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The Impact of Information and Communication Technology (ICT) Usage on Psychological Well-Being among Urban Youth

LaToya O'Neal Coleman Timothy M. Hale Shelia R. Cotten Philip Gibson

Article information:

To cite this document: LaToya O'Neal Coleman Timothy M. Hale Shelia R. Cotten Philip Gibson . "The Impact of Information and Communication Technology (ICT) Usage on Psychological Well-Being among Urban Youth" *In* Technology and Youth: Growing Up in a Digital World. Published online: 24 Sep 2015; 267-291.

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THE IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) USAGE ON PSYCHOLOGICAL WELL-BEING AMONG URBAN YOUTH

LaToya O'Neal Coleman, Timothy M. Hale,
Shelia R. Cotten and Philip Gibson

ABSTRACT

Purpose – Information and communication technology (ICT) usage is pervasive among present day youth, with about 95% of youth ages 12–17 years reporting use of the Internet. Due to the proliferation of ICT use among this generation, it is important to understand the impacts of ICT usage on well-being. The goal of this study was to determine the impact of ICT usage on psychological well-being among a sample of urban, predominately African American youth.

Methodology/approach – Paper and pencil surveys were administered to fourth and fifth grade students enrolled in 27 elementary schools in the southeastern United States. Relationships between hours using various

Technology and Youth: Growing Up in a Digital World
Sociological Studies of Children and Youth, Volume 19, 267–291
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ISSN: 1537-4661/doi:10.1108/S1537-466120150000019008

types of ICTs and the frequency of Internet activities on depression, hopelessness, self-esteem, and belonging were examined using Ordinary Least Squares (OLS) regression.

Findings – Results indicate that ICT usage has both positive and negative implications for psychological well-being, depending upon the type of ICT use and outcome being examined.

Social Implications – The proliferation of ICT usage among present day youth may actually lessen its impact on psychological well-being. Since the amount of ICT usage does not seem to influence psychological well-being, future research should examine the impact of ICT content on psychological well-being.

Keywords: Information and communication technology (ICT); psychological well-being; urban youth; minority youth

INTRODUCTION

The Internet has become a “central and indispensable element in the lives of American teens and young adults” (Lenhart, Purcell, Smith, & Zickuhr, 2010, p. 5). Today’s youth have been described as “digital natives” – born and raised in a world where the use of Information and Communication Technology (ICT) is nearly ubiquitous (Palfrey & Gasser, 2008). ICTs such as mobile phones, television, and the Internet, among others, are an integral part of the daily lives of many youth. The typical youth spends more time using ICTs than the typical adult spends at work (Rideout, Foehr, & Roberts, 2010), making knowledge regarding the impact of ICT usage on the development and well-being of this group increasingly necessary. While there are positive social and educational benefits of ICT use, there is some concern about whether usage is also harmful (Borzekowski, 2006; Livingstone & Brake, 2010; Plowman, McPake, & Stephen, 2010; Punamäki, Wallenius, Nygard, Saarni, & Rimpelä, 2007; Shaw & Gant, 2002; Wartella & Jennings, 2000), particularly as it relates to psychological well-being (Borzekowski, 2006; Jackson, Zhao, et al., 2008; Kraut et al., 2002; Rideout et al., 2010). Most of the research on the impact of ICTs on well-being has focused on the relationship between Internet usage and depressive symptomatology in young and older adults among majority white samples (Gross, Juvonen, & Gable, 2002; Kraut et al., 2002; Kraut et al., 1998; Morgan & Cotten, 2003; Sanders, Field, Diego, & Kaplan,

2000). Among the studies that focus on younger children, findings regarding the impact of the Internet on aspects of psychological well-being have been mixed with studies reporting both positive and negative findings (Attewell, Suazo-Garcia, & Battle, 2003; Jackson, Zhao, et al., 2008).

To better inform the literature on the effects of ICT usage on children, we must move beyond a focus on the relationship between Internet usage and depression to examine a variety of types of ICT use on dimensions of psychological well-being (Cotten, Goldner, Hale, & Drentea, 2011; Jackson, Zhao, et al., 2008; Valkenburg & Peter, 2007). Although depression is a prevalent mental illness with vast implications for public health (National Alliance on Mental Illness, 2010) and life outcomes (Bessière, Kiesler, Kraut, & Boneva, 2008), other measures of psychological well-being, such as self-esteem, have been shown to predict future health, criminal behavior, and economic capital (Trzesniewski et al., 2006). We must also move beyond the construction of children as vulnerable victims of a world inundated by ICTs (Livingstone, 2007) since ICTs are only one mechanism by which children are socialized. Children are agentic pursuers of ICTs whose interactions with family, friends, and community, not just ICTs, impact their short- and long-term functioning (Dubow, Huesmann, & Greenwood, 2006). Finally, we also need to focus on two populations that are often ignored in studies of ICT use and impacts: minority youth from urban backgrounds and elementary school children. Few studies focus on either of these populations and those that do are primarily descriptive in nature (e.g., Rideout et al., 2010). The purpose of the current study is to examine the association of hours using various types of ICTs and the frequency of Internet activities on depression, hopelessness, self-esteem, and belonging in a large sample of minority children ages 10–13 years old.

