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What it has or what it does not have? Signposts from US data for rural children's digital access to informal learning

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A fifth of US children live in rural areas with limited access to the informal learning opportunities available to their metropolitan counterparts. High-speed broadband internet access can be an important vehicle for delivering opportunities at home and outside of the classroom. In an attempt to explore what current data say about children's broadband access, the researcher examined recent data sets from two federal agencies. Results suggested that rural homes with children tended to have access to broadband but when they do not, cost and availability were barriers. Schools also tended to be sites of access that met the speeds required for current learning imperatives. Results are only suggestive; data sets reflect small samples not drawn from the same time or population. More precise and interoperable data must be collected for researchers and policy-makers to document the complementary roles of home and informal learning spaces in schools supported by broadband.

Keywords: broadband; informal learning; home–school continuum

1. Introduction

> Ironically, rural America has become viewed by a growing number of Americans as having a higher quality of life not because of what it has, but rather because of what it does not have! (Dillman and Tremblay 1977, 116)

Rural America has a growing, diverse, and isolated population of children with challenges; for this reason, for education researchers, rural America matters. Despite social scientists Don Dillman and Kenneth Tremblay's contention that rural American lacks many trappings of modern life, it has 75% of the US' land area and a consistently underrepresented estimated 20% of the population (United States Census Bureau 2012). Although their numbers appear to be declining, rural residents are still a noticeable proportion of the populous, especially because racial and ethnic minorities accounted for 83% of rural population growth between 2000 and 2010 (Johnson 2006, 2012). In rural America,

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nearly 28% of the child population is minority compared with 18% of the adult population. The absolute growth of school-aged minority children, including a 151% increase in Hispanic school children, is evident in rural areas even as the overall child population there declined by nearly 515,000 (Strange et al. 2012). Children on the edges of the average figures for educational attainment and other measures face serious obstacles. Many of them are in poverty, learning English, and are geographically disconnected from centers of technology, enriching activities, and academic support outside of school.

International policy researchers have pointed to informal learning as an important complement to highly variable formal learning experiences. Informal learning spaces encompass museums, public libraries, and community centers in which hands-on activities are complemented with experiences facilitated by the kinds of ultra-high-speed networking initiatives the US Ignite campaign makes available. However, for rural children, transportation to these sites is often impossible. Their parents likely work many hours and have long commutes, few homes have two vehicles, and public transportation is unavailable (Brown and Stommes 2004). Home and school are rural children's two main contacts with society and culture as well as sites of their informal learning opportunities outside of the classroom (e.g., student commons and school library).

In a rural context, much informal learning takes place through enacting tradition, engaging in hands-on learning, and participating in outdoor activities (Falk and Dierking 2010). Despite the challenges of low enrollment and teacher retention, these home-based experiences support rural schools' respectable record in providing the small class sizes, access to online learning, and after-school programs that relate to the academic achievement signified by high test scores and high school graduation rates (Strange et al. 2012). However, the degree to which these advantages can counteract the effects of predominant external factors affecting a changing generation of rural children remains to be seen when continuance to college, commitment to intellectually contributing to the community, and lifelong learning engagement are low (Strange et al. 2012). Each of these factors has been linked to the availability of broadband in the home (Economics and Statistics Administration and National Telecommunications and Information Administration 2010; National Telecommunications and Information Administration 2011). To this end, informal learning via broadband poses a possible option for the improvement of rural young people's lives.

That broadband internet should emerge as a channel of informal learning is not surprising. In any locale, the internet is a major medium for informal learning; connection speed and capacity have a special relationship with user satisfaction and engagement (Horrigan 2011). The majority of young Americans spend a good portion of their time outside of the classroom online (Rideout, Foehr, and Roberts 2010). This online time may include informal learning time that is defined as something other than what is learned in a formal classroom setting, whether it is incidental, socialized, or intentional (Joksalo and

Riu 2012; Peters 2008). For rural children, informal learning may mean engaging in self-directed use of broadband in the two non-classroom spaces they can access: home and school locations other than the classroom.

