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Leveling the Playing Field? Communication Technology as a Predictor of Future Attainments for Deaf Young Adults

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Abstract

Communication technologies are often proposed to level the playing field for individuals with disabilities, but the benefits may be magnified for deaf individuals in particular due to the communication barriers experienced by these individuals. In this paper, we set out to test the assumption that increased engagement with communication technology, specifically computer-mediated communication, during adolescence would contribute to actual attainment gains in adult life for deaf individuals in three domains: life, education, and employment. A secondary analysis using the National Longitudinal Transition Study 2 (NLTS2) was conducted, allowing for a longitudinal examination of deaf individuals' experiences in the transition from adolescence to adulthood. Findings revealed that deaf individuals who engaged with computer-mediated communication at higher frequencies during adolescence did not reveal discernible gains in adult life attainments in any domain. We propose that the benefits of communication technology only go so far, and that achieving greater equitable outcomes for deaf individuals requires larger systemic change.

Technological innovations are often characterized as creating conditions that level the playing field, break down barriers, and serve as a universal equalizer for individuals who experience marginalization. This perspective of technology as an equalizer emerges in discourses about disability, where technology is often mythologized as creating conditions that break down social and physical barriers, where "disability would simply fade away or become a largely inconsequential difference" (Foley & Ferri, 2012, p.192). However, current disability theorists present a more nuanced perspective on the role that technology plays in the lives of individuals with disabilities (Foley & Ferri, 2012; Goggin & Newell, 2003; Ellis & Kent, 2011). Technology can be as oppressive as it can be liberating; the context in which technological advances are developed and used are important considerations in evaluating the potentials of the technology as used in daily life for individuals with disabilities (Foley & Ferri, 2012). Technology is designed to meet certain purposes and goals, not all of which are viewed as personally liberating by the individual with a disability (Foley & Ferri, 2012; Goggin & Newell, 2003).

To help understand the role of technology in the lives of individuals with disabilities, the distinction between assistive and accessible technologies is an important one. *Assistive* technologies may carry stigma and an expectation of meeting social norms while *accessible* technologies are, ideally, universally inclusive and accessible for all individuals, not just those with disabilities (Foley & Ferri, 2012). Assistive technologies may result in unintended social exclusions, whether it be overt exclusion that occurs when technologies are visible markers of disability, or more subtle exclusion that occurs when technologies privilege specific ways of being (Foley & Ferri, 2012). For example, cochlear implants are a technology designed from a perspective of deafness as 'pathological and disabling', and not as a cultural and linguistic identity (Goggin & Newell, 2003, p.11). Assistive technologies designed to accommodate specific goals do not necessarily serve the broader spectrum of individuals that those technologies are designed for. The range of use and success rates of assistive technologies may vary widely, as in the case of cochlear implants in the deaf community (Humphries et al., 2012).

Beyond assistive technologies, a focus on accessible technologies as those that are "designed for *people* rather than for *disability*," allows for a more inclusive perspective of how individuals use technologies in personally liberating ways (Foley & Ferri, 2012, p. 5). Historically, communication technology for deaf individuals such as the TTY, a device that allowed for phone calls using hardware similar to a typewriter, were designed for *disability* and thus limited to usage within the deaf community. As technology evolved over time, communication technologies that utilized online networks became a part of life for users across the world, with or without disabilities. The deaf community is uniquely placed to benefit from

accessible technologies, considering that modern communication technologies, specifically computer-mediated communication (CMC), have significant benefits for deaf individuals, yet are largely integrated in the wider community and thus do not only confer benefits for a narrow segment of the community (Ellis & Kent, 2011). Communication technologies are broadly viewed as being universally accessible, creating conditions for constructing identities that move beyond the limitations of physical representations. Theoretically, CMC removes social cues that are attached with physical representations including gender, sex, ethnicity, disability, and attractiveness, and thus diminishes the likelihood that individuals may project their stereotypes onto others (Christopherson, 2007). Computer-mediated communication holds great promise for deaf individuals, as a community which experiences dis-abling conditions primarily as a result of the communication barrier between individuals who speak fluently and those who do not.