LITERATURE REVIEW

Youth and ICT Usage

Studies illustrate that youth use ICTs at very high levels, compared to other groups. Recent surveys of teens conducted by Pew Internet & Society find that 95% of 12–17 year olds use the Internet (Lenhart et al., 2011; Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013) and 80% use social networking sites (Lenhart et al., 2011). Of those teens who go online, 73% use email, 57% watch videos online, and 78% play online games (Zickuhr,

2010). Total daily hours of ICT use among youth (ages 8–18 years) has increased markedly during the past decade, from 6:19 (hours:minutes) in 1999 to 7:38 in 2009 (Rideout et al., 2010, p. 11). Age is an important predictor of ICT usage. Youth ages 8–10 use ICTs for fewer hours each day (5:29) than do 11–14 year olds (8:40) (Rideout et al., 2010, p. 43). In addition to age, race and gender are also associated with various aspects of ICT usage.

African American youth use ICTs and media more hours each day than White youth (9:44 vs. 6:22, respectively) (Rideout et al., 2010, p. 43). African American youth make greater use of television (5:54 vs. 3:36) and game systems (1:25 vs. 0:56) per day than White youth (Rideout et al., 2010, p. 37), and spend more time using a cell phone (2:49 vs. 1:47) (Rideout et al., 2010, p. 18). There is no substantial difference between African American and White youth in daily hours of computer use (1:24 vs. 1:17) (Rideout et al., 2010, p. 23). However, African American children are less likely than white children to have Internet access (Jackson, von Eye, Fitzgerald, Witt, & Zhao, 2011; Madden et al., 2013; Rideout et al., 2010). In 2009, 78% of African American youth had home Internet access compared to 88% of White youth (Rideout et al., 2010, p. 23). Jackson, Fitzgerald, et al. (2008) found that White children had been using a computer longer than African American children and that African American males used computers and the Internet for less time when compared to other groups. They also found consistent gender differences with regards to video game playing and cell phone usage. Males reported playing video games more than females and females used cell phones more than males. African American children used cell phones more than White children, with African American females using them the most (Jackson, Fitzgerald, et al., 2008).

While these differences show a narrowing digital divide as it relates to computer ownership, the issue of Internet access remains hidden among higher usage of some ICTs by African American youth. African American youth spend more time watching television, playing video games, and using a cell phone (Rideout et al., 2010), two of which have been linked to negative academic outcomes (Jackson, Zhao, et al., 2008; Rideout et al., 2010). There isn't much beyond speculation as to why African American youth use those particular ICTs more than White youth since there do not appear to be differences in parental monitoring or media rules (Rideout et al., 2010) and since other aspects of ICT usage have been found to contribute to more positive outcomes. Early access to ICTs, especially computers and the Internet, have been linked to more positive academic outcomes

(Jackson, Zhao, et al., 2008). Issues of access have been attributed to parents' socioeconomic status (Jackson, Zhao, et al., 2008; Rideout et al., 2010). Since White youth have been found to have earlier access to computers when compared to African American youth, the divide may potentially contribute to long term inequality in education and quite possibly psychological well-being. Consequently, we must explore how digital inequality might influence psychological well-being as the noted variation in usage among African American and White children may result in differences in psychological well-being outcomes which have yet to be examined in a large minority sample.

Psychological Well-Being and ICT Usage

Depression is one of the most common psychological disorders among children and adolescents (Merry et al., 2012) and has been linked to poor academic performance and negative cognitive functioning (Lundy, Silva, Kaemingk, Goodwin, & Quan, 2010). Research from a nationally representative sample of youth reveal a lifetime prevalence rate of 11.7% for Major Depressive Disorder (MDD) or Dysthymia among youth ages 13–18 (Merikangas et al., 2010). Levels of depression have been found to vary among racial/ethnic groups with whites having lower levels of depression when compared to African American, Hispanic, and Asian adolescents (Moon & Rao, 2010). Other aspects of psychological well-being, such as hopelessness, sense of belonging, and self-esteem, have been linked to academic achievement, subjective well-being, and risky behaviors (Bolland, Lian, & Formichella, 2005; Faircloth & Hamm, 2005; Vacek, Coyle, & Vera, 2010). These findings provide support for the importance of determining factors which may contribute to negative psychological well-being among children and adolescents such as ICT usage.

Despite research which confirms that youth utilize ICTs more than any other group, much of the research examining ICTs and psychological well-being has been on white college students and adults. This may be attributed to the fact that early Internet usage began as a tool for scientists and engineers (Kraut et al., 1998) and rapidly found its way to adults and then youth. The proliferation of ICTs, especially computers, among youth is fairly recent, as home computer ownership increased and more appealing content was developed. Early researchers thus focused on the heaviest users of technology. Noteworthy research, such as that of Kraut et al. (1998) and Sanders et al. (2000) who found that higher levels of Internet usage were

related to poorer psychological well-being were among the earliest studies of the relationship between ICTs and depression. As technology changed, studies began to examine more applications but continued to focus on populations who owned and had access to ICTs resulting in fewer studies examining the impact of ICTs on youth, especially minority youth. Still, findings from adults and college students provide some support for the relationship between ICTs and psychological well-being.

