or the interpretation, especially the unfamiliar technical terms (Marschark et al., 2006).

Long, Marchetti, and Fasse (2011) also indicated that a text-based format in online courses and communication eases the way DHH students communicate with their hearing peers and instructors, and it also provides them with open access to the course materials more than a F2F classroom does. Another study has concluded that formal lectures with a minimal amount of student-instructor interaction are not optimal for DHH students (Convertino, Marschark, Sapere, Sarchet, & Zupan, 2009). Various researchers have explained that communication difficulties exist in a mainstream classroom between DHH students and their hearing peers. For example, DHH students may depend on an interpreter to convey messages between them and others, but an interpreter is not always available for communication beyond that needed for instruction. In small groups, students depend on direct communication, but the presence of one DHH student in a group presents difficulties. In addition, the duration of the interpretation process limits some DHH students’ participation owing to their frustration. Thus, instruction via text may lead to better performance (Marchetti et al., 2012; Marschark, Sapere, Convertino, & Pelz, 2008; Richardson et al., 2010). Text can be an important means for increasing the level of interaction between DHH students and instructors and the academic content.

Conversely, it is important to recognize the wide range of differences in DHH students’ backgrounds, educational experiences, and communication preferences before implementing any technology in the classroom (Cavender & Ladner, 2008). Students’ previous experiences can affect their preferences in choosing the proper accommodation. Therefore, the best accessibility solution depends not only on students’ level of hearing loss, but also on their preferred communication style, their ability to use technology, and their English proficiency. Some students prefer sign language interpretation, and others prefer to have access to text, whereas yet others prefer face-to-face communication (Cavender, 2010). As a result, DHH students do not always welcome the use of technology, but it is instructors’ responsibility to integrate technology properly and to
introduce all students, including DHH students, to the assigned technology. Researchers have presented examples of different writing aids that can help DHH students when they use technology as a means of communication. They mentioned that a variety of electronic dictionaries, spell-check, and word prediction software can support students’ writing. Computer or mobile-based chats, such as Windows Live Messenger, can also help them to communicate with others easily, and they can share videos with captions if available. In addition, DHH students can use Word or PowerPoint when they have a presentation instead of speaking (Asuncion et al., 2012).

**Social Networking Sites (SNS) and Similar Studies**

A new technology that has entered our lives and changed the way we keep in touch is Web 2.0. As cited in Eckstein (2009), Richardson defined Web 2.0 as a read-only medium where anyone can publish and share content and easily collaborate with others. According to Dictionary.com, Web 2.0 is “the internet viewed as a medium in which interactive experience, in the form of blogs, wikis, forums, etc., plays a more important role than simply accessing information.” According to Tech Terms website, “Web 2.0 technologies provide a level of user interaction that was not available before. Websites have become much more dynamic and interconnected, producing ‘online communities’ and making it even easier to share information on the Web.” Examples of Web 2.0 uses are Twitter, Facebook, YouTube, instant messaging, and blogging (Holt, 2011). In this research, the focus is on social networking sites (SNS), referred to later as community-based technologies (CBT), in order to meet the research purpose and to demonstrate that they can help DHH students in higher education.

Social networking sites (SNS) have become highly important as one of the fastest developing computer-mediated communications (Lin & Lu, 2011). According to several researchers, SNS are cyber environments where individuals can create profiles and share notes, photos, and videos with other members or groups of the sites (Arnold & Paulus, 2010; Boyd & Ellison, 2008; Lin & Lu, 2011). Boyd and Ellison defined SNS as Web-based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections and those made
by others within the system. The nature and nomenclature of these connections may vary from site to site. (Boyd & Ellison, 2008, p. 211).

SNS can be created for specific purposes, such as LinkedIn for work, Facebook for relationships, Flicker for photography, and others. (Ellison, Steinfield, & Lampe, 2007; Lin & Lu, 2011). SNS have also become popular because they ease the way we communicate by providing information and opportunity easily and at no cost (Donath & Boyd, 2004).

In a school setting, SNS appear to encourage students to collaborate in their areas of interest, either synchronously or asynchronously. Some schools can also work together locally or internationally via SNS (Eckstein, 2009; Ellison et al., 2007). This form of computer-mediated communication helps to create more interaction by aiding users in presenting themselves to others (Ellison et al., 2007). The number of students who use SNS is increasing significantly as Dunn (2012) has explained in a Web article: “According to a study conducted by the Higher Education Research Institute, a majority of the first year undergraduates spend time on social networking websites.”

Because of its worldwide popularity, Facebook is a perfect example of the type of SNS that attract many researchers. In 2007, Needham and company stated that Facebook has more than 21 million members and 1.6 billion page views, as cited in (Ellison et al., 2007), and Facebook now has more than 1.1 billion monthly active users (Facebook, 2013). These figures demonstrate that the number of users on Facebook has increased dramatically. In 2006, 2,000 colleges across the U.S used Facebook as a tool for communication with family, friends, and acquaintances (Ellison et al., 2007). For example, Ellison et al. surveyed 800 undergraduate students randomly at Michigan State University. They found that 94% of the undergraduate students were Facebook members and that they spent from 10 to 30 minutes daily on Facebook. Moreover, they reported having approximately 150-200 friends on their lists (Ellison et al., 2007).

Many students use SNS to stay in touch with their families and friends, and using such networks has become an important daily ritual for many students. Using them for school purposes can attract all students equally to joining in classroom discussions and dealing with classroom content, including DHH. Nowadays, many colleges have incorporated SNS in the classroom, and some professors at universities communicate
effectively with students via Twitter, Facebook, or Google Plus. It is an affordable and modern means of communication with students.

A myriad of available tools on SNS can help to bring students together remotely, to offer the learning content electronically at any time, and to support a sense of community among students. It becomes a free space for students to extend the classroom discussion and to review the materials. Each student can independently choose how to interact with others as well with the content. For example, students are able to manage their profile pages, notifications, responses, and notes. Second language learners can take their time to comprehend the content and translate the new words or jargon, and students with disabilities as well can independently solve their own access barriers and freely use the assistive technology to read and respond.

Each of the social media has a specific purpose: for example, Facebook is for social networking, YouTube for sharing video, Second Life for virtual worlds, podcasts and blogs for sharing ideas, and instant messaging services for synchronous interaction. The Adaptech Research Network and the National Educational Association of Disabled Students (NEADS) in Canada have collaborated in an exploratory study to raise awareness about the use of social media and its accessibility to postsecondary students with disabilities. The main questions in the study were as follows: What social media can be used by all students, including those with disabilities? What problems currently exist with specific platforms when it comes to accessibility? The study involved 723 postsecondary Canadian students with disabilities. Individual email invitations were sent to participants along with a link to a questionnaire. The online questionnaire included questions about disability, specialized software used, hours spent using social media, and accessibility ratings for 20 forms of social media, such as Facebook. Finally, open-ended questions included asking about problems using social media and suggestions to improve social media. The results showed that 74% of students are frequent users of social media with an average of 12 hours per week in terms of personal use and 6 hours for educational purposes. Ten percent of the participants were students with hearing impairment. All students with disabilities indicated that they use mostly YouTube, followed by FaceBook, MSN, Skype, and Twitter. For accessibility issues, students reported that MSN, FaceBook, YouTube, Yahoo Messenger, and Skype are more
accessible than other social media. In response to the open-ended questions, students with disabilities had different suggestions for social media developers; one of the suggestions was having captions or subtitles. This study showed that students with disabilities like to use social media but that some accessibility issues still exist and prevent them from enjoying such media. At the end, the researcher recommended further studies and explained the need to examine the use of social media and accessibility for specific disabilities (Asuncion et al., 2012).

Long et al. (2011) researched the importance of interaction for academic success in online courses with both hearing and DHH students. They noticed that communication among DHH students and their hearing peers in the F2F courses is challenging because they depend on a support service to participate and to communicate with their hearing peers, and the processing time for the interpreter to convey the message makes the communication process challenging. Ignorance of the interpretation protocols also makes communication uncomfortable for DHH students; for example, the instructor expects an answer from the students before the interpretation is done. These communication challenges lead to students’ isolation and learning difficulties. Therefore, the researchers wanted to test interaction among DHH students and their hearing peers in online classes at The Rochester Institute of Technology (RIT). They tested the ease of direct communication via instant messaging, discussion forums where students can interact with their peers, and drop boxes where students can share their ideas and written assignments. The researchers examined the importance of interaction through three studies. First, researchers compared the academic achievement of students in the online and F2F classes. The students’ grades were analyzed for the fall quarter of 2007-2008 and the spring quarter of 2008-2009. The findings were that online students had more A’s and fewer C’s than F2F students. There was also an indication that DHH students in online setting had better achievement than their hearing peers. In the second study, researchers obtained the students’ perceptions of course satisfaction, learning, and communication via online surveys. No effect was found for perceived satisfaction or learning. However, the results found that students in more interactive courses communicated more with the instructors and their peers. The results also indicated there are benefits for DHH students in online courses.
In the third study, researchers looked at the academic achievement of students enrolled in 432 online courses based on the amount of online interaction that occurred in the course. The results showed that students, including DHH students, who enrolled in online courses with more interaction performed better than students in online courses with less interaction and that they have higher GPAs. At the end, researchers indicated that there are benefits to using a text-based format in asynchronous discussion forums as part of online courses. It allows DHH students to communicate directly with their hearing peers and instructors, and allows them better access to information than in F2F classes. Moreover, it affords DHH students the time to comprehend the content, lack of time traditionally being a difficulty in F2F classes. DHH students also have equal access to participation and can spend more time constructing their ideas and responding to their peers. Examples of DHH students’ comments included, “I like the fact that we have equal access to communication!” and “What I liked best about this course was that it was easier for me to participate in discussions without getting behind due to a delay through an interpreter. I was on the same ‘playing field’ which was nice.” Researchers concluded that interaction is important for students learning in either F2F or online classes. Institutions should derive the benefits from the ease of communication that has occurred in the classroom by means of engaging, asynchronous, and accessible space for students.

**Summary**

The main concepts of this study are based on learning theories that focus on the importance of social interaction and its impact on the learning experience. Vygotsky’s learning theory (1978) and Wenger’s COP (1997, 1998) theory are employed as a background to evaluate the effectiveness of using CBT to help DHH students participate, communicate and collaborate more with their instructors, peers, and academic content, and to look at the result of using these technologies on students’ satisfaction, persistence, and achievement.

The entry of a vast array of technologies into our lives has changed the way we learn. Most students now expect to use technologies as part of their curriculum. At the same time, technology has opened a new era of teaching and learning and with the
existence of social media the learning experience can be more vivid and interactive. This chapter looks at specific issues treated in earlier research: DHH students’ attrition rate, dropout after the first year at college, and their dissatisfaction with the interaction available to them in the mainstream. Previous research discussed accessibility and social media for students with disabilities and the importance of interaction for DHH students. This study specifically focuses on evaluating the use of CBT to enhance the educational experience for DHH students in higher education.

Therefore, many researchers have concluded that interaction is important for students’ success (Antia et al., 2007; Crawford, 1996; Hrastinski, 2009; Palloff & Pratt, 2007; Riddle, 1999; Rovai, 2002; Schwier, 2011; Woodie, 2007). Technology can be used as a new channel for communicating, teaching, and learning (Fulford & Sakaguchi, 2002). However, it is important to choose tools that offer more interaction as well as more accessible education (Burgstahler, Corrigan, & McCarter, 2004).

In the next chapter, the methodology of this research is discussed, and the relationship between DHH students’ learning experience and CBT will be explored later through an examination of the participants’ responses.
CHAPTER 3. METHODOLOGY

Previous chapters of this research have introduced the challenges that deaf and hard of hearing (DHH) students face in mainstream postsecondary education and the impacts of these challenges on their performance, persistence, interaction, and satisfaction. A qualitative method with a grounded theory approach was used in this study to generate a substantive theory regarding the effects of community-based technologies (CBT) on DHH students’ higher education experience. The chapter covers the research design, role of the researcher, participants and context, confidentiality, and instrumentation. In addition, this chapter discusses the data collection methods employed in order to analyze the data by coding and creating memos and diagrams in order to form a theory.

Grounded theory design was used in this study because it focuses on the participants’ voices in order to build a theory (Charmaz, 2006; Heath & Cowley, 2004). In this study, the questionnaire and online interview aimed to collect the information from the participants’ voices to develop a theory that explains the effectiveness of using CBT to help DHH students with better participation, collaboration, and achievement in their higher education experience. This theory addresses the importance of community-based technologies in the inclusive higher education environment.

Research Design

A grounded theory research design was chosen for carrying out this study for several reasons. According to Strauss and Corbin (1990), “the grounded theory approach is a qualitative research method that uses a systematic set of procedures to develop an inductively derived grounded theory about a phenomenon” (p. 3). They proposed the 11 procedures for grounded theory that make it a distinct method in qualitative research. The procedures are described by the authors as follows: (a) data collection and analysis are interrelated processes; (b) concepts are the basic units of analysis; (c) categories must be developed and related; (d) sampling in grounded theory proceeds on theoretical grounds;
(e) analysis makes use of constant comparisons; (f) patterns and variations must be accounted for; (g) process must be built into the theory; (h) writing theoretical memos is an integral part of doing grounded theory; (i) hypotheses about relationships among categories should be developed and verified as much as possible during the research process; (j) a grounded theorist need not work alone; and (k) broader structural conditions must be analyzed, however microscopic the research (Corbin & Strauss, 1990). These procedures are the basis for the research design proposed here.

Grounded theory is an inductive approach wherein the process of data collection is intended to move from specific to general. Therefore, it is very important to devote effort and time to the data collection process when using a grounded theory design in order to have adequate data that help to generate a theory. Further, data collection is intertwined with continual analysis, as Anselm Strauss and Corbin (1990) explained:

A grounded theory is one that is inductively derived from the study of the phenomenon it represents. That is, it is discovered, developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon. Therefore, data collection, analysis, and theory stand in reciprocal relationship with each other. (p. 23)

Pandit (1996) explained that data collection and analysis in grounded theory is a combined process. It is hard to separate them or to wait until the data collection process is complete because the analysis in grounded theory starts with the first piece of data. Also, in grounded theory, data are collected until saturation is defined—that is, no new findings may be obtained for the study (Corbin & Strauss, 1990; Heath & Cowley, 2004; Kolb, 2012; LaRossa, 2005; Strauss & Corbin, 1998; Strauss & Corbin, 1990).