The literature in deaf studies and deaf education is largely optimistic when discussing CMC, proposing that communication technologies break down communication barriers and level the playing field for deaf individuals (Barak & Sandovsky, 2008; Power, Power, & Horstmanshof, 2007). It is clear that the deaf community engages with CMC at significantly high rates, and emerges as early adopters of communication technologies (Barak & Sandovsky, 2008; Okuyama & Iwai, 2011; Valentine, Skelton, & Levy, 2006). In fact, some of our modern text communication behaviors, including textisms and other forms of condensing typed messages, are said to have originated in the deaf community through the early use of text communication in TTY conversations (Power & Power, 2004). Deaf individuals are more likely to use CMC technologies than their peers in the general population for emailing, chatting (Valentine et al., 2006), texting (Okuyama & Iwai, 2011), and for personal and group uses (Barak & Sadovsky, 2008). These findings indicate that the deaf community has largely embraced the use of communication technologies and may be utilizing those technologies in personally liberating ways.

In this paper, we set out to test the assumption that the increased access to communication through accessible technology truly levels the playing field for deaf individuals, following in the footsteps of disability theorists who are calling into question the assumption of technology as a universal equalizer (Foley & Ferri, 2002; Goggin & Newell, 2003; Ellis & Kent, 2011). It has yet to be empirically demonstrated as to whether the increased usage of communication technologies in the deaf community "levels the playing field," or from a research perspective, contributes to discernible improvements in future attainments for deaf individuals.

Background

Increased access to communication technologies have been said to contribute to improvements in equitable outcomes not only for individuals with disabilities

(Bowker & Tuffin, 2007), but also for women (Khan & Ghadially, 2010), individuals of lower income stratifications, and ethnic minorities (London, Paster, Servon, Rosner, & Wallace, 2010). For deaf individuals in particular, increased use of CMC may contribute to higher English literacy skills (Garberoglio, Dickson, Cawthon, & Bond, 2015), increased independence (Akamatsu, Mayer, & Farrelly, 2006; Pilling & Barrett, 2008), less likelihood of loneliness, and higher self-esteem (Barak & Sadovsky, 2008). Those outcomes may theoretically serve as mediators that would facilitate later gains in life, educational, and employment attainments.

Deaf individuals continue to reveal attainment disparities in multiple life domains. When compared to the general population, deaf adults' life experiences and attainments are often not comparable. Deaf individuals reveal lower self-esteem (Barak & Sadovsky, 2008; Weisel & Kamara, 2005), are less likely to complete a bachelors' degree or higher (Erickson, Lee, & von Schrader, 2013), and are underemployed and underpaid compared to the general population (Kelly, 2013; Newman et al., 2011; U.S. Department of Commerce, 2011).

Online communication is most often said to contribute to positive life experiences for individuals with disabilities through several mechanisms, such as reducing the visible indicators of disability, developing greater sense of identity, increasing social connectivity, and contributing to personal empowerment (Bowker & Tuffin, 2002; Bowker & Tuffin, 2007). The benefits of communication technologies may be magnified for deaf individuals due to the nature of hearing loss, which primarily manifests as a barrier to effective communication. Indeed, communication technologies are very much a large part of daily life for deaf individuals, as tools that enable increased independence (Akamatsu, Mayer, & Farrelly, 2006; Pilling & Barrett, 2008), greater ease of communication (Bishop, Taylor, & Froy, 2000; Power, Power, & Horstmanshof, 2007), social support, increased connectivity, and information transmission and evaluation (Shoham & Heber, 2012; Lomicky & Hogg, 2010; Valentine et al., 2006). Deaf people have been shown to use the internet more often than their peers in the general population for practical uses, such as searching for health information or employment opportunities, online banking, email and chat, and were less likely to use the internet for playing games or online shopping (Valentine et al., 2006).