Unlike findings among adults, several researchers have found ICTs to have a positive impact on psychological well-being among younger samples of college students. For example, [Shaw and Gant \(2002\)](#) used an experimental design to examine the impact of using chat rooms on depression, loneliness, self-esteem, and social support in a sample of college students. Participants engaged in five semi-structured chat sessions with an anonymous partner. The authors found that loneliness and depression decreased and that social support and self-esteem increased from pre- to post-test. [Morgan and Cotten \(2003\)](#) found that use of the Internet for email, participation in chat rooms, and instant messaging (IM) was associated with decreased depression among college students. [Rohall, Cotten, and Morgan \(2002\)](#) found that time spent using Internet chat rooms and IM had a small but significant positive effect on self-esteem among college students. Others have found that some students utilize ICTs specifically to improve their psychological well-being. [Barker \(2009\)](#) investigated the motivation to use social networking sites (SNS) in a sample of college freshmen. She discovered a moderate relationship between negative collective self-esteem and SNS use suggesting that students who felt more negatively about their current peer group may have compensated by seeking out other groups to communicate with online. While these studies may seem dated in terms of ICT research, they are some of the seminal studies in this area investigating the effects of ICT use on well-being among young adults.

These studies also highlight the need for additional investigation of the relationship between ICTs and the psychological well-being of youth since, comparatively, youth use ICTs at higher rates than other groups and they are in earlier stages of development which might result in different outcomes. Consequently, research related to the impact of ICTs is usually framed as having an effect on or being an aspect of the process of adolescent development. Effect related research tends to focus on the impact of ICTs on a problem (i.e., youth violence or poor grades) such as to suggest that ICT usage contributes to such problems ([Livingstone, 2007](#)). Process-related research focuses on how youth respond to media and how it benefits them

(Livingstone, 2007). These two types of research provide the foundation for two perspectives and hypotheses related to ICTs and well-being.

Jackson, Zhao, et al. (2008) describe two perspectives that have been used to explain how children's use of ICTs, most often in studies investigating Internet use, affects their psychological well-being. The "dystopian" perspective posits that the more time children spend on the Internet, the less time they spend engaging in more vital activities such as reading and face-to-face interaction with family and friends while concurrently being exposed to potentially damaging content or situations online. In contrast, the "utopian" perspective posits that the Internet affords children the opportunity to express themselves and communicate with others in ways that are novel while encouraging the development of the technological skills necessary for 21st century employment. These two perspectives have led to several hypotheses in the literature.

Research investigating the relationship between the Internet and psychological well-being has typically been guided by three hypotheses, the *social augmentation hypothesis*, the *social displacement hypothesis*, and the *social compensation hypothesis* (Bessière, Sara, Robert, & Bonka, 2008). Consistent with the dystopian perspective, the *social displacement hypothesis* argues that online interactions replace offline interactions so more time online may result in negative effects on well-being. Time online is thought to take the place of meaningful face-to-face interactions, which are valuable for positive psychological well-being. Conversely, the utopian perspective draws on the *social augmentation hypothesis*, stating that Internet usage has a positive impact on psychological well-being. The Internet provides the opportunity for individuals to increase their social resources and social networks by providing additional outlets for social interaction. This in turn results in positive psychological outcomes. Finally, the *social compensation hypothesis* suggests that this positive effect will be particularly strong for people who are socially isolated and lack access to social resources important to psychological well-being (Bessière et al., 2008).

Prior research on the effects of ICT use on youth's psychological well-being is mixed but along with studies among adults, provides some support for all three hypotheses. Findings from research on adults, such as Shaw and Gant (2002) provide support for the social augmentation hypotheses, while Barker (2009) provides support for the social compensation hypothesis. Other research, specifically among youth, finds that some types of communicative uses of technology are associated with negative psychological well-being – supporting the social displacement hypothesis.

Using a nationally representative sample of youth ages 10–17 years, Ybarra, Alexander, and Mitchell (2005) found that using email and chat rooms was positively associated with depressive symptomatology. However, Ybarra et al. (2005) also found that IM use and general Internet use was negatively associated with depression. Another study of Internet communication and well-being suggests that the negative impact on psychological well-being may be attributed to communication with strangers. Valkenburg and Peter (2007) examined the relationship between Internet communication, well-being, and communication with strangers using closeness to friends as a mediator and loneliness as a moderator. Initial results revealed that Internet communication had a negative influence on well-being among a sample of 687 adolescents from the Netherlands. After adding hypothesized underlying mechanisms, this direct relationship did not hold. This led to the researchers concluding that who adolescents communicate with online matters most in regards to well-being outcomes.

Gross et al. (2002) had similar findings. Using a sample of participants 11–13 years old, they found that those who had higher levels of loneliness and social anxiety were more likely to be communicating through IM with strangers as compared to students with lower levels of loneliness and social anxiety who were more likely to be communicating with friends. Finally, among youth ages 11–16 years, Jackson et al. (2011) found that cell phone use was associated with higher self-esteem. Non-communicative technology use (i.e., general Internet use, playing video games) had no significant relationship or a positive relationship with psychological well-being. Jackson et al. (2011) found that general Internet use and playing video games had no significant relationship to self-esteem among a sample of youth ages 10–17 years.

Despite it being well known that pre-adolescence is a critical period for psychosocial development, studies of the relationship between ICT usage and psychological well-being have primarily focused on college students and adults. This is problematic because findings are often used to draw conclusions about younger populations who are developmentally different (Valkenburg & Peter, 2011). Present literature also fails to consider whether existing differences among racial/ethnic and socioeconomic groups with regards to Internet access and usage (Bickham et al., 2003; Lenhart et al., 2010; Rideout et al., 2010) would result in different well-being outcomes for these groups. Considering such differences, what is the impact of ICT usage on the psychological development and well-being of minority youth? The current study examines the relationship of various types of ICT usage and activities on psychological well-being in a predominantly African

American sample of youth ages 10–13. Based on findings from previous research, which have been mixed, we propose the following exploratory hypotheses using both the dystopian and utopian perspectives:

- (1) The more hours spent using ICTs and the higher the frequency of Internet usage, the higher the level of negative psychological well-being as measured by depression and hopelessness (social displacement hypothesis).
- (2) The more hours spent using ICTs and the higher the frequency of Internet usage, the lower the level of positive psychological well-being as measured by self-esteem and sense of belonging (social displacement hypothesis).
- (3) The more hours spent using ICTs and the higher the frequency of Internet usage, the lower the levels of negative psychological well-being as measured by depression and hopelessness (social augmentation hypothesis).
- (4) The more hours spent using ICTs and the higher the frequency of Internet usage, the higher the levels of positive psychological well-being as measured by self-esteem and sense of belonging (social augmentation hypothesis).