From a sociocultural perspective, this interplay between home and school has the potential to strengthen rural children's learning about the world and acquisition of digital skills. Sociocultural theorists including Lev Vygotsky discussed the importance of cultural tools, including computers, as well as books and traditions that informally teach children about the expectations of the group. By using the tools of the society, the child learns what is important in their culture. According to Vygotsky (1978), 'Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level' (57).

Access to broadband at home and in school outside of the classroom may be rural children's only opportunity to access digitally mediated informal learning (Joksalo and Riu 2012) that will benefit them in all contexts. Digital literacy resulting from informal learning is seen as a key ameliorator for economic and geographic disparities in access (Drotner, Jensen, and Schrøder 2008) and academic shortfalls – roads out of poverty and isolation for many children. In light on this combined imperative, this paper will explore the data available to document the extent to which children have access to broadband at home and in school, especially outside of the classroom. This study will be guided by three research questions:

(1) What do existing data tell us about US rural children's home access to internet?
(2) How does this access compare to children's access in urban and suburban communities?
(3) To what extent do existing public data sources allow us to investigate children's access to broadband outside the classroom, particularly at home and at school?

2. Literature review

Children should have access to 'loose spaces' and 'slack times' in order to explore the internet on their own and feed their enthusiasm to learn (Hope 2012). Rural learners' access to digitally mediated non-classroom learning experiences may take place via mobile broadband; broadband outside the home; and home broadband.

2.1. *Broadband at school*

The internet is a fundamental medium for instructing students; for teachers who discuss technology use at school, they equate the term 'technology' with high-speed internet-enabled technology (Wood and Howley 2012). Ensuring robust

school broadband is emerging as a key issue facing education in the next five years (Fox et al. 2012). Educators see the internet as offering relatively sophisticated learning activities to their student, including in terms of information gathering and as a resource that could be catered to various levels of ability (Wood and Howley 2012). However, little is known about internet access in school outside of the classroom.

Research on technology use in rural schools has predominantly involved small samples or surveys of particular school community members like teachers or administrators. Rural teachers reported that their students had much less access to computers and broadband at home than at school; an important fact taking into account socioeconomic status, in rural areas, sophistication with computer use and student motivation to use technology had a statistically significant relationship with access to computer resources at home (Wood and Howley 2012). Indeed, location has emerged as a hidden indicator of the 'digital divide': what students can access at home can influence how excited and expert they are in using technology in any location. However, in isolation, school broadband use impoverishes the possibilities of the internet for learning (Somekh 2007). Available evidence indicates that children must have access at home and at school.

Geographic disparities in rural school technology access and effects compound over time. Children's socioeconomic level, technology access, and location 'fuse together in arrangements that produce less opportunities for many, and greater opportunities for an exclusive few' (Wood and Howley 2012, 35). Wood and Howley were particularly concerned that their study of elementary children in rural Ohio revealed geographic disparities in relation to the sophistication of technology use in schools, particularly among eight year olds. They concluded that differences seen at this age were indicative of early disadvantages that contribute to profound differences in long-term educational opportunity (Wood and Howley 2012).

The detrimental effects of classroom technology in rural schools may partially be an outflow of a teaching workforce that is less skilled, less experienced, and less established (Strange et al. 2012; Warren 2007). Even armed with adequate connectivity and devices, some teachers limit internet use because they perceive that it undermines their control and exposes them to possible censure from administrators and parents (Hope 2012). This type of controlled access and teacher-led learning tends to undermine the potential of the internet in formal learning activities (Livingstone 2009).