Communication technologies do not only confer practical benefits, but may also contribute to overarching psychological empowerment for deaf individuals (Barak & Sadovsky, 2008). Deaf adolescents who use the internet more extensively exhibited less loneliness and higher self-esteem than those who were not intensive users, and overall well-being that were comparable to their hearing peers (Barak & Sadovsky, 2008). Barak and Sadovsky suggest that the internet serves as an empowering agent for deaf individuals. Their finding is particularly significant because previous work indicates that deaf adults have lower self-esteem than their

hearing peers, even when their educational backgrounds are comparable (Weisel & Kamara, 2005). Communication technology may contribute to practical *and* psychological outcomes for deaf individuals.

The practical and psychological benefits of communication technologies may play a role in a variety of settings for deaf individuals; not only contributing to positive outcomes in like settings, but also spilling over to other settings. Despite the majority of CMC activity occurring in non-academic settings, unforeseen positive side effects of increasing communication access may later materialize in academic settings. For example, online communication in out-of-school settings such as email, online forums, and fan fiction writing serves as opportunities for strengthening identity development as writers, holding future potentials of emerging in academic settings (Black, 2008; Lam, 2000). Similarly, deaf individuals who engage with CMC more frequently in out-of-school settings reveal higher English reading comprehension levels when assessed at a time point two years later (Garberoglio et al., 2015). English literacy skills are an important component of academic success, and predict the likelihood of collegiate enrollment for deaf individuals (Garberoglio, Cawthon, & Bond, 2013). Communication technologies do not only enable greater engagement with English literacy for deaf individuals, but also create conditions for engaging with multiple tools under the umbrella of 'multiliteracies' towards the goal of acquiring and expressing knowledge, particularly for individuals who do not demonstrate mastery in traditional script literacies (Michael & Trezek, 2006).

Within academic environments, communication technologies do not only contribute to academic processes such as literacy and identity development, but also to other processes that may indirectly contribute to academic achievement. A longitudinal analysis revealed that students with disabilities who engaged with assistive technologies (e.g., computers, software, and communication technologies) at higher levels reported more optimistic academic processes and experiences when enrolled in postsecondary settings two years later (Craddock, 2006). Those processes and experiences included greater curricular access, more support in college, and positive quality of life and self-esteem. After all, academic skills alone are not sufficient to navigate academic environments; personal factors such as self-beliefs, time management, and motivation have been found to play a role in postsecondary retention and completion for deaf individuals (Albertini, Kelly, & Matchett, 2012). Despite significant increases over time in enrollment in postsecondary institutions of all types (Wagner, Newman, Cameto, & Levine, 2005), enrollment in and completion of degree programs at 2- and 4- year institutions are still low for deaf individuals (Erickson et al., 2013; Newman et al., 2011). It has yet to be explored whether increased use of communication technologies can directly contribute to future gains in postsecondary enrollment

and completion for deaf individuals.

Computer-mediated communication contributes to identity development on multiple levels, not only personal (Bowker & Tuffin, 2002) or academic (Black, 2008; Lam, 2000), but also professional (Krueger, 2008). Krueger (2008) asserts that social identities that are developed in online communities have potential of evolving into future professional identities. It is theoretically feasible that the psychological empowerment involved with identity development may positively affect individuals' employment experiences and attainments. However, the practical uses of communication technologies are widely capitalized upon by deaf individuals in the workplace, and may also positively affect employment experiences and attainments. For instance, deaf individuals are more likely than their hearing peers to use the internet in searching for employment (Valentine et al., 2006). The 'invisible' nature of text-based CMC can remove discernible traits of race, gender, and disability status that might otherwise be obvious in face-to-face communication, contributing to processes that may free the message from subconscious or conscious biases (Leetaru, 2008). The removal of potential biases may enable some initial employment processes, but once face-to-face connection is required, may not pan out to actual hiring decisions. The employment rates of deaf individuals are consistently lower than what is found in the general population, with 2011 statistics showing employment rates of 48%, compared to 70% in the general population (U.S. Department of Commerce, 2011).