METHODS

Participants and Procedures

In late 2008, the Birmingham City School District distributed 15,000 One Laptop Per Child (OLPC) XO computers to all 1st through 5th grade students. The XO laptop is a durable tool designed for, but not limited to, children in developing countries ([One Laptop Per Child, 2014](#)). With built-in wireless and open source software, it was designed to be a low cost alternative to traditional laptops. The dissemination of these laptops presented a unique opportunity to survey students before and after receiving the XOs to determine the effect of the XO program on a variety of social, academic, and psychological well-being outcomes. The program also presented an opportunity to collect data about students' use of information and communication technologies, including PCs at home, cell phones, and using the Internet for a variety of purposes.

The Birmingham Youth and Technology Study (BYTS) was conducted during the 2008–2009 school year. During that time the school district consisted of 39 elementary schools, of which 27 schools participated in the

study. There were 2,915 students enrolled at the participating schools during the 2008–2009 academic year. All 4th and 5th grade students at participating schools were given consent forms to take home to obtain their parent's consent to participate in the study. Only those students who returned signed parental consent forms and who also assented to participate were surveyed. Participation was voluntary and a small incentive was provided to students participating in the study.

Surveys were administered during school hours, in designated areas (i.e., classrooms, cafeteria, etc.), and at times considered most suitable by principals and teachers. Participating students were given a pre- and post-test survey (i.e., time 1 and time 2). The paper and pencil surveys took approximately 45 minutes to complete. The pretest survey was given just prior to the XO dissemination and the posttest surveys about three to six months later. The response rate for the pretest survey was 52% ($N = 1,583$). Only students who participated in the pretest survey were eligible for the posttest survey. About 76% of participants completed the post-test survey ($N = 1,202$). We use data from the pre- and posttest surveys to evaluate the relationship between our independent variables on psychological well-being while controlling for baseline (time 1) values in these variables. The school district is predominately African American (97%) and 83% of students qualify for free or reduced price lunch (Alabama State Department of Education, 2010). The study sample is similar to students in the school district with 83% of the sample being African American and 84% qualifying for free or reduced price lunch.

Dependent Variables

To examine the broad impact of ICT use on psychological well-being, we use four outcome measures: depression, hopelessness, belonging, and self-esteem. The use of multiple measures allows us to identify statistically significant factors across outcomes as well as factors unique to each measure of psychological well-being. Measures of depression and hopelessness are used to represent two factors that contribute to poor psychological well-being, and self-esteem and sense of belonging are used to represent two factors that contribute to better psychological well-being.

Depression

Depression is measured using the Center for Epidemiologic Studies Depression Scale for Children (CES-DC) (see Faulstich, Carey, Ruggiero,

Enyart, & Gresham, 1986). All 20 items that comprise the CES-DC were used in the pretest survey. To reduce response burden on students on the posttest the number of items was reduced to six that were identified as contributing to the internal reliability of the scale. The six-item scale values range from 0 to 18 with higher scores indicating greater levels of depression ($\alpha = 0.74$).

Hopelessness

Hopelessness is measured using three items drawn from the Mobile Youth Study (MYS) 2006 (Bolland, 2007), which used a modified version of the Hopelessness Scale for Children (HSC) (Kazdin, French, Unis, Esveldt-Dawson, & Sherick, 1983). The original scale used a true/false response format and was revised for use in the MYS as 0 = disagree, 1 = not sure, and 2 = agree. Although the MYS documentation does not explain the rationale for the change in response format we chose to use the same questions to enable future comparisons with the data collected in Mobile, Alabama. The scale was created by summing the three items, with a higher score representing a greater level of hopelessness. Factor analysis shows the three items load on a single factor that accounts for 71% of the variance. The Chronbach's alpha for the scale is 0.79.

Belonging

Belonging is measured using three items drawn from the eight items that comprise the Organization for Economic Co-operation and Development's (OECD) Program for International Student Assessment (PISA) measure of student engagement and belonging (Willms, 2003). Due to the young age of students in our sample, response options were modified from a four item Likert options to three options (0 = disagree, 1 = not sure, 2 = agree). All three items are first reverse coded and then summed to create the scale with higher values representing a greater sense of belonging ($\alpha = 0.80$). Factor analysis indicates a single common factor that accounts for 71% of the variance.

Self-Esteem

Self-esteem is measured using five items drawn from the MYS (Bolland, 2007). The original source of the items is the 36-item Self-Perception Profile for Children (SPPC) (Harter, 1985) that codes responses on a five item Likert scale. Taking into account the reading levels of children who participated in the MYS, items were reworded and presented as two contrasting statements that participants were asked to identify one as being "most like

you.” The score is created by summing the statements that represent positive self-esteem (coded as 1) and statements of negative self-esteem (coded as 0) with a higher score representing higher self-esteem. Factor analysis shows the five items load on a single factor that explains 63% of the variance. Chronbach’s alpha for the index is 0.72.