“Grounded theory has specific procedures for data collection and analysis, although there is flexibility and latitude within limits” (Corbin & Strauss, 1990, p. 6). Data analysis in the grounded theory approach was begun by Glaser and Strauss (1967) with two major phases and sub-phases. Later, Corbin and Strauss (1990, 1998) elaborated on the research design by adding another phase, for a total of three phases: open coding, axial coding, and selective coding. Both Glaser’s and Strauss’s versions of grounded theory followed the basic qualitative research process with a concentration on coding, categorizing, writing memos, comparing, and all the elements that lead to generating a
theory (Charmaz, 2006; Jones & Alony, 2011; LaRossa, 2005; Mills et al., 2008; Walker & Myrick, 2006). LaRossa (2005) elucidated that grounded theory is additionally useful for examining textual materials theoretically. Therefore, the analysis in a grounded theory study starts from receiving the first bit of data, and the data collection process does not stop until the researcher is receiving the same responses and there are no new findings. It is a dual and continuous process until a clear picture of the results is revealed (Jones & Alony, 2011; Mills et al., 2008; Walker & Myrick, 2006).

Corbin and Strauss (1990) illustrated that coding is the “fundamental analytic process used by the researcher” (p. 12). Charmaz (2006) also explained, “Coding means categorizing segments of data with a short name that simultaneously summarizes and accounts for each piece of data. Your codes show how you select, separate, and sort data to begin an analytic accounting of them” (p. 43).

**Grounded Theory and the Qualitative Paradigm**

Some researchers have raised the issue of potential risks in using grounded theory. First, interaction with data is very important in grounded theory because the data collection and analysis are extremely sensitive and time-consuming processes. Both require an immense amount of time, concentration, and determination. Lack of proper care in these stages would lead to incorrect implementation of the method (Gregor & Hart, 2005). In addition, one of the most common challenges is failing to reach a significant theory after collecting and analyzing the data (Jones & Alony, 2011).

However, grounded theory is still a good choice for this study for multiple reasons. First, it grants more freedom for exploring a new area of study by means of gathering data from different sources and finding concepts that will be thoroughly analyzed and compared to generate a new, up-to-date theory that contributes to the understanding of the topic (Charmaz, 2006; Corbin & Strauss, 1990; Cox-Davenport, 2010; Creswell, 2007; Heath & Cowley, 2004; Kolb, 2012; LaRossa, 2005; McGhee, Marland, & Atkinson, 2007; Mills, Bonner, & Francis, 2008; Strauss & Corbin, 1994). As Corbin and Strauss (1990) stated,

The procedures of grounded theory are designed to develop a well-integrated set of concepts that provide a thorough theoretical explanation of social phenomena under
study. A grounded theory should explain as well as describe. It may also implicitly give some degree of predictability, but only with regard to specific condition. (p. 5)

Second, the qualitative approach encourages participants involved in the phenomenon to express their ideas and perspectives, and their voices will guide the study. It also allows all the participants to witness the development of the theory (Creswell, 2007; Charmaz, 2006; Corbin & Strauss, 1990; Rubin, 2000; Walker & Myrick, 2006). According to Heath and Cowley (2004), “grounded theory sees researchers as social beings whose experiences, ideas and assumptions can contribute to their understanding of social processes observed” (p. 143). Third, data in a grounded theory design can be validated through systematic examination of the participants’ responses and further studies (Cox-Davenport, 2010). Moreover, a grounded theory design is suitable for exploring uncovered or unknown phenomena (Charmaz, 2006; Heath & Cowley, 2004) and is adequate in assisting doctoral researchers (Jones & Alony, 2011). Finally, according to Martin and Turner (1986), grounded theory “is an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observation or data” (p. 141).

Two methods were used to collect data for this qualitative study: online questionnaires and in-depth interviews. One of the most popular methods of collecting data for qualitative studies is interviewing (Browne, 2005; Creswell, 2007; Heath & Cowley, 2004; LaRossa, 2005; Rubin, 2000; Walker & Myrick, 2006). Interviews are often used to collect data for social issues as they are convenient, simple, maneuverable, and adaptable. Rubin (1995) stated, “Qualitative interviewing is a way of finding out what others feel and think about their worlds. Through qualitative interviews you can understand experiences and reconstruct events in which you did not participate” (as cited in Kee & Thompson-Hayes, 2012, p. 1). Furthermore, researchers have noted that the strongest aspect of qualitative research is the freedom to use different ways to study a phenomenon in order to deepen the understanding. Moreover, interviews provide direct and interactive communication between the researcher and participants, initial exploration of unstudied phenomena, and new insights (Rubin & Rubin, 2005).
Interviewing, though one of the best methods for collecting qualitative data, can present its own problems: some populations can be hard to reach, and costs for conducting interviews can be prohibitive. Researchers Kee and Thompson-Hayes (2012) have explained that computer-mediated communication (CMC) is effective and useful for providing an efficient interview environment when the research population is small and hard to reach. Also, they explained that using online tools such as Instant Messenger, Skype, or any teleconference technologies to conduct interviews can help to increase flexibility of interview, the ability to interview participants from different geographical places, the possibility to maximize the number of participants, and the ease of recording the interview. However, the most common disadvantage is the lack of nonverbal communication and body language (Kazmer & Xie, 2008).

**Purpose and Research Questions**

In educational technology, many studies have been conducted on the use of social media in postsecondary institutions; few, however, have focused on the experience of students with disabilities (Asuncion et al., 2012). Therefore, given the limited previous research on social media and students with disabilities in higher education documented in the previous chapter, a grounded theory research design has been chosen for this study because it is appropriate for generating a theory through inductive analysis. Grounded theory is useful for studying social issues, especially when there is a dearth of existing theories about the topic (Charmaz, 2006; Chesebro & Borisoff, 2007; Corbin & Strauss, 1990; Jones & Alony, 2011; Strauss & Corbin, 1998; Walker & Myrick, 2006).

According to Foster, a qualitative approach is appropriate for a study that focuses on DHH students in colleges because it allows greater flexibility for interaction between the researcher and the study participants (Foster, 1996). It is hoped that the findings of this study will provide rigorous insights, contribute to the field, and potentially generate new theoretical frameworks about the use of CBT to help DHH students participate and collaborate more with their instructors, peers, and academic content; to pursue greater achievement in their academic lives; and to persist in completing their postsecondary education degrees.
Therefore, the specific purpose for using grounded theory in this study was to evaluate the effectiveness of using community-based technologies to help DHH students to

- participate and collaborate more with their instructors, peers and academic content
- have higher academic achievement, and
- have increased persistence to complete their degree.

To reach the goals of this study, the following questions need to be studied:

- What is the relationship between using CBT and the development of satisfactory social interactions in higher education for DHH students?
- How do DHH students perceive the role of CBT in their academic achievement and satisfaction with higher education?
- What are the types of impact of using CBT on DHH students’ overall satisfaction in higher education?

**Role of the Researcher**

My background as a student in educational technology and disability studies motivates me to study the benefits of using community-based technologies in an inclusive postsecondary education setting. It also helps me to understand the students’ acceptance or rejection of the use of any technological tool. However, my previous knowledge may allow a bias to occur during the interpretation process.

Because the researcher is the "research instrument" in qualitative research, the researcher appears in every step during the data collection and analysis processes. Also, the researcher in a qualitative study connects with the participants emotionally in order to make them feel more comfortable in sharing their stories and experiences. Baldry, Hughes, Burnett, and Collinson (2011) noted as one example that “[i]n a research study looking at the experiences of bereaved parents, the interviewees might need to feel supported before they are able to disclose the emotional impact the experience has had on them” (p. 50).

In this study, my role as a researcher was central to the process, but I was not able to interact with the participants F2F. Therefore, I had to depend upon online tools to
obtain information from the participants whether for the online questionnaire or the online interview.

I did not have a prior relationship with the participants, and all the data were collected online. However, two deaf graduates and Dr. Gary Long from Richmond Institute of Technology helped me to disseminate the online questionnaire link to a larger deaf students’ community which they knew about. All the recruitment process was done anonymously. A snowball sampling technique was used as participants were asked to forward the questionnaire link to anyone who fit the research criteria. This technique is widely used in qualitative research because of its ability to increase the number of potential participants, especially when the population is small, hard-to-reach, hidden, or socially marginalized because of social stigma or illegal behaviors. As was the case for this study, it also allows the research participants to assist the researcher by recommending and recruiting others who fit the research criteria to participate in the study (Atkinson & Flint, 2001; Baltar & Brunet, 2012; Biernacki & Waldorf, 1981; Browne, 2005; Onwuegbuzie & Leech, 2007; Patrick, Pruchno, & Rose, 1998).

When the questionnaires were complete, I conducted online interviews with the participants. For the online interview, only participants who had agreed to be interviewed were contacted. Participants were asked to choose the best way for them to interview, either with the presence of an interpreter or by texting. I was also open to using any type of communication if the participant requested it. Because interaction with the participants in the online interviews necessitated either an interpreter or text-based conversation, there was less emotional interaction with the participants than would have been present in F2F interviews, but this was not a serious issue in obtaining the information required for the study.

Participants and Context

Participants

Choosing the right population sample is very important in all research. Most qualitative researchers in grounded theory select participants within a particular social context (Munhall, 2007; Onwuegbuzie & Leech, 2007). Theoretical sampling aims to explore the core categories by choosing sample participants purposefully. For this study,
the participants were former or current DHH students in postsecondary institutions in the US, where CBT was used either in an online classroom or as an extension of a F2F course. Participants needed to be able to use computer and communication technologies and to communicate in English in order to be able to complete the questionnaire and interview.

After obtaining the University of Hawai‘i at Mānoa Institutional Review Board’s (IRB) approval to conduct the research, I recruited participants, as already noted, by using the snowball sampling technique. The anticipated number of participants for the questionnaire was initially 40 to 50, with an expectation of narrowing down to between six and 15 for the interviews. However, the sample size for this study was decreased because of saturation of the collected data—that is, no new concepts or ideas received. As Munhall (2007) explained, saturation can often be reached with a relatively small sample in a qualitative study over a concentrated area. Therefore, the sample for this study ultimately comprised 30 participants for the questionnaire. The sample consisted of 12 male, 17 females, and one who preferred not to say. Most of them were between 18 and 35 years of age. There were 17 hard of hearing students, 12 deaf, and one who preferred not to say; 17 were undergraduate students, and 13 were graduate students from various majors. Participants’ length of experience in higher education ranged from 1 year to more than 10 years.

The online interviews comprised six participants. The number of participants for the online interview was small because a grounded theory design encourages the researcher to get more and thorough information from a limited number of participants. As Padgett (1998) explained, “the emphasis should be on the quality not the quantity” (p. 52). During the participants’ recruitment process, I took into account that a sample size in a qualitative study should not be too large or too small in order to reach theoretical saturation (Onwuegbuzie & Leech, 2007; Strauss & Corbin, 1990). It was important to choose participants based on the research criteria in order to enrich the research with valuable information. At first, the small number of participants helped with theory emergence, but more participants were later recruited to further elaborate and validate data.

The recruitment process contained three rounds: I began by sending emails to
invite DHH students whom I know and to ask them to recommend others. On July 10, 2013, I sent the questionnaire to a few participants. However, the response was very slow. On July 18, 2013, I started the second round by creating a Facebook page called “Social Media and Deaf and Hard of Hearing Students in Higher Education” in order to reach more participants. I attempted to recruit potential participants by posting the questionnaire link on the page. Within a few days, I realize that I was not reaching an ample number of participants. Therefore, I decided to find an alternative way to send the questionnaire link to a larger audience by promoting the Facebook page for this study with an ad that cost $10 dollars daily. The ad, which was active for two days, helped me to find more participants. I also “Liked” different FaceBook pages and groups for DHH, and I had a few extra responses from these pages.

To maximize the number of participants, I started the third round by contacting Dr. Gary Long from the Rochester Institute of Technology (RIT) to see if he would disseminate the questionnaire among his students. He advised me to apply to the RIT IRB for approval before sending the questionnaire to his students. Upon receiving the IRB approval from RIT (Appendix A), Dr. Long sent the questionnaire link to his students. The response from RIT students was impressive because most of the students were DHH and familiar with CBT.

The participants were selected purposefully by means of the aforementioned snowball sampling technique. The last part of the questionnaire was designed to ask participants to refer to other potential participants who met the research criteria, and the email addresses of those potential participants were collected. Later, those participants received an email with the consent form (Appendix A) and the questionnaire link for participation in the study. The same technique was used for the online interviews. At the end of each online interview, the participant was asked to recommend someone who might be interested in participating in this study. In addition, a new form of snowball sampling called a “virtual snowball sampling technique” was employed as Facebook was used as an online tool to disseminate the questionnaires (Baltar & Brunet, 2012; Brickman Bhutta, 2012). Researchers have found that virtual snowball sampling can help with reducing the selection bias, contacting people and encouraging them to participate, maximizing the number of participants, accessing hard-to-reach participants, and
increasing the validation and representation of the results (Baltar & Brunet, 2012). Therefore, I used a Facebook page as a virtual tool to recruit and interact with the participants and to post comments. The online correspondence with the participants could also be considered as a virtual recruitment tool.

**Context**

In this study, data were collected through online questionnaires and online interviews that were individual and synchronous. Upon expressing a willingness to be interviewed, the participants received an email asking about their preferences for conducting an interview: for example, asking whether they preferred online video and chat tools, text-based interviews, or the presence of an interpreter, as well as what might be a convenient time for them. Another email was then sent to the participants containing ten basic questions designed to give them an overview about the nature of the interview along with the consent form. The interview began with a general conversation and familiar topics based on the ten questions that had been sent in advance in order to discuss the participant’s own experience. All the online interviews were conducted via chat, using Skype and Facebook.

**Confidentiality**

The data collection process began after approval for the research proposal was obtained from the University of Hawai‘i at Mānoa IRB (Appendix A). Approval from the IRB at RIT was also obtained so that the questionnaire could be disseminated to DHH students in RIT through Dr. Gary Long, one of the researchers who created the CBQ that I used.

In this study, because the interaction with the participants was online, all the data, including the email correspondence, were secured and kept confidential in order to protect the rights of the participants. Two different forms of consent were obtained from the participants in this study: first, for the online questionnaire, participants could not proceed without agreeing to participate in the study (Appendix A), and second, a signed consent form was obtained from each participant for the online interview (Appendix A). Both consent forms had information about the study and the rights of the participants.
They were informed that participation in the study did not involve potential risk and that they could withdraw at any time without repercussion. They were also informed that text-based conversation would be saved for research purposes. Although it is not easy to maintain the anonymity of participants in qualitative research, I made sure that all the identities were removed when quoting or using screen captures (Grinyer, 2009; Kaiser, 2009). All data, including chat, notes, and documents, will be destroyed after the dissertation is completed.

Data Collection

The data collection process for this study started after IRB approval had been obtained from the University of Hawai‘i at Mānoa. The online questionnaire and online interview, the main data sources for this study, had been designed to collect data about DHH experience with CBT in higher education. Specifically, both tools focused on the impacts of CBT on DHH interaction, achievement, and overall satisfaction in a higher education environment.

The online questionnaire was designed primarily to gain a rich perspective of DHH students’ experience in higher education, and the open-ended questions helped the participants to share their various experiences (Charmaz, 2006). The questionnaire also enriched researcher understanding about the participants’ feelings toward using community-based technologies. The follow-up detailed interview was conducted to elicit further elaboration on the participants’ responses and to learn more about the participants’ experiences.