Beyond gaps in employment rates, disparities are also found within the workplace for deaf individuals. The average annual income for deaf individuals in 2011 was $39,283, $4,000 less than the average annual income in the general population (U.S. Department of Commerce, 2011). However, a closer look at the earning distribution over time revealed that deaf individuals' earning power appears to decline after the age of 31 (U.S. Department of Commerce, 2011), which aligns with findings showing that deaf individuals reveal disparities in career advancement (Kelly, 2013) and feel that they have less chances for promotion (Newman et al., 2011). Computer-mediated communication is becoming increasingly important in the workplace and can be assumed to facilitate earning gains and career advancement. A recent study of CMC use in employment settings revealed that deaf employees were very likely to use CMC in the workplace, regardless of sector of employment; a third of respondents stated that email was used for most of their communication with clients and customers, and a fourth responded that email was used for the entirety of their communications (Schiller, 2011). Interestingly, those employees that used email predominantly for communication in the workplace had higher salaries than those who were primarily dependent upon other forms of CMC (i.e., instant messaging or video communication technologies). Increased dependence on email in communication with coworkers and supervisors was also

positively related to job satisfaction (Schiller, 2011). It is clear that CMC plays a role in job search processes and in employment settings for deaf individuals, but less so whether the use of communication technologies outside of the workplace would facilitate future employment outcomes.

The purpose of this present study was to test the assumption that increased use of communication technology (i.e., computer-mediated communication) would level the playing field, or more specifically, contribute to greater equitable outcomes for deaf individuals. It is yet largely unanswered as to whether the increased access to communication that is enabled via communication technologies can contribute to reducing outcome disparities that are found in the deaf community in domains of life, education, and employment. We cannot directly assess whether greater use of communication technologies can contribute to outcomes that are equitable with what would be expected in the general population, but we can determine if greater use of communication technologies exhibited in adolescence makes a positive contribution to future attainments for deaf young adults. We are operating under the assumption that communication habits developed in adolescence will continue on to adulthood, and play a large developmental role in the transition process. This study utilized a longitudinal secondary data analysis approach to take advantage of the large sample size available of a nationally representative group of deaf individuals in transition from adolescence to early adulthood, found in the National Longitudinal Transition Study 2 (NLTS2). This approach also allows for the inclusion of multiple covariates as important factors in developmental processes that contribute to future outcomes, such as gender, ethnicity, and socio-economic status. Controlling for the influence of those factors will allow for a deeper understanding of the role of communication technology use in developmental processes, above and beyond multiple potential confounds.

Methods

Dataset

The U.S. Office of Special Education Programs (OSEP) and the Institute of Education Sciences (IES) commissioned the second National Longitudinal Transition Study (NLTS2) as a nationally representative dataset for students with disabilities. Data collection was conducted in five separate waves between 2001-2009. To be sampled, youth had to be between 13-16 years old on December 1, 2000. Surveyors conducted computer-assisted telephone interviews, mail surveys, and direct assessments to elicit data from students with disabilities, their parents and guardians, and school staff. This study uses data from the first wave to predict outcomes in the final wave.

Rather than employing simple random sampling, NLTS2 used a stratified

sampling scheme that employed weighting. The weighting was intended to make the dataset nationally representative, whereas the stratification was intended to improve the efficiency of estimation. Surveyors stratified at the local education agency (LEA) level first, then stratified within schools by disability category. Stratifying and weighting by disability category was intended to make NLTS2 nationally representative for every disability group they sampled. More detail can be found on the NLTS2 website (www.nlts2.org).