Independent and Control Variables

Hours Using ICT

Hours using ICT is measured using six items that ask respondents how many hours per day they spend using various types of ICT, including: a computer (not the XO), the Internet, the XO, a game system, watching TV, and a cell phone. Responses are coded as one of five ordinal categories (0 = I don’t use this at all, 1 = 1–2 hours, 2 = 3–4 hours, 3 = 5–6 hours, 4 = 7–8 hours, and 5 = more than 8 hours). Higher scores represent more hours using that particular type of technology.

Frequency of Internet Usage

Frequency of Internet usage is measured using seven items that ask respondents how often they do each of the following things using a computer on the Internet: (1) send or receive email, (2) send or receive instant messages, (3) visit social networking sites, (4) surf the web, (5) play games, (6) listen to music, and (7) watch videos. Responses are coded as one of five ordinal categories (0 = never, 1 = less than once a week, 2 = at least once a week, 3 = several times a week, and 4 = every day). Higher scores represent more frequent Internet usage.

Demographics and PC Ownership

Demographic and PC ownership were measured at the pretest and are time invariant. Demographics include gender (0 = female, 1 = male), grade level (0 = fifth grade, 1 = fourth grade), race (0 = other, 1 = African American). We do not include age in our analyses due to the high correlation between age and grade level. All students were given an XO to use at home and school. A measure of home PC ownership (0 = don’t own, 1 = own) was included to control for differences in access to other computers besides the XO.

Analytical Design

This study examines the impact of hours using ICTs and frequency of ICT usage on four measures of psychological well-being: depression,

hopelessness, self-esteem, and belonging. Descriptive statistics are presented in [Table 1](#) and include results using paired *t*-test and Wilcoxon signed-rank sum *z*-test for ordinal variables of significant changes from time 1 to time 2. Ordinary Least Squares (OLS) regression is used to test models that assess the relationship between: types of ICT use and frequency of ICT usage on psychological well-being at time 2 (i.e., posttest) while controlling for these measures at baseline (i.e., time 1). The models also include time invariant demographic variables and a control variable indicating PC ownership in the home. Robust standard errors are computed using the “cluster” command in Stata 13 to adjust for the nonrandom distribution of students, grouped by homeroom teacher. Listwise deletion for missing data yielded a final analytic sample of 870 participants. No independent variable used in the models is missing values on more than 3.3% of cases. However, the analytic sample is comprised of fewer African Americans and more PC owners than students with incomplete surveys. Additionally, students in the analytic sample have better psychological well-being on three of the four measures (lower levels of depression and hopelessness, greater sense of belonging) and made more frequent use of the Internet for three types of activities (i.e., email, surfing, games) at time 2. Post-hoc tests were conducted to examine patterns in the missing values using the “misstable” command in Stata, and pairwise correlations between each dependent (i.e., psychological well-being outcomes) and independent variables. We did not find patterns in the missing values or correlations. This leads us to believe that the differences observed in the analytic compared to the full sample are not likely to substantially affect the findings.

We choose to present results using OLS regression to ease the comparison between models for each outcome. We conducted several alternative statistical models to test the robustness of the OLS regression models presented in [Tables 2 and 3](#) (results available from authors). With few exceptions¹ the results did not differ substantially across statistical models.

RESULTS

Descriptive statistics are presented in [Table 1](#). The mean age of students participating in the study is 10.4 years old and 45% are male. Forty-five percent of the students are in the 4th grade and 55% are in the 5th grade. African Americans make up 83% of the sample and other race 17%. Eighty-two percent of students report having a PC in the household.

Table 1. Descriptives ($n = 870$).

	Time 1		Time 2	
	Mean	SD	Mean	SD
<i>Demographics and controls</i>				
Age	10.445	0.663	NA	NA
Male	0.453	0.498	NA	NA
Grade 4	0.451	0.498	NA	NA
African American	0.834	0.373	NA	NA
PC owner	0.823	0.381	NA	NA
<i>Mental well-being</i>				
Depression, CESD-C ^a	4.832	4.124	4.134***	3.957
Hopelessness	1.091	1.444	1.076	1.589
Belonging	4.478	1.692	4.684***	1.740
Self-esteem	3.611	1.505	3.651	1.535
<i>Hours using ICT</i>				
Computer	1.466	1.331	2.255***	1.826
Internet	1.857	1.463	2.929***	1.828
XO	NA	NA	1.726	1.487
Game system	2.487	1.743	3.337***	1.786
TV	2.746	1.296	2.648*	1.233
Cell phone	1.656	1.684	2.400***	1.958
<i>Frequency of Internet use</i>				
Send or receive email	1.574	1.596	1.555	1.576
Instant message	1.232	1.511	1.357*	1.531
Visit SNS	2.061	1.723	2.085	1.722
Surf the web	2.213	1.639	2.259	1.561
Play games	3.293	1.097	2.932***	1.304
Listen to music	2.828	1.389	2.716	1.467
Watch videos	2.609	1.411	2.628	1.490

Notes: Demographic and control variables are time invariant. Wilcoxon signed-rank sum test used to assess change between time 1 and time 2 for all other variables.

^aPaired *t*-test used to assess change in mean between time 1 and time 2.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

The mean of the 6-item CES-DC scale decreased significantly from 4.832 to 4.134 at time 2 ($t = -4.643$, $p < 0.001$). Sense of belonging increased significantly from a mean of 4.478 to 4.684 ($z = 3.950$, $p < 0.001$). There was no significant change in hopelessness or self-esteem.