Recruiting participants in this study was partly simultaneous with data collection because of the need to use the snowball sampling technique. As data was collected from participants, they, in turn, were asked to recommend a number of their colleagues and friends who met the requirements for the sample to add valuable contribution to the study (Onwuegbuzie & Leech, 2007). The FaceBook page also helped me not only to spread the questionnaire but also to ask some questions that were more public in nature; for example, I wrote a question to ask about DHH students’ experience with social media and about whether or not they could make many friends in social media (Figure 1). Figure 2 demonstrates that they are able to interact effectively with each other.
Online Questionnaire

For the online questionnaire, the Classroom Participation Questionnaire (CPQ) was used, initially developed by Dr. Gary and colleagues and modified by Long, Stinson and Antia (Antia, Sabers, & Stinson, 2007; Richardson, Marschark, Sarchet, & Sapere, 2010). The CPQ is a student-rated questionnaire measuring DHH students’ perceived communication and engagement in mainstream classrooms. For this study, I contacted Dr. Gary to get his permission to use CPQ with modifications and to ask him for the latest version of it. He responded with his permission and expressed his willingness to provide further assistance. Later, he also helped to disseminate the questionnaire among DHH students at RIT.

The CPQ has been tested for validity and reliability in a five-year longitudinal study by researchers. They compared students’ responses with their achievement and found that the CPQ is a useful, valid, and reliable tool that may be used also in elementary and middle school after being appropriately tested and used in high school and college. It is an adequate and reliable tool for both teachers and researchers in examining DHH participation in mainstream education and studying different phenomena (Antia et al., 2007).

Figure 1. DHH experience with social media  Figure 2. Deaf person asks for text buddies
The questions have been modified both to fit the purpose of this study and to obtain more information from DHH students in postsecondary education. The questionnaire was originally designed to give the participants a space to input their perspectives. The modified CPQ for this study consisted of 56 items that covered the participants’ demographics, participation, interaction (either online or F2F), use of technology, and communication and preferences; it also included two open-ended questions. Most of the questions were based on a four-point Likert scale: “almost never,” “seldom,” “often,” and “almost always.” The open-ended questions asked about the participants’ experiences and opinions. After I created the questionnaire, I sent it via email to my professors and two of my friends who are deaf, Karen Christie and Thomastine Sarchet at RIT, to test the appropriateness and adequacy of the questions for the purpose of the study and for DHH students. I received constructively critical comments and feedback that helped me improve the questionnaire. Figure 3 explains the questionnaire’s main sections along with the key points in the research questions.

![Figure 3. The main sections of the questionnaire](image-url)

- Social Interaction
  - Class Interaction
  - Online Interaction
- Academic Achievement
  - Achievement
- Satisfaction
  - Satisfaction
- General Information
  - Demographic Questions
  - The Use of Technology
  - Preference
  - Open-ended Questions
After the questionnaire was ready for distribution (Appendix B), its online format was created using Google’s form (Figure 4) in order to reach a larger audience and to elicit participants’ responses at their earliest convenience. Participants were able to read the consent form and answer the questions online as soon as they received the questionnaire link. They could not proceed to the questions without agreeing to participate in the study after reading all the details in the consent form. This form explained the purpose of the study, the risk and benefits for the participants, and their right to withdraw without any penalty or coercion. The entire questionnaire provided full visibility of the participants’ perspectives.

![Screenshot of the online questionnaire](image)

Figure 4. A screenshot of the online questionnaire.
The questionnaire took approximately 15 to 20 minutes to complete, and it was available online for one month. At the end of the questionnaire, participants were asked to recommend potential participants by either providing the potential participant’s email or forwarding the link directly to him or her. Participants were also asked to check a box to indicate willingness to participate in an online interview with the researcher in order to share their experiences and perspectives.

Use of the “virtual snowball sampling technique” enabled me also to collect data through a public Facebook page. The instruction, the purpose of the study, and the link of the questionnaire were included in the Facebook page information section in order to provide participants with clear information. Because the page was public, participants were eligible to invite participants or recommend the Facebook page to others who fit the research criteria. Thus, Facebook was used as a tool to maximize the number of participants. I recruited more participants either for the questionnaire or for the online interviews and updated the Facebook page intermittently, thus maintaining interaction between researcher and participants for the duration of the data collection.

**Online Interview**

In-depth interviews may be useful in situations in which the interview topic includes a discussion of purely personal matters or when it is impossible to collect all the respondents in one place at one time. Because the data from the questionnaire were not enough to evaluate the effectiveness of CBT for DHH in postsecondary education, online interviews were conducted to gain more in-depth information from participants who agreed to participate further in the research. The interviews allowed the participants who have experience with CBT in inclusive classrooms in postsecondary education to explain their perceptions about and experiences in using CBT in term of interaction with peers, instructors, and the academic content. The questions for the interview were selected very attentively because they were the major measurement for the results. Most of the questions were based on the participants’ previous experience and their opinion about CBT in education.

The online interviews allowed for a thorough exploration of the participants’ personal experiences as well as for obtaining more complete answers to the research
questions. The interviews also gave the researcher more time to ask the participants about their feeling and thoughts, and to express respect and appreciation for their participation. The participants and I felt comfortable exploring topics more deeply together; I was able to express my view properly, and the participants had a chance to be the experts and to share their significant experience. It was also a good opportunity to understand the nature of a group of people who may not like to express their own experience or who may not usually agree to be interviewed (Charmaz, 2006).

Online interviews were conducted with six participants, four males and two females. All of them are enrolled in graduate courses. These interviews took no more than 60 minutes apiece, depending on the amount of discussion with the participants. The interview questions focused on the participants’ previous or current experience with community-based technologies, their interaction, achievement, and satisfaction; and participants were welcome to add any suggestions or ideas for improving online interaction for them. At the end of the interview, each participant was asked to recommend others who might fit the research criteria (Atkinson & Flint, 2001). The online interview process occurred as follows:

Before the interview, I contacted each participant via email to discuss a convenient time for the interview as well as preparation for it. Then, a follow-up email was sent to determine a mutually convenient time and to ask the participant to sign the consent form and send it back before the interview. Moreover, the basic interview questions were sent to the participants prior to the interview so that they would have an idea about the nature of the interview. I checked to see if the participant had any special requirements, such as an ASL interpreter or any other communication tool that a participant might recommend. However, all the six online interviews were conducted via chat on either Skype or Facebook based on the participants’ requests. Participants were free to choose the best tools for the online interviews, and I tried to accommodate that if it was possible. Email correspondence with participants who indicated their willingness to have an online interview was saved; it could be considered as research data because it consisted of the research purpose, interview protocol, and answers to all the participants’ inquiries. The emails have been kept confidentially and carefully (Kee & Thompson-Hayes, 2012).
During the interview, I checked the audio setup and the participants’ familiarity with the tools they chose. I wrote the questions in the chat box and the participants read them and wrote their responses. All the data were saved confidentially.

After the interview, I sent an appreciation email with a compensation of $10 in a form of a gift card as an appreciation for their time and effort from either Amazon or Apple, whichever the participant chose. Figure 5 summarizes the data collection process.

**Data Analysis**

After the data for this study were collected from online questionnaires and online interviews, responses from both sources were analyzed based on Corbin and Strauss’s data analysis process, which includes open coding, axial coding, and selective coding (Corbin & Strauss, 1990; Strauss & Corbin, 1994; Strauss & Corbin, 1998). The analysis was carried out according to the 11 procedures detailed earlier in the chapter (see “Research Design”; Corbin & Strauss, 1990). Then, the findings were merged, and any themes were noted by way of observing the evolution of a theory (Allan, 2003; Corbin & Strauss, 1990; Heath & Cowley, 2004; Kolb, 2012; LaRossa, 2005; Strauss & Corbin, 1998; Strauss & Corbin, 1990).

The questionnaire data were collected in order to obtain the initial responses from the participants. Then, the online interview was conducted to derive more in-depth insights from the participants about the study. All data were analyzed as soon as they
were returned so that they could be categorized, compared, and sorted. In addition, instant comparison and analytical memos were used to observe the potential emergent categories and to create core categories and hypotheses that would lead to generating a theory. The constant comparison helped to alleviate researcher bias and subjectivity (Charmaz, 2006; Corbin & Strauss, 1990; Creswell, 2007; Jones & Alony, 2011; Strauss & Corbin, 1990). In depth, the data in this study were analyzed according to the following phases:

The first step in the coding process is open coding. Strauss and Corbin (1994, 1998) described open coding as a process wherein the researcher breaks the data up and examines it line by line in order to create concepts, categories, and subcategories. Constant comparisons for similarities and differences were used to achieve data saturation through a continuous process of comparing all the received data in order to affirm that there is no new response (Corbin & Strauss, 1990; Creswell, 2007; Heath & Cowley, 2004; Strauss & Corbin, 1990; Strauss & Corbin, 1994; Strauss & Corbin, 1998). Thus, I analyzed and transcribed both the questionnaires and the interviews as soon as they were received during the open coding phase. For the questionnaire, some basic statistics were done. Data from the open-ended questions and the interviews were broken down into phrases and sentences to create concepts and categories, using constant comparison in order to saturate the categories and affirm that no further insights could be found.

A review of the data from questionnaires and online interviews yielded over 140 codes and important information. These codes were then grouped to form concepts and categories, and the data were sorted according to each category. A memo was written for each category in order to define it.

In the next process, axial coding, the data were reviewed to scrutinize the specific categories and emergent themes in order to relate, sort, group the categories together, and label them (Strauss & Corbin, 1994). Categories and subcategories were linked to each other in order to make conceptual connections. Then, the findings were sorted and labeled. For analytical purposes, the open and axial coding phases were interrelated because “[i]t is the researcher’s responsibility to show specific linkages between conditions, actions and consequences” (Mills et al., 2008). It is also important to
understand how the participants respond to different questions and the relationship between different variables (Corbin & Strauss, 1990).

In the final coding phase, selective coding, the researcher wrote a “story line” while connecting the categories, predicting relationships, and formulating some hypotheses to determine the core categories that could lead to building a theory (Creswell, 2007, 2009; Mills et al., 2008). Therefore, categories and subcategories were connected from the open and axial coding phases to form a storyline that helped to put the small pieces together to generate a theory.

Numerical data analysis was also derived from the online questionnaire. The numerical data analysis was based on the response count and the percentages, and was charted to explore the findings.

All of the questionnaire and interview responses were categorized, sorted, compared, and labeled as soon as they were returned. The data were scrutinized in the above three phases, and a basic statistical method was used for the multiple-choice questions in the questionnaire. These procedures helped me as a novice researcher to understand when saturation had been achieved (Onwuegbuzie & Leech, 2007). Creswell (2007) also proposed a strategy called “discriminant sampling” to solve the saturation issue. It is helpful when there is a difficulty in determining if the data are saturated or the theory is adequate because it encourages the researcher to gather more information from other individuals (Creswell, 2007). Thus, I interacted with the Facebook page subscribers by posting some questions on the page and asking them to give more insights. These random responses were compared with the existing data to determine if the conclusion that I had reached was accurate. Technically, I used the technology to facilitate the analysis process. Therefore, I used qualitative data analysis software to code the open-ended questions and the interviews because this type of software provides more flexibility and ease in handling the data, and expedites the process (Buchanan & Jones, 2010).

Validation

The trustworthiness and validity of the findings are an important concern in either qualitative or quantitative research findings (Creswell, 1998). The methods used in data
collection and analysis determined the trustworthiness of the study. In this study, I used the word “validation” instead of “verification” because it is more accurate in a qualitative study (Angen, 2000). Bias is a form of systematic error that can affect scientific investigations and distort the measurement process. There are two types of researchers bias, (a) the effects of the researcher on the study participants and the effects of the study participants on the researcher (Miles & Huberman, 1994). The first bias tends to be introduced when the researcher poses a threat to the relationships of the participants, either socially or institutionally. It can inhibit a participant and lead to participants viewing the researcher as a spy, voyeur, antagonist, or critic. The other type of bias occurs when the researcher “goes native,” which is defined as the researcher becoming a participant (Adler & Adler, 1987).

For this study, certain procedures were used to increase the validity. First, a peer review strategy was used to ensure the validation of the study and assess the accuracy of the findings. A peer review was used as an external check for the research because it allows reviewers to comment and question anything in the research and gives the researcher the opportunity to express ideas to another person who may see things from a different perspective (Creswell, 2007). Moreover, the peer review strategy helped to provide more insight and reduce the researcher’s bias (Creswell, 2007; Johnson, 1997). Thus, the peer review strategy was used throughout the study to get more ideas and feedback as well as ensure the validity. I shared and asked for feedback during the research process from my committee members and my friends, and I was open to their inputs and insights. The use of this strategy began when the questionnaire was created, I sent it via email to my professors and friends who are deaf, Karen Christie and Thomastine Sarchet at RIT, to test the appropriateness and adequacy of the questions for the purpose of the study and for DHH students. I received valuable and constructive comments that helped me to improve the questionnaire. Then, I discussed the findings with colleagues during the coding and theory formation process to exchange ideas and opinions.

It is also important for the researcher to clearly discuss the potential bias in order to give a study more credibility. Therefore, I clarified any bias that occurred during the study, so any potential bias was discussed. Also, online recruitment was used as another
strategy to ensure the validity for the study. An online tool was used to recruit hard-to-reach participants because doing so helped to reduce the selection bias and increase the validation and representation of the results (Baltar & Brunet, 2012).

Furthermore, researchers studied the validity and reliability of the CPQ, the instrument used in this research, in a five-year longitudinal study and found that CPQ could be a useful, valid, and reliable tool (Antia et al., 2007). Finally, a triangulation technique was used to increase the validity of the study (Guion, Diehl, & McDonald, 2011). Triangulation is a process of collecting data from different sources so that it can be compared to validate the findings. In this study, responses from the online questionnaire, online interview, and online interaction were compared for similarities and differences. The constant comparison during the data analysis process, as well, helped to alleviate the researcher’s bias and subjectivity (Charmaz, 2006). Data reliability was established by using the theoretical sampling technique, which is a process of gathering data during the analysis in order to receive further information on a specific topic and to validate the existing findings (Fassinger, 2005). Facebook was used as a third source of data as relevant questions were posted in different pages in order to compare the responses with the existing data. Participants were also asked in the Facebook page for this study or in other pages for DHH to recruit other participants who might fit the research criteria. This virtual snowball sampling helped to reduce the selection bias, to contact people and encourage them to participate, to maximize the number of participants, to reach hard-to-reach participants, and to increase the validation and representation of the results (Baltar & Brunet, 2012).

The accumulation of common responses from different sources helped to eliminate any bias, and to build a clear conclusion that could be used to develop a theory.