Studies of broadband in informal learning tend to overlook spaces within the school that are not used as sites of formal learning. For example, school libraries are sites of informal learning that are very accessible to children and already provide continuity between home and school with reading and curriculum support materials (Partnership for 21st Century Skills (P21) 2012). The potential that these spaces have to support informal learning is largely ignored because formal and informal learning are usually discussed in philosophical

opposition, not as a matter of physical distance. Informal learning at school will require a fundamental philosophical shift by federal, state, and district education policy-makers (Hope 2012). An important change will need to be educators' fears for their own censure in the event of children's online misbehavior. With digital literacy skills and opportunity, children tend to behave responsibly and ethically online at home and at school, even in unsupervised areas outside of the classroom (Livingstone 2008; Livingstone and Bober 2006).

2.2. *Broadband at home*

Home broadband access is an important, but often unseen, element of children's ability to learn with technology. Geography and class are large influences on whether youth have broadband at home, despite the fact that home broadband seems to present particular benefits for rural children (Wood and Howley 2012). Because their access sites are limited mainly to home and school, children with low quality home internet access tend to limit their ideas of how the internet can be used in the learning. They develop a task-driven approach in which the internet is only used for specific purposes (Robinson 2009) and little time is left for exploration. In contrast, unrestrained informal learning allows for leisure time that is spent spontaneously exploring, augmenting school work, and enhancing information abilities (Hope 2012). A lack of home broadband prevents home as being the site of twenty-first century learning (Partnership for 21st Century Skills (P21) 2012). A robust, stable connection allows children to act as content creators, collaborators, and communicators as well as consumers with a range of Web 2.0-enabled technologies, including high-bandwidth activities such as participating in virtual worlds, engaging in simultaneous multi-player games, video blogging, and photo sharing (Selwyn 2007).

However, no amount of home adoption will eliminate the disparities in use. Home technology use follows established patterns and increased use of any technology is not the same as widened use of technology. Home access improves the circumstances of those who are engaging in informal learning in other ways; home access tends not to inspire new informal learners (Selwyn and Gorard 2004). If computers or the internet is not already woven into the behavior of the adults in the home, sustained use of broadband by any member of the household is not likely to occur.

As mentioned earlier, sociocultural theory suggests that the context in which the cultural tools are used shapes their transformative possibilities. Differences in family life and ideas of how the internet can be useful lead to different patterns of computer use, with families who have not experienced the benefits of technology and broadband using them less (Somekh 2007). For example, some adults in rural areas do not embrace technology and informal learning. Some adults feel that the internet poses threats to their children's safety and ideological development and choose not to adopt broadband for these reasons

(Livingstone and Bober 2006; Tripp 2011). Determinants of informal learning are family based. As Selwyn and Gorard (2004) reported, 'Like all learning, participation in ICT-based formal and informal learning appears to hinge not on accessibility, cost, or time constraints (although all are important in the first instance), but on the fundamental issues of motivation and disposition' (304). 'Selling' broadband on the basis of its benefits for informal learning alone is unlikely to make significant inroads into rates of adoption. The potential for change is determined by the perceptions and contexts of those undergoing the change (Somekh 2007, 39); children in the best position to benefit are likely to receive the most benefit from home broadband. Selwyn (2011a) noted:

> [D]igital technologies often seem to fit around (and be shaped by) the existing patterns in people's lives . . . The tendency to augment what has come before suggests that digital technologies in themselves will often do little to disrupt or radically alter pre-existing inequalities. From this perspective, it is perhaps not surprising that researchers often find that digital technology 'fails' to make people more likely to participate in education and (re-)engage with learning. It could be concluded that digital technology, at best, increases educational activity among those who were already learners rather than widening participation to those who had previously not taken part in formal or informal learning. (113)

With access, children will spend more time on the internet at home than at school (Somekh 2007) and those with broadband at home tend to perform better in school (Broadband Commission for Digital Development 2012). Informal learning via broadband at home allows children to attain 'flow' for rich learning and supports personal identity construction as a digital citizen. It allows for exploratory play and builds the capacity for self-directed learning (Somekh 2007); as a result, with digital technology children connect school experiences to home experiences. Informal and formal learning drive one another (Selwyn, Potter, and Cranmer 2010).