The mean usage of computers, the Internet, game systems, and cell phones increased significantly from time 1 to time 2 while use of TV decreased. Mean usage of the Internet increased from 1.857 to 2.929 ($z = 14.635$, $p < 0.001$) meaning that on average, students were using the Internet 5–6 hours per day at time 2 (coded as 3) as opposed to 3–4 hours

per day (coded as 2). Mean usage of computers increased from 1.466 to 2.255 ($z = 10.641, p < 0.001$). Game system use increased from a mean of 2.487 to 3.337 ($z = 12.173, p < 0.001$) and cell phone use increased from a mean of 1.656 to 2.400 ($z = 10.383, p < 0.001$). Hours of TV use decreased slightly from a mean of 2.746 to 2.648 ($z = -2.175, p < 0.050$). Students were provided XO computers after the pretest survey and the mean usage for the XO at time 2 is 1.726 or about 3–4 hours per day (coded as 2).

Use of instant messaging increased significantly from a mean of 1.232 to 1.357 ($z = 2.076, p < 0.050$) and playing games on the Internet decreased from a mean of 3.293 to 2.932 ($z = -7.033, p < 0.001$). There was no significant change in the frequency of other Internet activities. At time 2, students report accessing email, visiting social networking sites and surfing the web about once a week (coded as 2), and listening to music and watching videos several times a week (coded as 3).

Does Hours of ICT Usage and Frequency of Internet Usage Impact Psychological Well-Being?

Tables 2 and 3 present the results from OLS regression models estimating the relationship of ICT use at time 2 on each of the four outcome measures of psychological well-being at time 2. For each outcome we present two models. The first model includes time invariant demographic variables, a control variable measuring PC ownership, and a variable to control for baseline level in the outcome of psychological well-being at time 1. The second model adds variables measuring ICT use at time 2 and includes variables measuring ICT use at time 1 to control for baseline levels. We include the *R*-square for each model and use a Wald test to evaluate if adding the ICT use variables significantly improves model fit. The coefficients for the time 1 variables are not interpreted and although present in the models have been omitted from the tables.

Table 2 presents results for two measures of negative psychological well-being, depression and hopelessness. In models for depression and hopelessness, none of the demographic or control variables are significant. Hours using the XO was significantly related to greater depression ($b = 0.260, p < 0.010$) and use of instant messaging was significantly related to increased hopelessness ($b = 0.103, p < 0.010$). However, the change in *R*-square was small (about 3%) and not significant in either model at the $p = 0.05$ level, indicating that ICT use did not have a substantial negative impact on depression or hopelessness.

Table 2. Depression and Hopelessness Regressed on Technology Ownership, Use, and Demographic Factors Using OLS Regression ($n = 870$).

	Depression		Hopelessness	
	(1)	(2)	(1)	(2)
<i>Demographics and controls</i>				
Male	-0.103 (0.255)	-0.287 (0.308)	0.099 (0.106)	0.090 (0.111)
Grade 4	-0.047 (0.261)	-0.099 (0.263)	0.200 (0.132)	0.155 (0.136)
African American	-0.418 (0.350)	-0.299 (0.358)	-0.229 (0.133)	-0.244 (0.141)
PC owner	-0.321 (0.324)	0.019 (0.372)	-0.176 (0.131)	-0.195 (0.146)
<i>Hours using ICT</i>				
Computer		-0.023 (0.109)		-0.009 (0.045)
Internet		-0.092 (0.105)		-0.033 (0.044)
XO		0.260** (0.091)		0.079 (0.041)
Game system		0.070 (0.095)		0.028 (0.040)
TV		-0.030 (0.113)		-0.001 (0.055)
Cell phone		-0.038 (0.095)		0.021 (0.033)
<i>Frequency of Internet use</i>				
Send or receive email		0.096 (0.119)		-0.069 (0.041)
Instant message		-0.162 (0.117)		0.103* (0.044)
Visit SNS		0.002 (0.094)		0.060 (0.045)
Surf the web		0.076 (0.089)		0.002 (0.039)
Play games		-0.239 (0.122)		-0.080 (0.053)
Listen to music		-0.037 (0.135)		-0.038 (0.051)
Watch videos		-0.071 (0.132)		0.028 (0.050)
Intercept	2.990*** (0.480)	3.361*** (0.729)	0.893*** (0.179)	0.654** (0.237)
R^2	0.162	0.188	0.121	0.149
ΔR^2		0.026		0.028

Notes: Models include variables for each dependent variable and for independent variables at time 1. Demographic and PC ownership are time invariant and included only as time 1 variables. XO was not available to students at time 1 and is included only as a time 2 variable.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3. Belonging and Self-Esteem Regressed on Technology Ownership, Use, and Demographic Factors Using OLS Regression ($n = 870$).