**Strengths and Limitations**

Qualitative research helps researchers to be knowledgeable about a topic studied through deep exploration (Munhall, 2007) and to explain complex social processes (Reed & Runquist, 2007). Previous chapters presented a literature review for the study and the current situation for DHH in higher education. The effect of CBT (which generally refer to as social media) on students has been studied in terms of their online interaction, but a
gap in the research has existed with regard to how these technologies helped DHH students to communicate, participate, achieve, and better themselves in higher education.

This is a unique study that attempts to understand the effectiveness of using CBT in postsecondary education on DHH students’ educational experience. Multiple sources of data and different validation methods have also strengthened this study (Onwuegbuzie & Leech, 2007). The main limitation this study encountered was the lack of access to the DHH students due to the university’s rules and privacy. It took time and effort to reach enough people to make a good sample size. It was not easy, either, to elaborate on a specific topic and to get further information since all the online interviews were textual and some participants didn’t feel comfortable in sharing everything through typing. Moreover, participants who had graduated a few years ago were very frustrated with the idea of using technology as a means to communicate in the educational environment. It was hard to relate their response to the study since they were biased to the old-fashioned way of learning.

Summary

This chapter has presented the background and methods used in this qualitative study with a grounded theory approach. It has explained the process of the data collection and analysis thoroughly as well as the validation techniques.
CHAPTER 4: RESULTS

In this chapter, the findings from the data sources are discussed. This qualitative study with a grounded theory approach was used to generate a theory that explains the effects of CBT on DHH students’ higher education experience. The main sources of data were online questionnaires and online interviews. The progression of the analysis, using a grounded theory methodology that includes a coding process and creating memos and diagrams, helped in forming a theory. At the end of the theoretical coding, the core categories were explored: DHH interaction, DHH achievement, DHH satisfaction, and DHH use of technology. This chapter discusses those findings in detail, concentrating on the purpose of this qualitative research.

The next section of this chapter provides a thorough discussion of the four core categories. Each category is examined to identify the interrelationships between categories. Direct quotations are included to illustrate the emergent theory.

Generation of the Data

The research was conducted completely online. The participants were current or former DHH students in postsecondary education. There were 30 participants for the online questionnaire, 40% of whom were male, 57% female, and one preferring not to say. The age range for 53% of the participants was between 18 and 25, with 23% between 26 and 30, 13% between 31 and 35, 3% between 41 and 45, 3% between 46 and 50, and one more than 60 years old. The hard of hearing participants constituted 57%, 40% were deaf, and one participant preferred not to say. The participants attended a variety of educational institutions for secondary school: 66% attended an inclusive high school; 15% attended a special education classroom only for DHH students; 7% attended a special classroom with other special education students, and 7% attended a school that serves only DHH students. Finally, 5% attended a special education school. Regarding of where they were enrolled in postsecondary education, 90% of the participants were full-time students, and 10% were part-time. Of these, 57% were undergraduate students, and
43% were graduate students. Regarding the type of courses they have taken, 56% of them took F2F courses only, 31% took hybrid courses, and 14% took online courses only. All participants indicated that their English proficiency is good to excellent, and they feel comfortable using computers. Preferred methods of communication varied: 43% prefer to communicate with hearing peers through speech and lip-reading; 30% prefer technology, such as online discussion forums, Facebook, and Twitter; 17% prefer sign language; 7% prefer to write notes; and 3% only prefer to use an interpreter. Conversely, responses indicated that 33% of DHH students prefer their hearing peers to communicate with them through speech or lip-reading, 33% prefer technology, 13% prefer sign language, 13% prefer an interpreter, and 7% prefer writing notes. Further information about DHH students’ communication preferences can be found in Table 1. For most of the questions in the online questionnaire, a Likert Scale was used, with the choices being “almost always,” “often,” “seldom,” and “almost never.” In the questionnaire, there were two open-ended questions and two questions asking for examples. For the questionnaire analysis, the phrase “most of the participants” indicated that at least 20 participants responded. Table 1 shows DHH preferences in communication.

Regarding the interviews, there were six participants and the interviews were approximately 40-50 minutes long. I took notes about important points during each interview. I also saved the text-based interviews in Word format for analysis purposes.

**Data Analysis**

The analysis in this study was conducted in two stages; the online questionnaire and the online interview. First, the online questionnaire data were collected, and all the multiple-choice and Likert-scale questions were analyzed by assigning a value to each option and creating a score for each response. The score was then used to represent the data. On the other hand, the open-ended questions were added to the online interview analysis in order to be coded and analyzed. A quick analysis from Google’s form for the online questionnaire data helped in knowing how to prepare the online interview questions.
The questionnaire for this study was created with Google’s form, and its purpose was to gather information about the participants’ experiences and opinions through multiple-choice and open-ended questions.

<table>
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<th>Table 1: Preferences for DHH Communication to Hearing Peers and Teachers</th>
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<td>Hearing peers to DHH</td>
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All questionnaire responses were saved in Google’s form and downloaded as an Excel spreadsheet and as a PDF file with a summary of the results that included charts with percentages. Once the deadline for receiving answered questionnaires was reached, the link was disabled. All received data were analyzed using Google’s form analysis tool except the open-ended questions.

Second, the online interviews were conducted and analyzed as they were returned. The purpose of the interviews was to scrutinize further the information provided by the participants via the online questionnaire. The open-ended questions and interviews were analyzed through three processes: open coding, axial coding, and selective coding. The
reason for analyzing data as soon as they were returned was to continue collecting data until theoretical saturation was defined (Corbin & Strauss, 1990; Heath & Cowley, 2004; Kolb, 2012; LaRossa, 2005; Strauss & Corbin, 1990; Strauss & Corbin, 1998).

Both the online interview and the open-ended questions were coded and analyzed using HyperRESEARCH, computer-assisted qualitative data analysis software (CAQDA). CAQDA is widely used in qualitative studies to code and connect the findings. It also helps to break down the data into concepts and categories following the grounded theory procedures in order to form a theory (Wickham & Woods, 2005). Each online interview was coded separately as soon as it was received. In addition, constant comparison and analytical memos were used to assist in building core categories.

The analysis in this study was divided according to the research questions. It started with CBT and DHH interaction, CBT and DHH achievement, and then CBT and DHH satisfaction. For coding purposes, another section was added on DHH and the use of technology. In each section, the questionnaire data were analyzed first, then the interview and open-ended questions data.

**Coding Analysis**

Besides the numerical data analysis that showed the findings of the questionnaire results, textual data were also derived concerning DHH students’ use of CBT. These data were analyzed using open, axial, and selective coding. I coded the open-ended questions from the online questionnaire responses as they were returned and from the participants’ online interview responses as they were done. No transcription was necessary for the online interviews because all of them were textual interviews using chat in either Skype or Facebook. The analysis process helped me to identify the concepts, categories, and core categories. I identified the data by codes that explained the important information. Words or phrases that were repeated in the data helped to create the codes that identified the categories (Johnson & Onwuegbuzie, 2004). During the coding analysis, I discussed some of the responses with colleagues in order to exchange ideas and opinions. The three stages of coding were carried out as previously discussed in Chapter 3.

**Open coding.** In grounded theory, open and axial coding are interrelated processes. They allow the researcher to examine the data line by line to create codes,
categories, and subcategories (Corbin & Strauss, 1990). The purpose of open coding is to break down the data into codes, concepts, and subcategories. In this study, the open-ended questions and online interviews were reviewed, and the data were broken down into phrases that reflect the participants’ main ideas. The process was done by using HYPERRESEARCH, a computer-assisted qualitative data analysis software (CAQDA). First, the data were coded verbatim and line by line in order to understand the participants’ ideas. Later, data were coded line by line to identify concepts that helped to prepare the data to be categorized. Throughout the process, I kept analytic memos to make constant comparisons and to define the meaning of the codes.

**Axial coding.** Axial coding helps the researcher to group the data back together by creating categories. Codes and concepts were grouped in order to make the categories more apparent and to prepare the data for the next level. The axial coding data analysis provided 14 central categories, based on the open coding. The first central category was “in-class interaction”; the subcategories were about DHH preferences when interacting with peers and instructors in class. The second central category was “enhanced communication,” followed by the subcategories of help with writing, the comfort of using technology, and CBT and direct communication. The third central category was “enhanced learning”; the subcategories were more learning, better grades, and better achievement. The fourth central category was “creativity” with a subcategory about how CBT encourages creativity. The fifth central category was “CBT helps to get information”; followed by subcategories about how CBT helps in deriving more information, avoiding missing information, and conveying the message clearly. The sixth central category was “in-person interaction”; the seventh category was “technology assistance.” The eighth central category was “difficulties with online interaction,” with subcategories about the ease of online cheating, trust issues, grammatical errors, low motivation, low engagement in online discussion, and anxiety about grades. The ninth central category was “difficulties with in-class interaction,” followed by subcategories about missing information from an interpreter, the inconvenience of indirect communication, and the difficulties with F2F interaction in class. The 10th central category was “inconvenience” with the subcategories about teachers and applications. The 11th, 12th, and 13th central categories were “online educational experience,” “personal
effort to use technology,” and “school effort to use technology,” respectively. The 14th central category was “CBT to support the school’s purposes,” followed by subcategories concerning the importance of technology, CBT and the ease of retaining information, the availability of CBT, the speed of school work, and language skill improvements.

The codes were examined to find similarities and differences. Throughout this process, it was beneficial to question if the data would enrich the purpose of this study or not. This step also helped to link the pertinent data to the purpose of the study. At this level, the concepts were grouped to form similar themes, such as “difficulties with online interaction.” After the open and axial coding, the data were ready for the selective coding, which aims to put the data together in order to form a theory.

Selective coding: The goal of this process is to find a relation between the categories to develop a theoretical explanation. The tentative categories were generated after the data were constantly compared. The identified categories were analyzed for similarities and differences. Each core category was sorted and reviewed with peer advice to achieve clear identification. All the coding processes for this study are listed in Appendix C. In addition, writing memos was a constant operation during the coding analysis in order to capture the connections and thoughts that help to lead to theory. Forming a new theory requires deep understanding, insight, and several reviews. The selective codings were independence, educational experience, knowledge, persistence, challenges, learning support, and technology for school. The three levels of coding at last led to four core categories: DHH students interaction, DHH students achievement, DHH students satisfaction, and DHH and the use of technology. These core categories assisted in explaining DHH students’ perception about the use of CBT for school purposes.

CBT and DHH Students Interaction

The first research question asked “What is the relationship between using CBT and the development of satisfactory social interactions in higher education for DHH students?” There were 19 questions about DHH students’ in-class and online interaction. Participants expressed different responses about their interaction for school purposes and discussed the challenges that they encountered. Most of the responses about class interaction were positive. Only a few participants indicated some challenges and
frustration. The responses about their interaction are discussed in this section under two parts: in-class interaction and online interaction.

**Questionnaire**

In-class Interaction

There were eight questions about DHH students’ class interaction. The findings indicated that 63% of the participants depend on an interpreter in class and 37% do not. All participants indicated that they join the class discussions and feel good about their communication with their peers with respect to their different level of participation. However, 57% of the participants revealed that they feel frustrated when it is difficult to communicate with other students, and 20% of the participants get upset because the teacher cannot understand them. Nonetheless, 94% of the participants reported feeling relaxed when they talk to their teacher. However, there was a difference between the participants’ responses on their comfort level in group discussions in class: 57% were positive, but 43% didn’t feel comfortable in such class discussions.

Online Interaction

There were 11 questions about DHH students’ online interaction. Responses revealed that most DHH students join online discussions for course purposes and for more interaction with the instructor and with peers. However, 27% of the responses indicated that they do not join the online discussions for course purposes, and 36% of responses indicated that they do not join online discussion for more interaction with the instructor and peers. Overall, DHH students expressed that they feel good about how they communicate online, and only 10% indicated the opposite. Only 7% of participants expressed frustration about communicating online with other students. Most DHH students feel comfortable in group discussions online. A majority, 53%, of responses revealed that they use CBT for sharing personal stories with classmates, and 70% expressed that the instructor encourages the students to participate and interact online. Likewise, 70% felt able to interact with everyone in the class online. Although students explained that they are interested in interacting online, only 53% responded that they post
new topics and ideas. Regarding participants’ interactions with teachers, 6% revealed that they get upset when the teacher cannot understand them online.

**Interview and open-ended questions**

The participants in the online interviews and the open-ended questions from the questionnaire expressed various ideas about their interaction. There were five major open codings, two axial codings, and one selective coding under the core category, “DHH Interaction.” Regarding the in-class interaction, four participants mentioned that using text-based technology helped them to be independent and not rely on an interpreter all the time. Three participants indicated a preference for lip-reading, speech, and sign language over technology. However, 23 participants out of 30 in the online questionnaire preferred writing their comments or ideas in general over having an interpreter.

Eight participants explained the benefits of writing, noting that writing helps them to express themselves better because it allows them to convey their ideas and to become more involved. One participant wrote, “I prefer writing my discussion online because sometimes with an interpreter not all information is received.” This comment shows that writing also helps DHH to convey their messages directly to others. Another participant wrote, “Sometimes in class I miss [it] when people are planning something (homework groups, dinner outings, whatever) so when it's posted in our group page it's easier to get involved and write for them.” Yet another wrote, “If I can write my discussion online and read other student discussion, I can always go back and read what they say.” These examples show that participating in online discussion helps DHH students to be involved and independent. Moreover, it keeps them updated. Regarding enhancing communication, 19 participants explained several points about their communication. Some of them stated that CBT helps them to communicate with hearing peers easily and that they feel more relaxed and comfortable when they communicate online with others. Participants expressed that technology helps them to interact more with peers, and they mentioned Facebook, texting, and online forums as examples of technology. One participant wrote about CBT, “It definitely increases interaction with peers.” In addition, 17 participants mentioned that CBT eliminates the third person and makes the interaction more direct.
CBT and DHH Academic Achievement

Questionnaire

There were five questions in this section. Most of the participants’ responses were positive about their achievement, with 83% indicating that they always communicate better with peers through CBT. Only four participants (13%) chose “seldom” and one participant (3%) indicated “never” in response to the idea of communicating better with peers when using CBT. Regarding their communication with instructors, 67% responded that they communicate better when using CBT. However, 27% said they seldom communicate better with instructors when using CBT while 7% said they never do. The number of participants who do not find that CBT helps them to communicate better with instructors is noticeably higher than the number of those who do not find CBT helpful in communicating with their peers.

Another question was about DHH students’ participation and CBT. Most participants indicated that they participate better when CBT is integrated in the curriculum: only 7% chose “almost never,” with 10% choosing “seldom.” In addition, there was a question about the relationship between students’ grades and CBT. Most of the participants indicated that CBT positively affects their grades, only 7% indicating “never” and 10% “seldom.” The last question was about whether or not students learn a lot through online class discussion. Most of the students indicated that it does, whereas 20% said “seldom,” 7% saying “never.”