This dataset included information about students with a variety of disabilities, as reported by the school district. Students whose parents indicated that the child had a diagnosis of "deafness" or "hearing impairment," which was collapsed in a single category for this particular variable (np1B1a_11), were included in this study. This variable was chosen because the main construct of interest was the student's experience of hearing loss. Participants for whom outcome data was unavailable were not included in this analysis. Finally, we deleted nine participants who had "learning disability" as their primary disability, since they were weighted quite heavily to represent the large number of American students with LDs.

Variables

Most independent variables, covariates, and auxiliary variables were found in the first wave of NLTS2, collected in 2001, since it had the highest response rate. The only exception was that of the Woodcock-Johnson III (WJ) subtests of academic achievement, which were administered in the first and second waves. Dependent variables were taken from the fifth wave, collected in 2009, when most of the youth were 24-27 years of age. Those variables measured academic, employment-related, and general life outcomes. We outline all variables in more detail below.

Independent Variable

A single question from the first wave served as the independent variable. Parents responded to the following question, "how often [the youth] interacts with others using email/chatrooms," on a scale from one to six. We recoded this item so that a higher score indicated a greater use of CMC. This variable was automatically set to "never" if parents indicated that the child did not use email or chatrooms to communicate.

Dependent Variables

Our lab has used these dependent variables in a range of studies designed to gain greater understanding of what may contribute to

positive outcomes for deaf individuals (Cawthon, Garberoglio, Caemmerer, Bond, & Wendel, 2015; Garberoglio, Schoffstall, Cawthon, Bond, & Ge, 2014; Garberoglio et al., 2013). Outcomes of interest may be broadly organized into three domains: life, education, and employment.

Life outcomes of interest were twofold: living independently, and self-beliefs held by the individual. The independent living outcome was binary, and revealed if the youth had ever lived independently or semi-independently, defined by the following options: lived by him/herself, with a spouse or roommate, or any dormitory, including college housing. The self-beliefs measure was a continuous outcome, the sum of five scaled questions that assessed individuals' beliefs and attitudes about their capacities (Appendix A). The educational outcomes were binary, and described whether the youth attended and/or graduated from a postsecondary institution of any type. Employment outcomes included one binary variable and two continuous variables. The binary variable described whether the student had worked for pay outside of the home, while the first continuous variable described the youth's hourly wage. Finally, the job satisfaction score, a continuous variable, was the sum of seven questions that evaluated the youth's satisfaction with their career advancement potential, compensation, and social aspects of their job (Appendix B).

Covariates And Auxiliary Variables

Covariates and auxiliary variables consisted of demographic information and measures of achievement and ability level. As previously mentioned, these data were drawn from the first wave of NLTS2 with the exception of the WJ, which was collected in waves 1 and 2. Auxiliary variables were used in the missing data model, but not the research model.

Demographic covariates included gender, age, presence of additional disabilities, household income, and parental education level. Two covariates accounted for achievement and ability levels: the WJ score and students' grades. The WJ score was the average of six subtests of the research edition of the WJ, including the synonym-antonym subtest, passage comprehension, calculation, applied problems, social studies, and science. Students' grade estimates were drawn from the cross-instrument dataset in the first wave. Our auxiliary variables were binary: whether the youth was Caucasian, whether their parent or guardian lived with a partner, and whether the student had ever been suspended,

expelled, or part of any other serious disciplinary action.

Missing Data Procedure

Rather than using listwise deletion, omitting students if any data were missing, we used multiple imputation to make this study as representative as possible, consistent with our previous research (Garberoglio et al., 2013; Cawthon et al., 2015). This procedure is only appropriate to the degree that data are missing at random (MAR), which is not possible to directly evaluate outside of simulation studies. However, adding variables to the missing data model may make the assumption more credible (Allison, 2001; Collins, Shafer, & Kim, 2001). This is why we added auxiliary variables to the missing data model that were not included in the primary analysis. Overall, there was a tolerable amount of missing data for the independent variable and most of the covariates, ranging from 20% for the independent variable to 40% for the WJ measure.