	Belonging		Self-Esteem	
	(1)	(2)	(1)	(2)
<i>Demographics and controls</i>				
Male	-0.060 (0.118)	-0.069 (0.131)	-0.231* (0.096)	-0.207* (0.099)
Grade 4	-0.047 (0.124)	-0.027 (0.126)	-0.220* (0.101)	-0.266** (0.090)
African American	0.599*** (0.163)	0.548** (0.167)	0.096 (0.104)	0.165 (0.121)
PC owner	-0.049 (0.134)	-0.148 (0.152)	0.196 (0.114)	0.236 (0.127)
<i>Hours using ICT</i>				
Computer		-0.019 (0.045)		0.009 (0.034)
Internet		0.076 (0.049)		-0.055 (0.035)
XO		-0.095* (0.041)		0.014 (0.032)
Game system		-0.027 (0.038)		-0.013 (0.031)
TV		-0.019 (0.052)		-0.026 (0.040)
Cell phone		0.047 (0.032)		0.050 (0.030)
<i>Frequency of Internet use</i>				
Send or receive email		-0.027 (0.048)		0.018 (0.041)
Instant message		-0.053 (0.051)		0.056 (0.042)
Visit SNS		0.030 (0.046)		-0.122*** (0.036)
Surf the web		-0.138*** (0.039)		0.003 (0.037)
Play games		0.024 (0.057)		0.053 (0.048)
Listen to music		0.041 (0.064)		-0.033 (0.047)
Watch videos		0.106* (0.051)		0.046 (0.046)
Intercept	2.500*** (0.244)	2.383*** (0.339)	1.781*** (0.197)	1.894*** (0.257)
R^2	0.170	0.205	0.281	0.315
ΔR^2		0.035		0.034

Notes: Unstandardized OLS regression coefficients and robust standard errors in parentheses. Models include variables for each dependent variable and for independent variables at time 1. Demographic and PC ownership are time invariant and included only as time 1 variables. XO was not available to students at time 1 and is included only as a time 2 variable.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3 present results for two measures of positive psychological well-being, belonging and self-esteem. African American race was positively associated with sense of belonging ($b = 0.599, p < 0.001$). Males ($b = -0.231, p < 0.050$) and students in the 4th grade ($b = -0.220, p < 0.050$) on average reported lower self-esteem than females and students in the 5th grade. In contrast to models for depression and hopelessness, measures of ICT use had a slightly larger impact on R -square and significantly improved model fit (belonging, $F(25, 120) = 2.46, p < 0.001$; self-esteem $F(25, 120) = 1.99, p < 0.010$). Frequency watching videos were positively associated with sense of belonging ($b = 0.106, p < 0.050$). Hours using the XO and frequency surfing the web were associated with lower sense of belonging ($b = -0.095, p < 0.050$ and $-0.138, p < 0.001$, respectively). Frequency visiting social networking sites ($b = -0.122, p < 0.001$) was associated with lower self-esteem.

DISCUSSION

This is the first study to measure the impact of hours using various types of ICTs and frequency of ICT usage on a range of psychological well-being outcomes in a predominantly African American sample. Little research has focused on the positive and negative impacts of ICTs for urban minority youth. Our research suggests that in many cases ICT usage has no impact on psychological well-being. The current research supports studies with adults which note that the impact of ICT usage on psychological well-being vary depending upon the type, timing, and amount of ICT usage (Cotten, Goldner, et al., 2011). However, the results are modest at best, with the variables measuring ICT usage explaining about 3% of the variation in our psychological well-being outcomes. In fact, addition of ICT usage did not significantly improve model fit for depression or hopelessness; although there was a significant improvement in model fit for belonging and for self-esteem.

Time spent engaged in particular types of Internet activities had negative and positive relationships with the measures of positive psychological well-being. Frequency of surfing the web was associated with lower sense of belonging while frequency of watching videos was associated with higher sense of belonging. The lower sense of belonging among those who spent more time surfing the web can be explained by the social displacement hypothesis. Time spent surfing the web may be taking the place of face-to-face interactions which has a negative impact on positive psychological well-being. The positive relationship between sense of belonging and

frequency of watching videos may be explained by the social augmentation hypothesis. In line with the process approach (Livingstone, 2007), we suggest that youth who spent more time watching videos may be able to increase their social networks by connecting with other youth who watch videos, thereby increasing their social interactions offline through a common interest. By engaging in a specific activity, such as watching videos, they may increase their chances of finding peers who do the same. African American race was also associated with higher sense of belonging. Considering the racial makeup of the school district, this is not a surprising finding.

Self-esteem was inversely related to frequency visiting social networking sites, being male, and being in 4th grade. The finding that frequency visiting social networking sites was related to lower self-esteem supports previous research (e.g., Barker, 2009) and possibly the social compensation hypothesis. It is unclear why males in the sample have lower levels of self-esteem than females or why 4th graders have lower levels of self-esteem than 5th graders. This is not consistent with findings from studies of older adolescents where females were found to have lower levels of self-esteem and where self-esteem seemed to decline with age (van der Berg, Mond, Eisenberg, Ackard, & Neumark-Sztainer, 2010). However, the current study uses students who have not yet reached adolescence – thus, factors that emerge during adolescence that specifically affect females' self-esteem may not present the same self-esteem disadvantages compared to males. It might also be related to the unique population in this study – an almost all African American sample of elementary school students. Given that African Americans are the majority population in this school system, cultural beliefs and socialization experiences may also come into play in these relationships.

Although previous findings show that cell phone use was positively associated with self-esteem (Jackson et al., 2011), we found no significant relationship between cell phone use and self-esteem among our study participants. It is possible that cell phone use has a more protective effect for slightly older children from more affluent backgrounds as the current sample is slightly younger and likely less affluent than those in the Jackson et al. (2011) study. This is merely speculation as the current data cannot speak to this possibility.