Interview and open-ended questions

The core category “DHH achievement” has five open codings, five axial codings, and three selective codings. The three selective codings in the core category were better educational experience, knowledge, and persistence. Regarding the better educational experience, 11 participants explained that technology helps them in different ways. Some participants indicated that DHH are visual learners and that technology supports their learning experience. A participant wrote, “I can tell that many Deaf and Hard of Hearing people as well can learn better in school since most Deaf and Hard of Hearing people are visual learners. Without Technology it seems almost impossible for me and others to do well in school.” They also discussed that online communication increases their level of
comfort, in turn accelerating their learning. A participant clearly wrote, “Without the community-based technologies available, I would not be nearly as successful in the classroom as I am now.” Thus, the support that technologies offer for online communication helps them to learn more, to achieve better, and to reach their goals.

One participant mentioned that CBT encourages DHH to be creative because their ideas can be shared with others online. Regarding knowledge, 25 participants explained that CBT helps them to receive information. One of the participants wrote, “I think community-based technologies for school purposes is a lot [more] effective than any other methods. I can get so much information without missing anything.” They confirmed that when CBT is integrated into the curriculum, their knowledge is expanded and their independence is improved because they can go back at any time and read or participate in the discussion. They also like to find the class materials online because it makes it easier for them to review what they might have missed in the classroom. Some participants expressed that CBT also helps them to write their ideas and convey the meaning to others without any confusion. One participant mentioned that writing the idea helps them to get the point across quicker, especially when the hearing peer is impatient. Not everyone agreed on this point; two participants maintained that in-person interaction helps them to gain knowledge and is better than online interaction. A participant wrote, “I like being in person because it gains the best knowledge than technology.”

In terms of persistence, four participants discussed the importance and relevance of CBT to their persistence in school. One of the participants wrote, “Personally I am afraid that if technology wasn't around, I would fail in school so poorly. Technology is a must, most useful tool for all Deaf and Hard of Hearing.” Another participant wrote, “I believe that the technology today enables more HOH and Deaf individuals to pursue higher education.” Thus, the opportunities offered by CBT make it possible for DHH students to pursue a higher education.

**CBT and DHH Satisfaction**

**Questionnaire**

There were five questions about DHH students’ satisfaction with CBT, the first question asking if they feel comfortable with online tools in the class. Most students
agreed with only 17% participants indicating lack of comfort with online tools in the class. Another question asked if they feel more satisfied with their experience in using CBT for class participation; most of the participants were positive, only 23% expressing dissatisfaction. Most of the participants indicated that they do not feel overwhelmed when technology is integrated into class participation, but 17% chose the opposite. Finally, 60% expressed enjoyment of non-class interaction and said that they feel part of the class community, whereas 40% indicated the opposite.

**Interview and open-ended questions**

The core category “DHH Satisfaction” was divided into two main selective codings, challenges and support learning. Regarding challenges, the participants discussed three major points: difficulties with online interaction, difficulties with class interaction, and inconvenience. Regarding CBT to support learning, participants discussed their experience with online education.

In terms of difficulties with online interaction, one participant first raised a concern that using CBT could increase the possibility of cheating when participating or doing research online. Another participant wrote, “Teachers need to understand that just because classes are on line or work is done on line that students aren't trying to cheat.” This shows that there is a trust issue among all the students including DHH and teachers. Second, one of the participants mentioned that when students make grammar mistakes, it becomes hard for others to understand the context. Moreover, two participants discussed the frustration caused by some students or teachers who ignore the online discussion or messages or who do not participate effectively with others. The final negative point concerning online interaction is grading issues. Two participants mentioned this issue and one of them wrote, “I don't feel engaged when it comes to online discussion. I do it because it is required for all of us to participate in order to earn good grades.” They explained that anxiety about grades decreases the students’ willingness to participate online freely.

With regard to difficulties with class interaction, four participants expressed difficulties with all of the related challenges having to do with the interpretation process.
Participants asserted that it is hard to receive all the information through interpretation during a class because it is impossible to look at the interpreter and the presentation or instructor at the same time. One participant wrote, “An interpreter gives out the information once, and I tend not to ask the interpreter to repeat what was said because I don’t want make them miss more information when they are repeating what was said.” Three more participants referred to the inconvenience of the interpretation process, and one of the participants characterized it as three-way communication. They explained that this mode of communication slows down the process and causes information leakage. They added that some instructors or peers don’t have experience with communicating with DHH, and this causes communication obstacles; for example, one of the participant wrote, “Peers and some instructors have not experienced meeting a deaf or hard of hearing and they talk too fast, which makes it difficult for me to understand them.”

Finally, several DHH students explained that the use of CBT has its inconveniences. Six participants indicated that some instructors don’t use CBT owing to either their inability or their preferences. Participants said that some instructors don’t use technology and that they prefer in-class discussion instead of online discussion. One participant noted that some instructors are old and that they don’t want to integrate technologies into their course. Other instructors still depend only on emails for online communication with students. One of the participants wrote, “RIT MyCourses has neat discussion and forum tools, but teachers rarely use them.” Other participants shared the same idea that the school system encourages teachers and students to use online communication tools but that sometimes teachers don’t use them and thus derive the benefits. Accessibility is also an issue, as indicated by four participants, who expressed frustration because of lack of knowledge about how to use CBT. Two of them recommended that all videos in the classrooms should be closed captioning and that companies should create more accessible applications for education.

Regarding CBT to support learning, five participants expressed satisfaction with CBT in their educational experience. Four of them wrote about how easy it makes their communication with others, and another participant added that online discussion is fun when compared to in-class discussion.
The Use of Technology and Students’ Preferences

Questionnaire

There were several questions about DHH students’ use of technology and their preferences. First, participants were asked to name three tools they used for class discussion and interaction. Figure 6 shows the word cloud that was created via Wordle to depict the participants’ preferences for class discussion. They chose Facebook, a learning management system, email, Instagram, twitter, Skype, Google Docs, Google Plus, and videophone.

Figure 6. Best tools for class discussion.

Most of the participants explained that the instructors that use CBT introduce it clearly and carefully and encourage them to use the integrated tools. Regarding the participants’ use of CBT for school purposes, 47% of the participants indicated they spend around 4 hours daily in CBT for school purposes; 37% spend from 4 to 7 hours; 10% spend from 7 to 10, and 7% spend more than 10 hours. On the other hand, in answer to a question about the participants’ use of CBT for personal purposes, 43% of participants spend around 4 hours for personal purposes, 27% spend more than 10 hours for personal purposes, 17% spend from 7 to 10 hours, and 13% spend from 4 to 7 hours.
Regarding the participants’ preferences, 87% of participants prefer a course with communication technologies. However 50% of participants prefer in-class discussion when discussing school topics or projects, 33% prefer an online discussion forum, 10% prefer text messages, and 7% prefer online chat. There was also a question if students preferred writing their ideas or comments, or having an interpreter to express them. Most of the participants chose writing ideas or comments, and only seven chose having an interpreter. Figure 7 displays the participants’ choices as best tools for communication and collaboration. Participants chose Facebook, email, text messages, Skype, an interpreter, online discussion, online chat, a course management system, and videophone. They also mentioned Google Plus, Twitter, and Google Docs. The word cloud was created via Woordle to show participants’ preferences.

![Word cloud showing participants' preferences for communication tools.](image)

**Figure 7.** Best tools for communication and collaboration.

**Interview and open-ended questions**

The core category “Use of technology” has seven open codings, three axial codings, and one selective coding. This section was divided according to personal effort to use technology, school effort to use technology, and support that technology provides for school’s purposes. Regarding personal effort to use technology, two participants said that the students themselves make the effort to use technology for school purposes. One
participant explained that during a group project it was hard to communicate with other hearing peers. Therefore, he decided to create a Facebook page for that group project, and it was helpful to the whole group for discussing and sharing ideas for the project. Another participant explained that one of the hearing peers started a Facebook page for a cohort to discuss school and personal issues, such as planning for a trip, going to the theater, etc. This Facebook page helped all the class to be in one online community with DHH students.

Six participants discussed the school’s effort to use technology. Four of them explained the benefits of using a learning management system when it is integrated well into the curriculum. One participant wrote, “With community-based technologies, such as Blackboard for classes, I can more easily communicate with other class members and get my ideas across, as well as understand them!” They explained that they feel more active and interactive when they can communicate for school purposes online, especially because they can participate or read at any time of the day. They also discussed the benefits when the technology is supported by the school because the instructor will be responsible for providing the materials online and managing the discussion online.

In addition, participants explained that instructors should encourage students to use it in order to be more effective. One participant explained his school’s policy for encouraging students to use CBT. He wrote, “Teachers tend to ignore messages [from students that are] not sent through school email or Blackboard.” Such a strategy will obligate students to use online tools and will help them to be part of the online community. Another participant wrote about using video samples for each project. The participants explained how helpful it was to watch a sample, to read other peers’ discussions, and to participate in the online discussion. On the other hand, one participant explained the benefits of using CART (Communication Access Real-time Translation) for school purposes and wrote, “Explore how cart reporting helps deaf/hoh students in the classroom as it really helped me understand the discussion & dialogue amongst classmates & professor.”

The section about technology to support school purposes revealed important information about using technology in school. Six participants stated that technology is a must in the educational environment. Four participants explained that CBT makes it easier to retain information because the students can go back and read the information
they missed. One participant wrote, “I don't have to worry about losing my notes if the notes are posted on Blackboard.” Nine participants reiterated that CBT is reliable because they can use it to participate in online discussion anytime. Two participants added that the online discussion improved their English development. Another two participants pointed out that CBT helps to speed the schoolwork because the discussion is available anytime, they can clarify any confusion immediately, and they can share ideas anytime.

**Summary of Findings**

Chapter 4 has provided information about the generation of data and the data analysis, explaining how the data were documented and analyzed. The discussion of the results was also presented in this chapter. The numerical data analysis from the online questionnaire and the coding analysis from the online interviews and the open-ended questions were presented and discussed. The analysis helped to explain how CBT can affect the DHH students’ postsecondary experience. The result of the online questionnaire was discussed in terms of percentages and numbers.

In the coding analysis, the axial coding data analysis identified 14 central categories. Then, the selective coding grouped the previous codings into seven categories that helped to form the core categories for the study. Based on the open-ended questions in the online questionnaire and the online interview, followed by the coding process, the four major categories reflected were DHH interaction, DHH achievement, DHH satisfaction, and DHH use of technology.

The results show that most DHH students appreciate the use of CBT in school, but they find that schools still need to integrate technology properly and to encourage instructors and students to use it as a community. Students’ responses revealed that they prefer to be independent as much as they can, with most choosing speech, technology, sign language, and writing notes for communicating with peers, and only one participant choosing an interpreter. In the questionnaire, 26 of the participants preferred a course with communication technologies, and only four chose the one without communication technologies. In the online interviews, all participants preferred courses with
communication technologies. Thus, most of the participants were positive about using CBT for school purposes.

Chapter 5 provides a summary, discussion, and recommendation for further studies.
CHAPTER 5: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter extends the data analysis in order to draw further conclusions and make recommendations. The participants’ responses provided the framework for this chapter, the conclusions from each research question, and the recommendations.

The study explored DHH students’ perceptions of the effectiveness of CBT in postsecondary education on their interaction, achievement, and overall satisfaction. It has explored how DHH students perceive the impact of CBT on their success in the educational experience. The key findings show that DHH students have become reliant on text-based technologies, that they prefer to use CBT for school purposes, and that they recommend that postsecondary institutions should integrate CBT properly. Postsecondary institutions can design a CBT integration plan that is fundamentally based on all students’ needs, interests, and communication styles, including those of DHH students.

Summary of Research Questions

The first research question is as follows: What is the relationship between using CBT and the development of satisfactory social interactions in higher education for DHH students? This question sought to determine whether students were satisfied with their interaction with instructors, peers, and the academic content through CBT. A specific section for DHH students’ use of technology was included in the online questionnaire to gain a better understanding of the students’ method of communication. Descriptive statistics were used to analyze the data from the online questionnaire. In addition, DHH students provided more information about their interaction during the online interviews.

The second research question asked the following: How do DHH students perceive the role of CBT in their academic achievement and its effect on their satisfaction with higher education? This question measured DHH students’ achievement through their participation, communication, and grades when using CBT. The responses from the
online questionnaire and the online interview enriched the data about their achievement in postsecondary education.

The third question is as follows: What are the types of impact of using CBT on DHH students overall satisfaction in higher education? This question was built on the previous questions. The responses for this question discussed different factors that raised the DHH students’ satisfaction in postsecondary education. Because the questions in the survey focused on DHH students’ feelings, such as their comfort level, satisfaction, and enjoyment, they helped especially in finding an answer for the third question. Moreover, one section in the online questionnaire addressed DHH students’ preferences in order to understand their satisfaction with CBT. This section focused on DHH students’ preferences in CBT, methods of communication, and examples of best tools. Therefore, the more satisfaction the DHH students have with using CBT, the more persistent they are. Some responses from the interview also provide examples of how CBT helps students to be satisfied and to persist in their education.

Overview of Research Findings

The purpose of this research study was primarily to ascertain the effectiveness of using CBT to help DHH students participate and collaborate more with their instructors, peers, and academic content in order to achieve more in their studies and persist in completing their degree. A number of factors affected their overall satisfaction with their educational experience. The descriptive statistics derived from the online questionnaire and a coding analysis for the open-ended question in the questionnaire and the online interviews were used to analyze the data gathered from DHH students in postsecondary education. The findings that emerged from this study show the effect of CBT on DHH students’ social interactions, on their academic achievement, and on their satisfaction with higher education.
The Effect of CBT on Satisfactory Social Interactions in Higher Education for DHH Students

Four of the questions in the background section discussed how DHH students communicate with their instructors and hearing peers. Their responses revealed that participants have different opinions depending on whether they are communicating with instructors or with their peers. Figure 8 shows DHH students’ ways of communicating with hearing peers, and Figure 9 shows how DHH students communicate with teachers. These figures reflect that DHH students are more independent when they communicate with their peers because they depend more on speech and technology. Although, researchers found that formal interaction with a minimal amount of students-instructor interaction are not optimal for DHH students, interpretation and speech are common ways of communicating with teachers (Convertino, et al. 2009).

Figure 8. DHH Students’ Communication with Hearing Peers

However, speech and an interpreter are the most popular options when they communicate with teachers. Participants chose technology more when they were asked about the best way for teachers to communicate with them, but they did not prefer to communicate with teachers via technology. It is also important to note that only one participant chose an interpreter when communicating with hearing peers. The responses indicate that DHH students like to communicate via technology in general as long as they
can; however, it is still not an option for communicating with teachers, even though they desire that teachers communicate with them via technology.