2.3. *Mobile broadband*

Mobile broadband, while a growing sector of the connectivity market, may not be ready to fully support learning in any context. Despite recent reports that show that children are increasingly using mobile devices to access the internet (Purcell 2013), mobile connectivity is less accessible and less reliable in rural areas (Federal Communications Commission 2012; Reardon 2012). Using mobile devices for learning requires more than a basic cell phone; it requires a much costlier smart phone or wireless device and service to be able to take advantage of multimedia components. Even with a smart phone, many interactive elements of online learning do not render properly and cannot be used. For this reason, mobile devices are not appropriate for learning all subjects; science learning is particularly poorly suited (GSMA Development Fund and MasterCard Foundation 2012).

2.4. *Broadband in public spaces*

Broadband is, of course, accessible in spaces outside of home and school like restaurants, public buildings, and libraries. For example, public libraries are often seen as sites for informal learning, but public librarians are often stymied in their attempts to promote digital literacy due to competing responsibilities (McShane and Thomas 2010) and public buildings do not promise support or supervision to their users (Beavis, Nixon, and Atkinson 2005). Regardless of practical considerations, users with access only in public spaces are often perceived as less sophisticated because they do not have dedicated, private access. Of the sites explored in this section, home access is perceived as superior (i.e., more stable, more convenient, and more spontaneous) to access in public spaces (Viseu et al. 2006). Still, it has been noted that effective and maximized informal learning will also depend on changed perceptions of access in public spaces (Viseu et al. 2006).

This literature review suggests that more research into how to use informal learning to increase user engagement with broadband is needed (Selwyn and Gorard 2004). In rural areas, rich informal learning environments can drive demand for broadband and, in turn, broadband can drive the demand for informal learning (Mason and Rennie 2004; Rennie and Mason 2005). For rural children, access to digitally mediated informal learning is centered on home and school sites outside of the classroom. It may be inevitable that the spread of informal learning will formalize informal learning experiences or raise expectations that children engage in informal learning to some extent (Kendall 2005), but the benefits of engaging in both formal and informal learning likely outweigh the drawbacks since bilingual content will drive the demand for broadband (Broadband Commission for Digital Development 2012).

Broadband may be a key affordance of formal and informal learning, but research suggests that reliable access to high speed, high capacity connectivity outside of the classroom may be challenging for rural children. To understand whether rural children have the option of using broadband for anywhere, anytime learning, it is important to understand the extent to which current data can be used to characterize rural children's access.

3. Method

The researcher used three data sets in two analyses. Separate analyses were required because current broadband data sets are not designed to be integrated (Carmichael et al. 2012).

3.1. *Data collection and sample*

This study was not designed to be exhaustive, but to provide a snapshot of home broadband adoption. Data sets were not available for identical time frames, so the most recent data from each provider were used.

3.1.1 *US Census data*

The data set for Analysis 1 was drawn from the US Census October 2010 Current Population Survey (CPS) School Enrollment and Internet Use Supplement and was limited only to respondents from rural areas who reported having children aged 15 or younger enrolled in school ($n = 2559$). The questionnaires used for each data set were included in the documentation for the 2010.[1] The CPS is conducted monthly and includes a random stratified sample based on citizens' characteristics such as age, sex, race, marital status, employment situation, educational attainment, family relationship, occupation, and industry. The Internet Use Supplement includes data that reflect the type of internet connection utilized at home (the respondent was asked to choose from three options: 'dial-up', 'broadband', or 'something else'). The survey also asked respondents in households in which no one used the internet or where a 'dial-up' connection was utilized to state their main reason for not using broadband internet services. Using these data, one can therefore identify households and individuals who use broadband internet at home to connect to the internet.