We also included measures of a unique type of technology, the XO laptop. Hours using the XO were associated with higher depression and hopelessness, and lower sense of belonging. It is not clear why hours using the XO were consistently associated with worse psychological well-being

among participants. Some research suggests that implementing large-scale technology disseminations in minority communities may be challenging due to previous experiences using technology and related attitudes, as well as structural factors that may present barriers to adopting new technology (Cotten, Hale, Howell-Moroney, O'Neal, & Borch, 2011b). This may be the case with the XO program in Birmingham, Alabama, as the project was highly politicized from the initial discussions and continues to be to this time period (Warschauer, Cotten, & Ames, 2011). In addition, little support was provided to the school system to help them integrate the XOs into the curriculum and the XOs were given to the students (the school system did not retain ownership of the laptops).

One of the limitations of this study is that not all students in the schools participated. Parents had to return consent forms in order for their children to participate and it may be that parents who took the initiative to return the consent forms live somewhat different lives than those who did not return the forms. Unfortunately our data do not provide information to investigate this possibility. A noted limitation is that our analytic sample differed significantly from those excluded from the analyses. It appears that those who had more positive psychological well-being were more likely to complete the posttest survey. This may have introduced bias in the results. An additional limitation is that we rely on student report of daily hours spent using ICT. Primary caregivers and teachers were not included in this study, however data from both sources might have been beneficial for determining the accuracy of student reports. Also, our analysis examines hours spent using ICT and frequency of Internet usage, but not ICT content. Future studies might find measuring ICT content useful for developing strong theoretical foundations from which to explore the impact of ICT on psychological well-being among elementary school and minority students. Finally, the time between the pre- and post-test survey averaged 141 days (ranging from 105 to 183 days) and may be too short to detect the effect of changes in ICT use on psychological outcomes. Future studies should follow youth over longer periods of time in order to disentangle these relationships.

CONCLUSIONS

This study examined the impact of hours spent using various types of ICTs and frequency of ICT usage on psychological well-being in a large, primarily African American urban school district. This study took place during a

dissemination of One Laptop Per Child XO Laptops to elementary school students in this school system. Thus, this seemed to be an appropriate time to investigate these issues given the dissemination of a new ICT to the students. The results suggest, that even given the addition of a new ICT, there were few effects on well-being for the students. We suspect this is due to the pervasiveness of ICT devices in their larger social worlds and their prior socialization experiences with ICTs. While the goal of giving the XO laptops to the youth was to help eliminate the digital divide and to prepare them for our information based society, little attention was paid to whether students and their families owned computers before receiving the XO laptops. Some of our earlier research shows that a majority of the students reported owning or having access to computers in their households (Cotten et al., 2010). Though we do not have data to test this, we suspect that these students, as many youth their age do, had substantial prior experience with ICTs; thus, the addition of the XO laptops did not result in a disruption in this setting.

Previous research focused on predominantly White samples of college students and adults and was used to draw conclusions regarding youth. Considering the differences in developmental trajectories of adults and children as well as the differences in access and usage among these groups and along racial/ethnic lines, it was important to examine the impact of ICTs among the sample used in the current investigation. Although there were not many significant relationships found, this is a case where non-significant findings are important since earlier studies suggested that ICTs might have a negative influence on development.

While much of the research in this area, including the current study seems to follow the effects approach of examining the impact of ICTs on psychological well-being, it is necessary to consider the process approach in that children and adolescents have at least some agency regarding how much they use ICTs as well as which ICTs they use. Moreover, with the prevalence of information and communication technologies among present day youth, it is important to be aware of the ways in which ICT usage may not only impede but also facilitate healthy development (Borzekowski, 2006; Livingstone, 2007; Punamäki et al., 2007; Shaw & Gant, 2002; Wartella & Jennings, 2000). Previous findings were inconsistent (Attewell et al., 2003; Jackson, Zhao, et al., 2008; Kraut et al., 2002, 1998) and aside from being taken from predominantly white samples of adults, they only examined one type of ICT use, that of the Internet.

The current study examined the impacts of both types of ICT usage and frequency of Internet usage on depression, hopelessness, self-esteem, and

belonging, as prior researchers have noted the importance of focusing on a range of technologies being used (Cotten, Goldner, et al., 2011) and outcomes other than depression (e.g., Jackson, Zhao, et al., 2008) in a large minority sample. The results of the current study suggest that use of ICTs may have both positive and negative implications for psychological well-being but those impacts are minor. Perhaps most importantly, the results suggest that the vast majority of these measures of ICT usage and types had *NO impact* on depression, hopelessness, belonging, and self-esteem levels among the participants. Thus, our results suggest that for this sample, ICT use does not impede healthy psychological development. It may simply be that ICT use is such a major part of the normal lives or the process of socialization for these youth that it is not likely to play a significant role in their psychological well-being.

NOTE

1. For depression and hopelessness, we tested OLS regression with logged dependent variables, and count models (i.e., Poisson and negative binomial regression). The results using logged dependent variables did not differ substantially from those in Tables 2 and 3. Tests showed that the variables depression and hopelessness are over-dispersed and that negative binomial regression is a better fitting model. The results using negative binomial regression were not substantially different from the OLS model for hopelessness. However, in the depression model frequency of playing games had a small negative relationship. For self-esteem and belonging we tested a ordered logit model. The results were substantially the same as the OLS model, but for two exceptions: (1) hours using a cell phone had a small positive relationship to belonging, and (2) frequency of email use had a positive relationship to self-esteem.

ACKNOWLEDGMENT

This research was supported by a grant from the National Science Foundation (DRL-0819063; Shelia Cotten, PI).

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