**Figure 9. DHH Students’ Communication with Teachers**

As one of the interviewees replied to the question about using CBT to increase interaction, “It definitely increases interaction with peers; not so much with faculty and academic content.” Even those who indicated that their level of English proficiency is fair preferred writing over interpreting to express their ideas. Most of the participants felt less frustrated when communicating with other students online than they did during in-class interaction. Most of them also felt more comfortable in-group discussions online than in-group discussions in class. Overall, seven participants indicated that they seldom feel good about how they communicate in class, whereas in terms of feeling good about how they communicate online only one participant chose “seldom” and two chose “almost never” This proved what Cavender (2010) discussed that not all DHH student welcome the use of technology due to various reasons but it is the teacher’s responsibility to integrate technology properly with an understanding of students’ background and skills.

In the interaction section, the differences between the participants’ responses concerning their in-class and online interactions indicated that most DHH students preferred online interaction owing to many factors, such as independence, ease of communication, and writing ideas versus interpreting. For example, three of the six participants who chose interpreting over writing for expressing ideas mentioned that
teachers do not encourage them to participate and interact online, and all the participants who mentioned the lack of teacher encouragement also mentioned that they do not post new topics. Participants prefer to see more encouragement to use CBT for school purposes as one of the participants wrote, “Community based technology should be encouraged in schools.” Although 23 participants indicated that they feel relaxed when they talk to their teachers, six mentioned that they get upset when teachers cannot understand or interact with them in class, whereas only two mentioned being upset when teachers cannot understand or interact with them online. One of the interviewee wrote, “I have always advocated for myself to do anything possible to interact with my instructor so that I can understand what is going on in class. But then again, I took an online class where the teacher doesn’t interact with us.” On the other hand, an interviewee explained the difficulty to understand peers and some instructors in class because of their way of communicating. He wrote, “Many times I see that peers and some instructors have not experienced meeting a deaf or hard of hearing and they talk too fast which makes it difficult for me to understand them.”

All of the responses indicated that DHH students interact more online than in the classroom, with the greatest increase in satisfaction occurring in online communication with other students and with comfort in online group discussions. In response to two questions concerning online participation, 22 participants indicated that they join in-class and online discussions, and 28 participants said that they feel good about their interaction online. One of the interviewees also wrote about CBT, “It definitely increases interaction with peers, not so much with faculty and academic content. Unless it is to share a link to an article or something we need for class.” Therefore, these responses show that online interaction and participation are interrelated process between teachers and students. Teachers are responsible for encouraging students to communicate, participate, and interact online in order to build a community that enriches everyone’s understanding and attracts all students to the learning environment. As previous research concluded that online interaction affects students’ perception of satisfaction, learning, and communication (Long et al., 2011). Most of the participants spend more hours with CBT for personal purposes than for school purposes, but they also said they feel relaxed when they talk to their teachers, share personal stories with classmates via CBT, and are able to
interact with anyone in the class via CBT. Thus, DHH students are willing to use CBT for school purposes if it is integrated well with the environment in an attempt to provide more interaction.

The Effects of CBT on DHH Students’ Academic Achievement

Part of the purpose of this study was to compare DHH students’ communication habits with their grades and learning. Fifteen participants who said that they communicate better with their instructors and peers, and participate better when CBT is integrated tend to have better grades and to learn more through online class discussions. However, one participant indicated that CBT almost never enhances communication with peers and instructors or promotes better participation if it is integrated into the class; thus, neither are the grades better nor does this person learn through online class discussion. Two other participants indicated that they do not participate better when CBT is integrated into the class discussion, so their learning experience is affected, as well their grades. Four of the participants who indicated that they do not learn more through online class discussion also said that they do not communicate better with instructors via CBT. One participant gets better grades and learns more through online class discussion, even though no communication occurs with either the instructor or this person’s peers via CBT, whereas two participants, although indicating that they communicate well with peers and instructors, and communicate better via CBT, said they do not learn more through online class discussion. On the other hand, those participants wrote positive comments when they were asked to write their opinions about CBT for school purposes. For example, “School should use it because everyone is now using technology. It is quick and advance.” Another participant wrote, “Community based technologies are almost free to access and can easily be available almost everywhere you are. Because I always have my phone I can communicate with peers any time.” Another example “I love it. I wish the platform my college uses was a little nicer--it's very basic right now & sometimes it's hard to find the right icon (button--quote, etc.) I'm looking for. It's somewhat user-friendly, but it needs a lot of work to make it easier to use.”

The results revealed that there is a connection between DHH students’ communication and their achievement, but they are not generalizable because a few
participants have better grades or learn more through online discussion without having proper communication with either instructors or peers. Postsecondary institutions should enhance the communication style by offering more CBT to bring students closer to each other and to their instructors. As one interviewee wrote when I asked if CBT can help them to have better achievement and interaction with peers and academic content, “Way better because it helps to become more involved with class room activities and discussion. When I am more comfortable, I learn more, and the more I learn, the better and well I do in the course.” Another interviewee wrote, “It really helps out because it's [the discussion] easy to follow. People can respond quickly and I can keep up with it, whereas] sometimes in class when we do group work I have trouble following it. Group discussions are difficult in class because since we are such a small group; we don't really raise our hands or anything so I can miss a bit.” Interviewees also mentioned that having the materials online helps them to learn more and to have better grades. As one interviewee wrote, “I learn better when I see pictures or example videos that I can do well on my own by not relying on other people”; another interviewee wrote, “I like to find the class materials online because I can go back at anytime and prepare before the class to avoid missing information.” The online interaction and online materials can alleviate the difficulties that DHH students face in classrooms as Long et al (2011) explained,

It can be extremely difficult for students with a hearing loss to keep up with classroom presentations and to be full participants in discussions in a traditional lecture-focused classroom. All information is taken in through the eyes, so allocating time to the multiple inputs in a classroom (instructor, Power Point slides, interpreter, other students) can be an overwhelming information-processing task (p.15)

These difficulties should be taken into account because it affects DHH students’ achievement. Therefore, online interaction and online materials can help supporting DHH students learning by making course materials available online and by offering a space for more interaction.
How CBT Use Affects DHH Students’ Satisfaction with Higher Education

Two sections of the online questionnaire, which involve satisfaction and preferences, apply to this section in addition to the interviewees’ responses. Most of the participants felt comfortable with the online tools used in the class and satisfied with their experience in using CBT. It was important to note that 26 participants from the online questionnaire preferred a course with communication technologies, and 23 participants preferred writing ideas and comments over having an interpreter to express them. One of the interviewees wrote,

I prefer writing my discussion online because sometime with an interpreter not all information are receiving. If I can write my discussion online and read other student discussion, I can always go back and read what they say. Compare to an interpreter gives out the information once and I tend not to ask the interpreter to repeat what was said because I don’t want make them miss more information when they are repeating what was said.

Previous research also discussed that interpretation is a time-consuming process and a proper interpretation is always a concern (Long et al., 2011). Another interviewee wrote about CBT, “It could be really beneficial for deaf students like me who express themselves better through writing.” Interviewees also indicated that having an online discussion can help them to feel comfortable because they don’t miss many things. One of them wrote, “Sometimes in class I miss when people are planning something (homework groups, dinner outings, whatever), so when it's posted in our group page, it's easier to get involved and write for them.” However, two of the participants in the online questionnaire who preferred interpreting over writing to express ideas indicated that they seldom feel satisfied with their experience with CBT, and one of them added that he or she seldom learns more through online class discussion.

Although most of the participants in the online questionnaire indicated that instructors encourage them to use CBT for the school purposes, interviewees expressed their disappointment about the instructor’s role in integrating technology or encouraging them to use it. When interviewees were asked if they like to see more use of CBT in the
classroom, five of them said that it would add more support to their learning experience. Only one of the six interviewees didn't like the idea of CBT integration in the curriculum, preferring instead to see more educational videos with closed captioning and F2F interaction. Some of the interviewees explained that sometimes students themselves can create an online environment to increase their interaction with peers. As one of them wrote, “I have always advocate for myself by do anything possible to interact with my instructor so that I can understand what is going on in class. But then again, I took an online class where the teacher doesn’t interact with us.” Another one wrote, “I'm working on a master’s in clinical psychology, and we have a group page for announcements, homework help, etc.” When asked if it helped this person to feel like a part of the group, the person replied, “Yes it does. I was the one who created it.” The person continued, “It's nice to have our little group page to make plans also. Sometimes in class I miss when people are planning something (homework groups, dinner outings, whatever) so when it's posted in our group page, it's easier to get involved.”

Conclusions Emerging from the Findings

A review of the results indicated that most DHH students were positive about their experience with CBT in general and for school purposes. Their satisfaction with the use of CBT should be good news for postsecondary institutions that are trying to create an excellent inclusive educational environment for DHH students. Most of the participants explained that they depend on CBT for personal communication in their daily lives. Eight participants indicated that they spend more than 10 hours with CBT for personal purposes, whereas only two spend more than 10 hours for school purposes. The second most common way of communication with hearing peers was via technology, before sign language and interpreters, whereas technology was the fourth most common way of communication with teachers. These results indicate that CBT provide a new method of communication for DHH students and that such technologies can supply helpful tools for implementation in education and to improve students’ interaction with peers, instructors, and the academic content.

Some of the participants were not satisfied with their experience with CBT in education owing to various reasons, such as lack of a clear technological integration plan,
lack of interaction with instructors online, and some students’ ignoring of online interaction. Some of the interviewees also explained that certain students have created an online environment for their interaction for projects, and in this way have put forth an effort of their own to enhance their interaction for school purposes. Overall, the results show that almost all the participants prefer courses with communication technologies. However, when interviewees were asked if CBT should be integrated into the curriculum, one of the interviewees wrote, “Some people don't want a large presence online, or they don't always have access to a computer—it's not fair to those people to force them to rely on a computer for class work.”

The findings of this study can be applied to a larger sample at other postsecondary institutions through the Untied States and other countries. The data of this study cannot be generalized; however, it can be valuable to show that DHH students can increase their interaction at school through CBT. As a result, their academic performance will improve owing to their level of interaction with peers, instructors, and academic content. It may also be important to note that DHH students appreciate such meaningful communication at school, the encouragement to interact online, the building of a community within the class, and the sense of involvement. Previous research has located that students’ interaction is one of the potential factors for students’ academic success in general and for students with disabilities in particular (Arnold & Paulus, 2010; Crawford, 1996; Friend Wise et al., 2009; Hrastinski, 2009; Lang, 2002; Palloff & Pratt, 2007; Riddle, 1999; Rovai, 2002; Schwier, 2011; Woodie, 2007).

The Relation between Old Theories and the Generation of a New Theory

The participants’ responses to the online questionnaire and interviews proved to be in line with previous research that has asserted the importance of interaction for DHH students so that they will feel comfortable, achieve more, and to persist in continuing their education. In this context, it should be noted that interaction in this research means, as Moore explained, interaction between student and instructor, student and content, and the student and peers (Moore, 1989).
As mentioned earlier, Lev Vygotsky, a constructivist and educational theorist, proved that social interaction profoundly enhances human cognitive development, and both Vygotsky and Wenger theorized that social interaction is an important factor in the learning process (Vygotsky, 1978; Wenger, 1998; Wenger et al., 2002). Both researchers maintained that learning is better when there is social interaction and theorized that learners perform better and do more tasks when collaborating with others who have more knowledge, skills, and experience. Indeed, Wenger (1998, 1999) believed that learning cannot be separated from interaction. Therefore, interaction can be an impetus for learning and a tool for more achievement and greater independence (Cox-Davenport, 2010; Riddle, 1999; Thompson, 1999). Students who have more interaction tend to achieve their goals, learn effectively, and increase their persistence in completing the degree (Antia et al., 2007).

All of the previous research enriches our understanding of the relationship between students’ interactions and their achievements. Research has also shown that DHH students’ rate of attrition increases if they have a sense of isolation. Consequently, interaction among students and instructors can affect DHH students’ persistence as well (Lang, 2002). Though these students may have some form of socialization amongst themselves, more interaction in the mainstream is a must for helping them feel a part of the larger society because it reduces the sense of isolation (G. Long, Vignare, Rappold, & Mallory, 2007; G. L. Long et al., 2011; Schick, Williams, & Kupermintz, 2006; Stinson, Liu, Saur, & Long, 1996; Watson et al., 2007). It is important to offer a cooperative and fully inclusive environment for DHH students that positively affects their achievement and leverages their academic outcomes.

It is, therefore, vital to find possibilities for enhancing DHH students’ interaction in order to have a positive impact on their educational experiences in postsecondary institutions. The analysis of the data for this research revealed that CBT are valuable, appropriate, and cooperative tools for enhancing DHH students’ educational experience. However, the integration of CBT should be planned in order to meet the both instructors’ and students’ expectations. First, it should be designed to meet the course purposes. For example, instructors should decide in advance the topics that will be discussed online, the frequency of online contributions during the semester, and the rules that should control
these interactions. The plans should be introduced well to the students along with encouragement for them to use CBT. As one interviewee wrote,

I think it could be enforced more often if that means to get the best results from it. Because we're constantly evolving and so is the use of technology as well; therefore, the introduction to integrating the technologies into the classroom would be very beneficial for all.

Instructors should emphasize the importance of online interaction in building a community in the classroom. They should also respond in a timely manner to the students online. A well-integrated plan will help to serve the course interaction and avoid distraction. An interviewee wrote that CBT can be a distraction because of such CBT uses as Facebook but observing that “if the technology is strictly for courses, it is very effective.”

The elements in this research have led to the formation of a new theory that I have developed regarding DHH students and the use of CBT to enhance their educational experience in postsecondary institutions. This study concluded that there is a relationship between DHH students’ interaction and their successful educational experience in postsecondary institutions. It shows that community-based technologies can increase students’ interaction, achievement, and satisfaction. Through CBT, DHH students can
independently participate in and contribute to their courses. Figure 10 shows the proposed Ibrahims’s Theory named after my nephew. It shows the two-way communication between DHH and teachers, hearing peers with the focus on the academic content through the use of CBT. The successful inclusive environment helps the DHH to feel satisfied, to have better achievement and grades, and to increase their persistence in pursuing an education. These results are possible because the CBT help to increase DHH students’ independence, offering them better chances to communicate anytime with teachers and peers, and to add to or participate in the course discussions online. The proposed theory (Figure, 10) named “Ibrahim’s Theory” explains the way CBT can bring DHH students, teachers, and hearing peers together with the focus on the academic content. This interactive relationship affects DHH students’ interaction, achievement, and satisfaction in postsecondary education. This new theory is in line with the past theories of Vygotsky and Wenger who theorized that social interaction is an important factor in the learning process (Vygotsky, 1978; Wenger, 1998; Wenger et al., 2002).

Limitations of this Study

The study sample was not big enough to facilitate generalization of the findings. However, follow-up research can be done to examine the theory and assess the effectiveness of CBT in enhancing the educational experience for DHH students in higher education. The main limitation of this study was the lack of access to the DHH population due to their school’s privacy rules. It took time and effort to reach even the few included in this sample. Nor was it easy to elaborate on a specific topic in order to obtain further information because all the online interviews were textual, and some participants did not feel comfortable to share everything through typing.