The October 2010 CPS School Enrollment and Internet Use Supplement[2] data were imported into Statistical Package for the Social Sciences (SPSS). The US Census data set represented a nationwide stratified sample; the researcher narrowed the data set just to include cases of households in rural areas that had children enrolled in school up to grade 12.

3.1.2 *National Telecommunications Infrastructure Agency*

Analysis 2 involved the State Broadband Initiative (SBI) Community Anchor Institution (CAI; i.e., schools, hospitals, public libraries, and community centers) data collected and maintained by National Telecommunications Infrastructure Agency (NTIA) in partnership with each state in December 2011. These data are organized by county and contain information that telecommunications and Internet Service Providers provide about the actual digital subscriber line (DSL), cable, and other terrestrial fixed broadband services to within a given state area. Analysis 2 involved the 'US CAIs' data set.[3] This table is a statistical compilation of data assembled from the 56 semi-annual state/territory submissions for the SBI. This table includes one record for each unique anchor institution for which broadband providers supplied information to NTIA. The researcher only used the records for schools that corresponded to the counties in the Census data set ($n = 411$).

3.2. *Data analysis*

For Analysis 1, the researcher conducted a secondary analysis of US Census CPS School and Internet Use Supplement survey data. The size of the data set limited the number of statistical tests that could be reasonably used. For

this reason, the researcher decided to analyze the data set with frequencies and then visually inspect the results for patterns that were either remarkably consistent with or in contrast to literature findings. Analysis 2 was also a secondary analysis and involved generating frequencies, means, and ranges for target variables. All analyses were performed with the SPSS.

4. Results

This section will present the results of Analysis 1 and Analysis 2 in an attempt to determine children's access to broadband at home and at school.

4.1. *Analysis 1: broadband access and use in rural households with children*

The intent of the first analysis was to determine how many respondents to the US Census were in households with children-accessed broadband. The Census data reflected 2322 rural respondents with children in school who answered this question, with 92% ($n = 2146$) reported accessing the internet at home. The remaining 8% ($n = 176$) reported that no one in their household connected to the internet. The respondents also reported their connection types. Table 1 illustrates the distribution of connection types from respondents who connected to the internet. Census staff recorded 2246 responses, indicating that some respondents reported more than one internet connection.

Only 110 (5%) of internet users had dial-up (slow) internet connections, while the bulk ($n = 2136$ or 95%) used some sort of broadband, including mobile broadband and satellite.

4.1.1. *Reasons for broadband non-use in rural homes*

Two groups of Census respondents were included in this analysis: respondents who had dial-up ($n = 110$; Table 1) and respondents who did not use the internet at home at all ($n = 176$; Table 2).

Table 1. Distribution of internet connection types ($n = 2246$).

Connection type	*n* (%)
Dial-up	110 (5%)
DSL	916 (40%)
Cable modem	798 (36%)
Fiber optic	59 (3%)
Mobile broadband	210 (9%)
Satellite	114 (5%)
Other broadband service	39 (2%)
Total	2246 (100%)

Table 2. Reasons for broadband non-adoption ($n = 281$).

Reason	No broadband, *n* (%)	No internet, *n* (%)	All non-users, *n* (%)
Do not need it; not interested	21 (20%)	15 (8%)	36 (13%)
Too expensive	36 (34%)	96 (56%)	132 (47%)
Can use it somewhere else	0 (0%)	18 (10%)	18 (6%)
Not available in area	45 (43%)	15 (8%)	62 (42%)
Computer inadequate	0 (0%)	8 (5%)	8 (3%)
Other reasons	3 (3%)	24 (13%)	27 (10%)
Total	105 (100%)	176 (100%)	281 (100%)

For respondents who accessed the internet at home with dial-up connection and reported their reasons for not having broadband ($n = 105$), most did not have broadband available in their area ($n = 45$ or 43%); many also reported that broadband was too expensive ($n = 36$ or 34%). Twenty-one people (20%) were not interested and three others (3%) had other reasons for not having broadband connections in their homes.