Data Analysis Strategy

Since four of the dependent variables were binary and three were continuous, we ran four logistic regressions and three ordinary least squares regressions. To account for the stratification, we employed Taylor linearization to correct standard errors properly. Test-wise type I error rates are set at 0.05, and only the variables of interest are reported here.

Results

Descriptive Statistics

Descriptive statistics revealed reasonable diversity in the sample. About 50% were female; about 50% had additional disabilities; and 60% were Caucasian. There was a wide range of household income, with 20% households having incomes less than $20,000 annually, and another 20% having annual incomes greater than $70,000. Parental education level ranged from no GED or high school diploma (20%) to a graduate degree (10%).

Table 1. Frequency statistics for the independent variable: "how often [the youth] interacts with others using email/chatrooms"

Level	Frequency
(1) Never	240
(2) Less often than once a week	200
(3) Once a week	100

(4) Several times a week	150
(5) Once a day	80
(6) Several times a day	130
These numbers are rounded to the nearest tens place, in accordance with IES policy.	

Finally, the independent variable revealed a fair amount of variability (Table 1). Recall that the independent variable measured the degree to which students used email or chatrooms to communicate with others. Since this information was collected in 2001, students may have used e-mail and chatrooms less often than a more modern sample. Parents reported that 240 students never interacted with others using email or chatrooms.

Preliminary Analysis

We ran four logistic regressions and three ordinary least squares regressions. Sensitivity studies for outliers did not result in any inferential differences. For binary outcomes, we assessed the assumption of correct fit using Hosmer-Lemeshow tests (Hosmer & Lemeshow, 2000). We ran the tests as if the data were unstructured, since the tests are computationally unavailable for survey data (Archer, Lemeshow, & Hosmer, 2007). Overall, non-significant results were obtained; indicating no evidence to suggest that the correct fit assumption was violated. For continuous outcomes, we checked the homogeneity of error variance assumptions by visually inspecting the relevant plots, which revealed that most of the residuals were normally distributed with homogenous variance.

Primary Analysis

Computer-mediated-communication did not have a statistically significant impact on postsecondary outcomes. In general, effect sizes were also small, with all odds ratios below 1.5 and most β values below 0.10. The only exception was the effect size for job beliefs, with a β value of 0.248. See table two for further detail.

Table 2. The Impact of CMC use on postsecondary outcomes

Binary dependent variables					
Dependent Variable	Odds ratio estimate	t-statistic	p-value	Odds Ratio 95% Confidence interval	
Postsecondary Attendance	0.98	-0.08	0.9305	0.58	1.64

Postsecondary Graduation	0.72	-0.33	0.3629	0.35	1.47
Employment	1.30	0.62	0.5364	0.57	2.98
Independent Living	1.28	1.07	0.2848	0.81	2.03

Continuous Dependent Variables			
Dependent Variable	β value	t-statistic	p-value
Job Beliefs	0.248	1.15	0.2555
Self Beliefs	0.013	0.06	0.9507
Hourly Wage	0.034	0.41	0.6797

Discussion and Conclusions

The aim of this study was to explore whether communication technologies would truly 'level the playing field' for deaf individuals, through a longitudinal analysis of the contribution of CMC usage to future attainments. Despite the widely acclaimed potentials of communication technologies for deaf individuals, our analyses did not reveal CMC usage in high school to be a comprehensive predictor of successful life attainments for deaf young adults. This study was conducted under the assumption that patterns of communication technology use in adolescence would persist through adulthood, as has been indicated in previous studies (Craddock, 2006). Nevertheless, engaging with communication technologies has been demonstrated to contribute to a wide range of positive processes, which could then serve as indirect effects on future attainments. However, comprehensive gains in future attainments for deaf adults that could be explained by CMC usage did not emerge in this study.