Moreover, participants who had graduated a few years ago were frustrated with the idea of using technology as a means to communicate in the educational environment. It was hard to relate their responses to the study because they are biased toward the traditional way of learning. Also, the difference between the participants who are enrolled in online courses versus who are enrolled in f2f courses with technological supplements was not recognized in this study and it is an area that needs more attention in the future.
On the other hand, all the participants of this study reported that their English proficiency is from good to excellent. The results of this study can’t be generalized because it is important to relate the level of the language proficiency with the students’ use of CBT. This is also an area needs more attention in the future.

**Recommendations**

In addition to the new theory previously mentioned, several recommendations based on the findings of this study may be made to enhance the field. These recommendations apply to practice, theory, and research.

**Practice**

DHH students are good at adapting to community-based technologies, and they use these technologies to maintain their relationships with others (Marchetti et al., 2012; Russell & Demko, 2013). All the participants in this study indicated that they feel comfortable when they use computers.

The students’ expressed comfort level is a key indicator that it is possible to implement CBT as a tool for increasing DHH students’ interaction in an inclusive environment for school purposes, particularly because most of them are active users of CBT for personal purposes. Moreover, most of the participants expressed their satisfaction with the course when CBT is integrated into the curriculum. However, some of the participants provided ideas for improving the use of CBT in school as they were not entirely satisfied with their CBT experience in education for various reasons, such as lack of a clear technological integration plan, lack of interaction with instructors online, and lack of commitment. Participants noted several factors that may contribute to such dissatisfaction. First, they explained that some traditional teachers do not use technology and prefer not to use online interaction. Second, some instructors or peers ignore the messages or the online discussion. Third, there is sometimes no clear instruction from the beginning on how to use CBT. Fourth, instructors do not encourage students to engage in online interaction. If these problems can be addressed, CBT will be a powerful tool in helping DHH students to overcome the challenges they face in an inclusive environment, especially when it comes to their interaction with peers and instructors independently and
at any time. However, CBT will not be useful if no commitment is made to the objectives and outcomes to be achieved. Instructors should make a clear commitment in order to improve the use of CBT so that online interaction among students may prosper. As the course progresses, in-depth comments, reviews, and interaction will help to engage the students in online interaction. Participants also indicated that it is very useful to have the class materials uploaded online because they can go back to the materials and read what they might have missed in class. This has proven the previous study done by Long et al., (2011) that concluded that text-based format of online courses allows DHH students to be independent and communicate directly with instructors and hearing peers and it provides them with open access to the course materials more than F2F classroom. Also, Summet (2010) discussed,

Given the difficulties faced when communicating with hearing individuals, there appear to be two ways to address the communication divide. One way is to focus on helping Deaf individuals use written English through augmented communication devices, phrase books, automated translators, etc. Another way is to focus on assisting hearing people in learning ASL (p. 143)

The use of CBT for school purposes needs improvement. This study reveals important elements that can contribute to enhancing interaction through using CBT among students, including DHH students. Postsecondary institutions may be able to study these elements and plan a future strategy.

**Theory**

Previous studies have shown the importance of social interaction in order to enhance learning. Other studies have explained the importance of interaction for DHH students as well. In 1898, Triplett, a psychologist at Indiana University, discussed the significance of human interaction on performance using the social facilitation theory, suggesting that social encouragement, comparison, distraction, and automaticity has possible effects on performance (Aiello & Douthitt, 2001; Strube, 2005; Zajonc, 1965). As noted above, Lev Vygotsky (1978) and Etienne Wenger (1998; Wenger et al., 2002) theorized that social interaction is an important factor in the learning process and that
social learning leads to more cognitive development. Vygotsky called this phenomenon the Zone of Proximal Development (ZPD) and defined it as “the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky, 1978, as cited in Riddle, 1999, p. 1). Wenger presented his theory about the community of practice (COP), which is a social network wherein participants have common interests; therefore, they are able to share knowledge, experiences, and beliefs with each other. Wenger (1999) also defined participation as referring to “[a] process of taking part and also to the relations with others that reflect this process” (p. 55). According to Lawthom and Chataika (2012), a COP is an experience through participation.

The findings of this study—specifically, Ibrahim’s theory regarding the impact of interaction via CBT on DHH students’ educational experience in postsecondary institutions—it was concluded that DHH students look for more involvement, interaction, and independence in order to increase their satisfaction with inclusive classrooms in higher education. They want to be engaged directly with instructors, peers, and the academic content. Further theoretical studies should be done to find more about CBT and DHH students in higher education.

Research

Whereas this study concentrated on areas that need further improvement, the next step is to study how to improve those areas not discussed in this study. The findings of this study open a door for future research because there is a need for knowledge of the relationship between DHH students’ success, persistence, and interaction via various communication tools. This study focused on a small number of DHH participants and on higher education. However, there is a real need for research into successful interaction through CBT for improving the educational experience for DHH students in schools or postsecondary education. Further research should be conducted in order to discover how to plan interaction through CBT to meet the needs for all students, including DHH students, and to investigate how DHH students’ backgrounds, previous educational experiences, or abilities in using computers influence their interaction through CBT.
Several case studies should be done to measure and compare DHH students’ satisfaction, interaction, and achievement in a course with communication technologies versus a course without communication technologies. It is also important to conduct further studies to observe the differences between the experience of participants who were enrolled a few years ago and current students and the difference between students who are enrolled in F2F courses versus online courses.

In addition, it is important to study how to improve DHH students’ use of CBT for educational purposes, especially because the data showed that they use it more with peers than with teachers. More work should be done to study faculty members’ perceptions of using CBT in their classroom and the results when they do so. In addition, if new CBT enter the market, studies should be conducted to scrutinize their impact on DHH students in an educational setting. The results of previous studies can then be compared to those of the new studies.

**Conclusion**

The goal of this grounded theory research was to evaluate the use of CBT to enhance the educational experience for DHH students in higher education. The data collection for this study focused on DHH students’ experiences with and perspectives on CBT for educational purposes. The data were collected through online questionnaires and online interviews, and Ibrahim’s theory was developed from the data. The theory suggested that social interaction via CBT can improve DHH students’ educational experience in postsecondary institutions. It addressed the notion that CBT can create and maintain an equal online social presence for DHH students. The data revealed that participants were satisfied with CBT because it helped them to communicate directly and independently with peers and instructors at any time, to review what they had missed in class, to find the class materials and discussions online, and to feel themselves a part of the class community. However, technology can’t replace the role of sign language interpreters, it adds an additional communication channel for DHH students to communicate with teachers and peers. It is a tool that can be used to enhance DHH students’ interaction.
The current study may contribute to a better understanding of DHH students’ communication and satisfaction with CBT for educational purposes. This study points to the importance of a sense of community online for all students, including DHH students, whether online classes are taught solely with CBT or if the technologies are used merely as an extension of F2F classes.

It is hoped that this study will encourage more researchers to study the use of CBT in educational settings in relation to DHH students. It is also hoped that this study will foster the sustained success of DHH students in higher education and will effectively show how CBT can contribute to their interaction, achievement, satisfaction, and persistence until graduation.
APPENDIX A – Consent Forms and Institutional Review Board (IRB) Approval

A) Online Questionnaire Consent Form:

Dissertation Title: *A Grounded Theory Study to Evaluate the Use of Community-based Technologies to Enhance the Educational Experience for Deaf and Hard of Hearing Students in Higher Education*

My name is Hana Omar. I am a graduate student at the University of Hawai‘i at Mānoa in the Department of Educational Technology. As part of the requirements for earning my graduate degree, I am conducting a research study for my dissertation. The purpose of my research is to evaluate the effectiveness of using community-based technologies to help deaf and hard of hearing (DHH) students participate and collaborate more with their instructors, peers, and academic content in order to have more academic achievement in and persistence for completing their degree.

In this research, the term “community-based technologies” is used to indicate a type of platform that allow users to create a profile, participate in discussions, collaborate with others, share resources, and provide constructive comments. Various tools are seamlessly integrated into community-based technologies that allow users to select their preferred mode of communication and interaction. This platform can be accessed through computers or smartphones. Community-based technologies can include course management systems or available social media. Examples of course management systems are Blackboard, Moodle and eCollege; examples of social media are Facebook, Google Plus, Ning, Twitter, and LinkedIn.

**Activities and Time Commitment:** Participation in the project will be a two-part process: 1) An initial 56-item questionnaire will be disseminated to gather information on the demographics, learning experience, communication preferences, and general background information concerning participants’ uses of technology and their satisfaction
with the online technology tools. The questionnaire should take between 15-20 minutes to complete.

2) An optional online interview will be done with participants who agree to be further involved in the study by checking the box at the end of this questionnaire. A $10 gift card will be given for your participation.

**Benefits and Risks:** There will be no direct benefit for participating in the questionnaire. I believe that there is no risk in participating in this research project. If, however, the participant becomes stressed or uncomfortable answering the questionnaire, the participant may withdraw from the project altogether. I hope that the results of this project will help the university improve the learning experience for DHH students in higher education.

**Privacy and Confidentiality:** During this research project, all the data will be kept in a secure location. Only the University of Hawai‘i at Mānoa advisor and I will have access to the data. Legally authorized agencies, including the UH Human Studies Program, also have the right to review research records.

All the research data will be erased and/or destroyed after the completion of the study. The results of the research project and all personally identifying information will remain anonymous, and pseudonyms will be used to report findings in order to protect the privacy and confidentiality to the extent allowed by law.

If participants have any questions, they may contact the researcher, Hana Omar, at 406-205-0039 or hanaomar@hawaii.edu. If any questions arise regarding rights as a research participant, please contact the UH Human Studies Program at 808-956-5007, or uhirb@hawaii.edu. Note: This questionnaire is adapted from Stinson et al. and modified to meet the purpose of this study.
I have read and understand the information provided to me about participating in the research project for a dissertation titled *A Grounded Theory Study to Evaluate the Use of Community-based Technologies to Enhance the Educational Experience for Deaf and Hard of Hearing Students in Higher Education*.

☐  Accept
☐  Refuse
B) The Consent Form for the Interview:

University of Hawai‘i at Mānoa
Consent to Participate in Research Project
(Interview)

Dissertation Title: A Grounded Theory Study to Evaluate the Use of Community-based Technologies to Enhance the Educational Experience for Deaf and Hard of Hearing Students in Higher Education

My name is Hana Omar. I am a graduate student at the University of Hawai‘i at Mānoa in the Department of Educational Technology. As part of the requirements for earning my graduate degree, I am conducting a research study for my dissertation. The purpose of my research is to evaluate the effectiveness of using community-based technologies to help deaf and hard of hearing (DHH) students participate and collaborate more with their instructors, peers, and academic content in order to have more academic achievement and persistence to complete their degree.

In this research, the term “community-based technologies” is used to indicate the type of platforms that allow users to create a profile, participate in discussions, collaborate with others, share resources, and provide constructive comments. Various tools are seamlessly integrated into community-based technologies that allow users to select their preferred modes of communication and interaction. These platforms can be accessed through computers or smartphones. Community-based technologies can include course management systems or available social media. Examples of course management systems are Blackboard, Moodle and eCollege; examples of social media are FaceBook, LinkedIn, Ning, and Twitter.

Activities and Time Commitment: If you accept the opportunity to participate in an online interview, I will contact you via email to set the date and time, and to check if any other arrangements need to be made. The interview will last for about 25 to 30 minutes. I
will record the interview using Audacity, a free audio editor and recorder. The interview will be recorded and saved so that the responses can later be transcribed and analyzed. The interview questions will be focused on the use of technology and its impact on DHH students’ learning experience. Participants will receive an example of the research questions prior to the interview so that they can preview the basic interview questions that I will ask.

**Benefits and Risks:** There will be no direct benefit for participating in this study. However, I hope that the results of this project will help the university improve the learning experience for DHH students in higher education. I believe there is no risk in participating in this research project. If however, the participant becomes stressed or uncomfortable answering any of the interview questions or discussing topics during the interview, the question(s) can be skipped, a break can be taken, or the interview stopped; the participant may also choose to withdraw from the project altogether.

**Compensation:** Participants will receive a $10 gift card after the interview in appreciation for their time and effort.

**Privacy and Confidentiality:** During this research project, all the data will be kept in a secure location. Only my University of Hawai‘i at Mānoa advisor and I will have access to the data. Legally authorized agencies, including the UH Human Studies Program, also have the right to review research records.

All the research data will be erased and/or destroyed after the completion of the study. The results of the research project and all personally identifying information will remain anonymous; pseudonyms will be used to report findings in order to protect the privacy and confidentiality to the extent allowed by law.

If participants have any questions, they may contact the researcher, Hana Omar, at 406-205-0039 or hanaomar@hawaii.edu. If any questions arise regarding the rights of
research participants, please contact the UH Human Studies Program at 808-956-5007, or email uhirb@hawaii.edu.

☐ I require a sign language interpreter during the online interview.

☐ I agree to being audiotaped.

☐ I understand that my participation is voluntary and that I am free to withdraw at anytime.

☐ I understand that all data and information will be stored securely and will be reported anonymously.

☐ I agree that the researcher can contact me on the below email to set the date and time for the online interview.

☐ I have read and understood the information provided to me about participating in the research project, *A Grounded Theory Study to Evaluate the Use of Community-based Technologies to Enhance the Educational Experience for Deaf and Hard of Hearing Students in Higher Education*.

My signature below indicates that I am providing consent to participate in the online interview.

Printed name: __________________________

Signature: __________________________

Date: __________________________
C) Institutional Review Board (IRB) Approval from the University of Hawai‘i at Mānoa:

June 7, 2013

TO: Hana Omar
Principal Investigator
Educational Technology

FROM: Denise A. Lin-DeShetler, MPH, MA
Director

SUBJECT: CHS #21290- “A Grounded Theory Study to Evaluate the Use of Community-Based Technologies to Enhance the Educational Experience for Deaf and Hard of Hearing Students in Higher Education”

This letter is your record of the Human Studies Program approval of this study as exempt.

On June 7, 2013, the University of Hawai‘i (UH) Human Studies Program approved this study as exempt from federal regulations pertaining to the protection of human research participants. The authority for the exemption applicable to your study is documented in the Code of Federal Regulations at 45CFR 46.101(b)(Exempt Category 2).

Exempt studies are subject to the ethical principles articulated in The Belmont Report, found at http://www.hawaii.edu/irb/html/manual/appendices/A/belmont.html.

Exempt studies do not require regular continuing review by the Human Studies Program. However, if you propose to modify your study, you must receive approval from the Human Studies Program prior to implementing any changes. You can submit your proposed changes via email at uhirb@hawaii.edu. (The subject line should read: Exempt Study Modification.) The Human Studies Program may review the exempt status at that time and request an application for approval as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so. Signed consent forms, as applicable to your study, should be maintained for at least the duration of your project.