Of the respondents who reported that they did not access the internet at home at all ($n = 176$), the most frequently given reason for not having broadband ($n = 96$ or 56%) was that it was too expensive. Some of the group could access broadband elsewhere (18 or 10%) or had other reasons (24 or 13%) for not using it at home. The remaining respondents ($n = 15$ or 8%) were not interested in having broadband in their homes and had a computer that was inadequate (8 or 5%).

When the two groups were combined, expense (132 or 47%) and availability (62 or 42%) emerged as predominant reasons rural householders did not adopt broadband, with others citing a lack of interest (36 or 13%) and other reasons (27 or 10%). It should also be noted that follow-up questions were asked about which aspects of expense posed the greatest barriers to broadband adoption. Although only 36 respondents answered these follow-up questions, they reported major concerns about monthly subscription cost and installation.

In detail, Table 3 shows the respondents who did not adopt broadband broken down by income range, race, and education level.

As the table indicates, more respondents in the lowest income brackets reported that broadband was too expensive ($n = 18$ and $n = 63$, respectively), although respondents in both of the higher income brackets ($n = 9$, $n = 22$ and $n = 9$, $n = 11$, respectively) also made this report. Likewise, respondents in all income brackets reported that broadband was not available and that they were not interested.

Table 3. Demographic characteristics of broadband non-adopters.

Category	Measure	Broadband non-use reason						Total
		Do not need it; not interested	Too expensive	Can use it elsewhere	Not available in area	Computer inadequate	Other reasons	
Dial-up users								
Income	≤34,999	12	18	0	16	0	2	48
	35,000–59,999	1	9	0	22	0	0	32
	60,000≥	8	9	0	7	0	1	25
Total		21	26	0	45	0	3	105
Education	Less than high school	0	3	0	2	0	0	5
	Some high school	12	20	0	29	0	1	62
	High school graduate	2	2	0	5	0	0	9
	Some college	6	7	0	9	0	1	23
	College graduate	1	4	0	0	0	1	6
Total		21	36	0	45	0	3	105
Race	White	9	24	0	37	0	3	73
	Black	6	2	0	3	0	0	16
	Hispanic	3	2	0	0	0	0	5
	Asian	1	0	0	0	0	0	1
	Native American	2	1	0	3	0	0	6
	Multiple races	0	2	0	2	0	0	4
Total		24	38	0	45	0	3	105
Internet non-users								
Income	≤34,999	11	63	10	5	5	14	108
	35,000–59,999	2	22	6	7	2	6	45
	60,000≥	2	11	2	3	1	4	23
Total		15	96	18	15	8	24	176

Table 3. (*Continued*.)

Category	Measure	Broadband non-use reason						Total
		Do not need it; not interested	Too expensive	Can use it elsewhere	Not available in area	Computer inadequate	Other reasons	
Education	Less than high school	1	3	1	0	0	2	7
	Some high school	7	48	6	8	4	9	82
	High school graduate	0	7	0	0	2	3	12
	Some college	6	27	7	7	0	8	55
	College graduate	1	11	4	0	2	2	20
Total		15	96	18	15	8	24	176
Race	White	11	62	10	12	2	11	108
	Black	1	10	3	1	2	9	26
	Hispanic	1	13	2	1	2	1	20
	Asian	0	3	0	0	0	0	3
	Native American	2	6	2	1	2	1	14
	Multiple races	0	2	1	0	0	2	4
Total		16	109	20	16	10	25	176

Although no respondents who had not graduated high school used broadband elsewhere, most of them still used dial-up because home broadband was not available in their area ($n = 29$). In contrast, most of the respondents who had not graduated high school did not access the internet at home at all because it was too expensive ($n = 48$). As the table indicates, dial-up users and internet non-users could be found to some extent among all respondents' education levels.