We are not proposing that CMC use should be considered a direct effect, but rather that it likely plays an role in facilitating processes that contribute to future outcomes. The specific processes that may make a direct contribution to future outcomes were not explored in this study, but the literature suggests some possibilities. Our previous analyses with the same sample and dataset have found two key points of interest relevant to this discussion: 1) CMC frequency predicts English literacy skills, and 2) English literacy skill predicts collegiate enrollment (Garberoglio et al., 2013; Garberoglio et al., 2015). We did not undertake an empirical examination of the nature of these relationships, but it is clear that CMC is inextricably linked to literacy skills for deaf individuals, and those skills have been found to contribute to some outcomes in adult life, yet not comprehensively (Garberoglio et al., 2013). A possibility also exists that the increased frequency of

engaging in CMC contributes to identity development as a literate individual, one that continues employment and educational endeavors. Deaf individuals' relationship with English literacy is a complex one; identifying as a literate individual does not always occur despite active engagement with multiple forms of text (Herzig, 2009). Computer-mediated communication is also linked to deaf individuals' self-beliefs in adolescence, as previous literature shows (Barak & Sadovsky, 2008), and those self-beliefs may indirectly contribute to future outcomes. It is necessary to recognize that our analyses were very conservative due to the inclusion of multiple covariates, thus had reduced likelihood of reaching significance, but were more reflective of the complexity of actual life.

The literature also showed that youth who used accessible technologies at higher extents were able to capitalize on the greater access enabled by those technologies when enrolled in future postsecondary settings, reporting greater curricular access and more support received in collegiate settings than those who used accessible technologies at lesser rates before enrollment (Craddock, 2006). Deaf students largely report utilizing communication technology in postsecondary environments, but postsecondary completion rates are still low. This study demonstrated that despite the high level of expertise with communication technology that deaf students bring to postsecondary environments, those skills do not ultimately contribute to postsecondary completion. This finding calls to attention the question of institutional capacity to serve those students once they are enrolled in postsecondary institutions, a question explored in depth in Cawthon, Schoffstall, & Garberoglio, 2014. Institutional capacity is affected by multiple factors, such as institutional policies, faculty and staff attitudes, and the resources dedicated to providing access and support for students who are deaf. Institutional capacity in these and related areas may play a role in how a student uses and further develops their use of communication technology, and its subsequent impact on learning and employment outcomes, as also discussed in Burgstahler, 2003.

The frequency of engaging with CMC in adolescence did not significantly predict any dependent variables of interest in this study: collegiate enrollment or completion, living independently, self-beliefs, employment, earnings, or job satisfaction. Communication technologies apparently enable a more optimistic well being for deaf individuals, but those positive psychological experiences may not pan out to actual future attainment gains for deaf individuals beyond postsecondary enrollment. A closer look at the literature that has demonstrated relationships between positive psychological processes and higher internet and communication technology usage for deaf individuals reveals a point of interest that could partially explain where our findings diverged from previous research: that of the developmental stage of the sample. Internet usage and communication technologies contribute to greater independence, higher self-esteem, and reduced

loneliness in samples of deaf *adolescents* (Akamatsu et al., 2006; Barak & Sandovsky, 2008). However, in this longitudinal study, deaf young *adults* (age 24-27) who were high users of communication technology in their adolescence did not reveal higher self-beliefs than their peers who used communication technology at lesser extents during adolescence. Adolescents with disabilities are often buffered from experiencing systemic inequities while in secondary institutions, and that buffer disappears once they leave the protected space of secondary school. It is highly feasible that deaf young adults are faced with more practical realities and systemic inequities, and reveal self-beliefs that are more realistic than adolescents exhibit, as the positivity bias changes with age (for discussion, see: Mezulis, Abramson, Hyde, & Hankin, 2004).

Indeed, as disability theorists point out, systemic inequities still exist beyond spaces that are designed to be accommodating to disability. Communication technologies may create conditions for removing visible indicators of disability from the equation, but "if these differences were to vanish when online, it might serve merely to mask inequalities in people's analog lives" (Ellis & Kent, 2011, p. 86). Deaf individuals continue to face inequalities in their daily, or analog, lives, and communication technologies are clearly not a universal solution for all of those inequalities. Yet, we recognize that communication technologies serve important purposes in the lives of deaf individuals, and are widely capitalized upon in the deaf community.