This approval does not expire. However, please notify the Human Studies Program when your study is complete. Upon notification, we will close our files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact the Human Studies Program at 956-5007 or uhirb@hawaii.edu. We wish you success in carrying out your research project.
D) Institutional Review Board (IRB) Approval from the Rochester Institute of Technology:

**Form C**
**IRB Decision Form**

**TO:** Hana Omar; Gary Long

**FROM:** RIT Institutional Review Board

**DATE:** September 6, 2013

**RE:** Decision of the RIT Institutional Review Board

Project Title – A Grounded Theory Study to Evaluate the use of Community-based Technologies to Enhance the Educational Experience for Deaf and Hard of Hearing Students in Higher Education

The Institutional Review Board (IRB) has taken the following action on your project named above.

☒ Exempt 46.101 (b) (2)

Now that your project is approved, you may proceed as you described in the Form A.

You are required to submit to the IRB any:

- Proposed modifications and wait for approval before implementing them,
- Unanticipated risks, and
- Actual injury to human subjects.

Heather Foss, MPH
Associate Director
Office of Human Subjects Research

Revised 10-18-06
APPENDIX B – QUESTIONNAIRE

Questionnaire Form

I. Background

1. Gender: □ Male □ Female □ Other

2. Age

□ 18-25
□ 26-30
□ 31-35
□ 36-40
□ 41-45
□ 46-50
□ 51-54
□ 55-60+

3. Are you: □ Deaf □ Hard of Hearing □ Prefer not to say

4. In your pre-college education in high school, were you (check all that apply)

□ In an inclusive “mainstreamed” classroom with students who were not deaf or hard of hearing
□ In a special classroom with other special education students
□ In a special education classroom only for deaf and hard of hearing students
□ In a special education school
□ In a school that only served deaf and hard of hearing students
□ None of the above

5. Please identify your type of enrollment in higher education?

□ Full-time □ Part-time

□ Student □ Student

6. Are you:

□ Undergraduate Student □ Graduate Student

7. How many years have you been in higher education?

□ 0-2
□ 2-4
□ 4-6
□ 6-8
□ 8-10+

8. What is your major:

□ Agriculture
□ Biological and Biomedical Sciences
□ Business
□ Communication
□ Computer Science

This questionnaire is adapted from Stinson, M., Long, G., Reed, S., Kreimeyer, K., Sabers, D. & Antia, S.D. and modified to meet the purpose of this study.
Questionnaire Form

☐ Disability Studies  ☐ Engineering  ☐ Education  ☐ Foreign Languages  ☐ Social Science  ☐ Media and Social Science  ☐ Other, specify ________

9. In your college courses, what kind of courses have you taken:
   ☐ Face-to-face only  ☐ Online only  ☐ Both f2f and online

10. Generally speaking, how comfortable do you feel using a computer?
   ☐ Very comfortable  ☐ Somewhat comfortable  ☐ Not very comfortable  ☐ Not at all comfortable

Please answer the following questions by choosing the correct number:

<table>
<thead>
<tr>
<th>Interpreter</th>
<th>Sign (ASL)</th>
<th>Speech</th>
<th>Writing Notes</th>
<th>Via Technology, Specify:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5,</td>
</tr>
</tbody>
</table>

11. How do you like best to communicate with hearing peers?
12. How do you like best for hearing students to communicate with you?
13. How do you like best to communicate with teachers?
14. How do you like best for teachers to communicate with you?
15. Rate your written English proficiency?  Excellent  Very Good  Good  Fair

II. Class Interaction

<table>
<thead>
<tr>
<th>Almost Never</th>
<th>Seldom</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

This questionnaire is adapted from Stinson, M., Long, G., Reed, S., Kreimeyer, K., Sabers, D. & Antia, S.D. and modified to meet the purpose of this study.
Questionnaire Form

19. I feel frustrated because it is difficult for me to communicate with other students. 1 2 3 4

20. I get upset because my teacher cannot understand me. 1 2 3 4

21. I feel relaxed when I talk to my teacher. 1 2 3 4

22. I feel comfortable in-group discussions in class. 1 2 3 4

23. I feel not comfortable in-group discussions in class. 1 2 3 4

III. Online Interaction

24. I join in online discussions for the course purposes. 1 2 3 4

25. I join in online discussions for more interaction with my instructor and peers. 1 2 3 4

26. I feel good about how I communicate online. 1 2 3 4

27. I feel frustrated because it is difficult for me to communicate online with other students. 1 2 3 4

28. I get upset because my teacher cannot understand me online. 1 2 3 4

29. I feel comfortable in-group discussions online. 1 2 3 4

30. I feel not comfortable in-group discussions online. 1 2 3 4

31. I use community-based technologies for sharing personal stories with my classmates. For example, Facebook, Ning, or learning management system such as Blackboard, Moodle, etcetera 1 2 3 4

32. The instructor encourages the students to participate and interact online. 1 2 3 4

This questionnaire is adapted from Stinson, M., Long, G., Reed, S., Kreimeyer, K., Sabers, D. & Antia, S.D. and modified to meet the purpose of this study.
Questionnaire Form

33. I feel I’m able to interact with everyone in the class online.
   1 2 3 4

34. I post new topics and ideas.
   1 2 3 4

IV. The Use of Technology

35. Which assigned tool do you use for class discussion and interaction?
   1.
   2.
   3.

36. The instructor introduces the tool carefully.
   1 2 3 4

37. The instructor encourages the students to use community-based technologies to discuss, communicate, and interact.
   1 2 3 4

38. I spend ___ hours in community-based technologies for school purposes.
   (0-4) (4-7) (7-10) 10+

39. I spend ___ hours in the community-based technologies for personal purposes (family, friends or others).
   (0-4) (4-7) (7-10) 10+

V. Achievement

<table>
<thead>
<tr>
<th></th>
<th>Almost Never</th>
<th>Seldom</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.</td>
<td>1 2 3 4</td>
<td></td>
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<tr>
<td>41.</td>
<td>1 2 3 4</td>
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<tr>
<td>42.</td>
<td>1 2 3 4</td>
<td></td>
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<tr>
<td>43.</td>
<td>1 2 3 4</td>
<td></td>
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<tr>
<td>44.</td>
<td>1 2 3 4</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

This questionnaire is adapted from Stinson, M., Long, G., Reed, S., Kreimeyer, K., Sabers, D. & Antia, S.D. and modified to meet the purpose of this study.
VI. Satisfaction

45. I feel comfortable with the online tools used in your class.
   1 2 3 4

46. I feel more satisfied with your experience in using community-based technologies for class participation.
   1 2 3 4

47. I feel overwhelmed when technology is integrated in the class participation.
   1 2 3 4

48. I think the course online discussions have too much non-class interaction.
   1 2 3 4

49. I enjoy the non-class interaction and I feel part of the class community.
   1 2 3 4

VII. Preference

50. Which course would you prefer? Choose one.
    □ One with communication technologies
    □ One without communication technologies

51. Which way of communication do you prefer when discussing school topics?
    □ In-class discussion
    □ Online discussion forum
    □ Online chat
    □ Text Message

52. In your experience what is the best tool that you have used for communication and collaboration.
    1.
    2.
    3.

53. Do you prefer writing your ideas and comments or having an interpreter to express them?
    □ Writing
    □ Interpreting

54. Do you prefer accessing community-based technologies from Smartphone or personal computer?
    □ Smartphone
    □ Personal Computer

This questionnaire is adapted from Stinson, M., Long, G., Reed, S., Kreimeyer, K., Sabers, D. & Antia, S.D. and modified to meet the purpose of this study.
VIII. Open-ended Questions

55. What is your opinion of using community-based technologies for school purposes, and why?

56. Is there anything else you think I should know in order to better understand your experience with community-based technologies?

IX. Further Information

☐ Would you please recommend a person who fits the research criteria to participate in the study?

Email: ____________________________

☐ Check this box and write your email if you would like to receive an invitation to participate in an online interview to get more details about your experience in using community-based technologies in either online or face-to-face courses. A $10 dollars gift card will be given for your participation as an appreciation for your time and effort.

Email: ____________________________

This questionnaire is adapted from Stinson, M., Long, G., Reed, S., Kreimeyer, K., Sabers, D. & Antia, S.D. and modified to meet the purpose of this study.
# APPENDIX C: THE CODING TABLE

<table>
<thead>
<tr>
<th>Example</th>
<th>Open Coding</th>
<th>Axial Coding</th>
<th>Selective Coding</th>
<th>Core Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I just don’t want to rely on an interpreter too much in class&quot;</td>
<td>Prefer using Tech: - Don’t want to rely on interpreter</td>
<td>In class Interaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;I lip-read most of the time&quot;</td>
<td>Prefer F2F: - Lip-reading - Speech - Sign Language</td>
<td>Help of writing</td>
<td></td>
<td>DHII Interaction</td>
</tr>
<tr>
<td>&quot;It is beneficial for class participation &amp; discussion because it allows me to express my ideas &amp; become more involved in class&quot;</td>
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<tr>
<td>&quot;Sometimes in class I miss when people are planning something (homework groups, dinner outings, whatever) so when it’s posted in our group page it’s easier to get involved and write for them&quot;</td>
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<tr>
<td>&quot;It could be really beneficial for deaf students like me who express themselves better through writing.&quot;</td>
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<tr>
<td>&quot;I prefer writing my discussion online because sometimes with an interpreter not all information are receiving.&quot;</td>
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<tr>
<td>&quot;It’s easier to talk and say what you mean instead of think of a way to communicate it&quot;</td>
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<tr>
<td>&quot;Using community-based technologies for school purposes help deaf students to reconnect with their hearing peers&quot;</td>
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<tr>
<td>&quot;On Facebook I can be a little more relaxed when talking to people.&quot;</td>
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<tr>
<td>&quot;Peers I test them on Facebook them&quot;</td>
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<tr>
<td>&quot;I always have my phone, so texting is big&quot;</td>
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<tr>
<td>&quot;It definitely increases interaction with peers,&quot;</td>
<td></td>
<td></td>
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<tr>
<td>&quot;I feel more relaxed when I use technology,&quot;</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&quot;Community-based technologies give my comfort to people who are shy and can not express their views and ideas in class discussions.&quot;</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&quot;It is easier for me to communicate online because I can write my ideas to my peers&quot;</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>&quot;Communication-based technologies eliminates the third person, making it more direct.&quot;</td>
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<td></td>
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<tr>
<td>&quot;Technology is the best option I can take&quot;</td>
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</tr>
</tbody>
</table>
| "I can tell that many Deaf and Hard of Hearing people as well can learn better in school since most Deaf and Hard of Hearing people are visual learners. Without Technology it seems almost impossible for me and others to do well in school."
   "When I am more comfortable, I learn more and the more I learn, the better and well I do in the course."
   "The ability of technology gives more space to achieve more. The variety of tools help students to reach their goals."
   "Without the community-based technologies available, I would not be nearly as successful in the classroom as I am now."
| CBT helps to learn more                                                                             | CBT helps to do well                                               | CBT helps to reach goals                      | Enhance Learning   | Better Educational Experience |
| (1 Participant)                                                                                   |                                                                            |                                                                               |                     |                       |
| "It helps to encourage for creativity because my ideas can be shared with others"              |                                                                            |                                                                               |                     |                       |
| (1 participant)                                                                                  |                                                                            |                                                                               |                     |                       |
| "I think community-based technologies for school purposes is a lot effective than any other methods. I can get so much information without missing anything." |                                                                            |                                                                               |                     |                       |
| "It's good sometimes easier to get your point across without confusion or hearing getting impatient!" |                                                                            |                                                                               |                     |                       |
| (25 Participants)                                                                                |                                                                            |                                                                               |                     |                       |
| "I like being in person because it gains the best knowledge than technology."
   "Technology therefore can not help much in this field."                                       |                                                                            |                                                                               |                     |                       |
| (2 Participant)                                                                                  |                                                                            |                                                                               |                     |                       |
| "Personally I am afraid that if technology wasn’t around, I would fail in school so poorly. Technology is a must, most useful tool for all Deaf and Hard of Hearing."
   "I believe that the technology today enables more HOH and Deaf individuals to pursue higher education."
<p>| | | | | |
|                                                                            |                                                                            |                                                                               |                     |                       |
| (4 Participants)                                                                                 |                                                                            |                                                                               |                     |                       |</p>
<table>
<thead>
<tr>
<th>Example</th>
<th>Open Coding</th>
<th>Axial Coding</th>
<th>Selective Coding</th>
<th>Core Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>My cohort also has a dedicated Facebook page for announcements and questions about classes, which has been very helpful. I can no longer use the phone, and I don’t have everyone’s number to text them. (2 Participants)</td>
<td>Cohort creates a Facebook page for announcements and questions about classes</td>
<td></td>
<td>Personal Effort to use Tech</td>
<td></td>
</tr>
<tr>
<td>“With community-based technologies, such as Blackboard for classes, I can more easily communicate with other class members and get my ideas across, as well as understand them!” “Teachers tend to ignore messages not sent through school email or blackboard” (4 Participants)</td>
<td>Use technology for class purposes</td>
<td></td>
<td>School Effort to use Tech</td>
<td></td>
</tr>
<tr>
<td>“Explore how our reporting helps deaf students in the classroom as it really helped me understand the discussion &amp; dialogue amongst classmates &amp; professor” (1 Participant)</td>
<td>Use technology for class purposes</td>
<td></td>
<td>School Effort to use Tech</td>
<td></td>
</tr>
<tr>
<td>“The teacher provided the video samples for each project I am expected to turn in so it is easier that I follow it and create my own” (1 Participant)</td>
<td></td>
<td></td>
<td></td>
<td>Technology for school</td>
</tr>
<tr>
<td>“Technology is a must, most useful tool for all Deaf and Hard of Hearing. For deaf students who rely on ASL, visual technologies are significant to the successful application.” (6 Participants)</td>
<td>Technology is a must for DHH</td>
<td></td>
<td></td>
<td>Use of Technology</td>
</tr>
<tr>
<td>“Can go back and read the information that was missed” “I don’t have to worry about losing my notes if the notes are posted on Blackboard” “If I can write my discussion online and read other student discussion, I can always go back and read what they say” (4 Participants)</td>
<td>CBT makes it easier to retain the information</td>
<td></td>
<td></td>
<td>Support the School’s Purposes</td>
</tr>
<tr>
<td>“Community based technologies are almost free to access and can easily be available almost everywhere you are. Because I always have my phone I can communicate with peers any time.” (5 Participants)</td>
<td>CBT is available at anytime</td>
<td></td>
<td></td>
<td>Support the School’s Purposes</td>
</tr>
<tr>
<td>“Community based technologies is important because they speed group work and discussions” (2 Participants)</td>
<td></td>
<td></td>
<td></td>
<td>Speed school work</td>
</tr>
<tr>
<td>“improving language skills especially English development” (2 Participants)</td>
<td></td>
<td></td>
<td></td>
<td>Improve language skills</td>
</tr>
</tbody>
</table>
REFERENCES


Richardson, J. C., & Swan, K. (2003). Examining social presence in online courses