Dial-up users tended to be white and not to use broadband because it was not available in their area ($n = 37$) or too expensive ($n = 24$). Similarly, white internet non-users were primarily concerned about expense ($n = 62$) also reported lack of availability ($n = 12$), perception of need ($n = 11$), expense ($n = 10$), and ability to use it elsewhere ($n = 10$) as reasons for non-adoption, although in much lower numbers. Black ($n = 10$) and Hispanic ($n = 13$) internet non-users were primarily concerned about cost, but black ($n = 6$) and Hispanic ($n = 3$) dial-up users did not perceive broadband as a need. Asian ($n = 1$ and $n = 3$, respectively), Native American ($n = 6$ and $n = 14$, respectively) and multiple race ($n = 4$ and $n = 4$, respectively) respondents in both categories responded along the same lines.

4.1.2 *Other broadband sites used by rural households*

Respondents reported using broadband in other places in addition to or instead of home. Respondents who use the internet outside of the home ($n = 2000$) at one or more of the following locations reported locations in the following order, as illustrated in Figure 1.

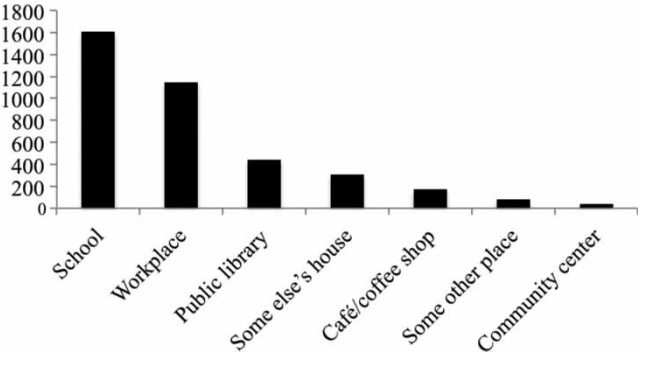

Figure 1. Broadband access sites outside the home ($n = 2000$).

As the figure demonstrates, school is used as a broadband access location by 1607 (63%) of the respondents to this question, followed by workplace access ($n = 1148$ or 57%). Far less frequently reported were the public library (439 or 17%), someone else's house (303 or 15%), café or coffee shop (169 or 9%), and a place not among the listed choices (83 or 4%).

Finally, community centers were the least frequently reported sites with only 39 (2%) of users using them.

4.2. *Analysis 2: broadband in rural schools*

The second analysis involved the schools included in the NTIA SBI CAI data set that were in counties in which respondents to the Census data resided. Of the 411 schools included in the data set, 271 reported that they had broadband. A total of 140 schools did not report data, and no schools reported that they did not have broadband. Although 383 schools did not report whether they made broadband available to the public, 15 schools reported having broadband connections available to the public and 13 reported not allowing the public to access their broadband.

Speed data were also recorded for many schools. Figure 2 illustrates these data.

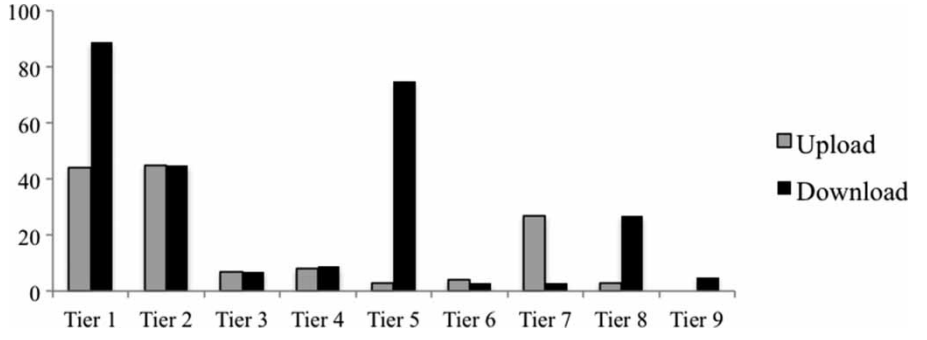

Figure 2. Broadband speeds reported in NTIA SBI data for rural schools.