The nature of these communication technologies requires a closer examination, however. The bulk of CMC occurs via the language of the majority, of English (in the US context), and this language is not always the primary language of the deaf community, of which many use sign language (for discussion, see: Mitchell, Young, Bachleda, & Karchmer, 2006). Deaf individuals using communication technologies are expected to meet societal norms of communication using standard English, and not all deaf individuals may have the capacity, or the desire, to meet these norms, nor the resources needed to achieve English language proficiency. The expectation of deaf individuals to demonstrate communication proficiency using English, despite the accessibility of text-based English, may be intertwined with the expectation of 'passing' as a hearing individual without a disability that is often present in the lives of deaf individuals, whether implicit or explicit (Harmon, 2013). Technology can create dis-abling conditions just as much as it enables, when users of the technology are expected to conform to societal norms and expectations (Ellis & Kent, 2011; Foley & Ferri, 2012). Text-based CMC may serve as an accessible technology, but of a limited scope, that of providing greater access to the English-using landscape, not access on a greater scale. In the early 2000s, when study data was collected about deaf adolescents' usage of CMC, video communication technology was not widely used. The deaf community has largely embraced video

communication technologies that are used in the current technological landscape such as direct video communication or video remote interpretation. Those technologies allow for alternate forms of communication technology that do not necessarily require the user to conform to the expectations of using standard English, instead allowing for direct communication access using sign language. Access to forms of video communication technology may show greater alignment with preexisting cultural practices in the deaf community, as opposed to expectations steeped in the cultural norms of the English-speaking community. The changing landscape of communication technology for deaf individuals that is enabled by video necessitates further study.

Other limitations to this study about the data on CMC usage were the time in which the data were collected, and the scope of the data. Data were collected during adolescence, and data on communication technology use in adulthood was not available. However, this study was conducted under two assumptions: 1) that patterns of CMC continue through adulthood, and 2) that CMC usage during adolescence plays an indirect developmental role in transition processes. The limited scope of the data also did not allow for a nuanced understanding of how, specifically, CMC was used by deaf individuals, and in what contexts. Previous literature on CMC use in the workplace, for instance, suggests that CMC usage in those settings is linked to increased job satisfaction and earnings (Schiller, 2011). This dataset did not allow for that level of exploration, and future studies would benefit from a closer look at deaf individuals' CMC usage across purposes and settings.

To conclude, despite the prevalence of CMC use in the deaf community and the practical and psychological benefits that are enabled by increased access to direct communication, these technologies do not appear to contribute to future gains across the board for deaf individuals. Deaf youths who engaged with CMC at higher frequencies did not reveal discernible gains in adult life attainments in the contexts we explored. The assumption that communication technology levels the playing field for deaf individuals, despite the merits thereof, stands on shaky ground. The benefits of accessible technology as an accommodation only go so far; achieving greater equitable outcomes for deaf individuals requires larger systemic change..

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Appendix 1. Self-Beliefs Measure

Prompt	Scale
You know how to get the information you need	Likert 1-3
You can handle most things that come your way	Likert 1-3
You are proud of who you are	Likert 1-3
You feel useful and important	Likert 1-3
You feel your life is full of interesting things to do	Likert 1-3

Appendix 2. The Job Satisfaction Score

Prompt	Scale
Youth thinks he/she has opportunities to work his/or her way up	Binary
Youth thinks he/she is paid pretty well for his or her work	Binary
Youth thinks he/she is treated pretty well by others at work	Binary
Youth thinks his or her education is being put to good use	Binary
How well youth gets/got along with co-workers at current or most recent job	Likert 1-4
How well youth gets/got along with boss at current or most recent job	Likert 1-4
How well youth usually likes/liked his/her current or most recent job	Likert 1-4

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