First tier speeds exceed 1 gigabit per second (gbps), and speed of 100 megabits per second (mbps) or more was recorded in a second tier. Schools clustered around these tiers of speeds with 44 and 45 schools in the first two tiers of upload and 89 and 45 schools in the first two tiers of download speed. The third largest number of schools ($n = 75$) were in the fifth tier with download speed between 10 and 25 mbps, the seventh tier of upload ($n = 27$) at speed between 3 and 6 mbps, and the eighth tier of download speed between 1.5 and 3 mbps.

5. Discussion

In this study, the researcher set out to explore data that may give insight into children's access to broadband for informal learning at home and in school sites outside of the classroom. The researcher analyzed publicly available data from the US Census and NTIA in pursuit of two research questions.

5.1. *What do existing data tell us about US rural children's home and school access to internet?*

Prior research (e.g., Horrigan 2011) has suggested that rural home broadband non-adoption stems from perceptions that high-speed access to the internet is not important. However, these results suggest that children in rural areas have access to broadband at home, but when it is limited, it is due to issues relating to availability and cost. These reasons for parents' non-adoption of broadband occur at every economic level and in every race and education category. Data did not demonstrate that many respondents reported that broadband was not important.

Children have access to broadband primarily through home DSL connections and school. Frequently, parents' workplaces provide access to at least some person in the household. This analysis suggested that children far less frequently access broadband through public libraries, cafés, and community centers. Home and school emerged as key locations. School connections also appeared to be robust with most schools meeting the near-term imperative of at least 100 mbps with many schools meeting the 2017–2018 recommended threshold of 1 gbps (Fox et al. 2012), although these data do not indicate the number and sites of access points or speed at the actual end-user level.

5.2. *To what extent do existing public data sources allow us to investigate children's access to broadband outside the classroom, particularly at home and at school?*

The results of the data analyses demonstrated that publicly available data sets do not allow for the granular, in-depth analysis of broadband adoption in rural homes with children. This challenge is partially due to the data sets themselves. Some data are collected in an effort to reflect public attitudes about broadband and those attitudes can be cross-tabulated with other demographic factors that generate a highly correlative and potentially misleading view about the relationship between a survey respondent's location, ethnic and economic background, and desire to use broadband at home or in another location. Any conclusions drawn from these data are heavy with caveats relating to the character of the sample as well as to the substitution of causation for correlation. A second challenge from existing data stems from a lack of agreed-upon metrics or units of analysis between providers of subscriber data and US Census respondent approaches. It is simply not possible to integrate findings from the Federal Communications Commission and Census data because not enough information is available to match respondents or judge their overlap.

A third, but insurmountable, issue has to do with data that are not being collected or made available at all. There is no single repository of school broadband data at the school district, building, or instructional context level. To this end, connections that might be drawn between home broadband use and school use cannot even be guessed. For children in rural communities who may lack

home broadband, the precise contribution of their access at school cannot be uncovered. Currently, it is just not possible to characterize access in school libraries, common areas, and other non-classroom sites.

This measurement confusion also applies to the varied definitions of 'rural'. In this study, the researcher defaulted to the designations of rural used by the data providers. These definitions were based on a county designation of metropolitan status, but these definitions are revised occasionally and certainly frustrated long-term analysis. The 'rural' designation also homogenizes the range of rural communities that may center on retirement, recreation, manufacturing, mining, or farming activities. Limiting the Census analysis to just homes with children was an attempt to try to offset some of the differences these various cores might introduce, but it is very likely that a home with children in the midst of a rural county centered on recreation is different than a home with children in a rural county centered on mining.

However, these frustrating factors do not erase the importance of studying rural children's access to informal learning opportunities that allow them to build important technology and media skills. In keeping with sociocultural theory's emphasis on learning as being a blend of individual and socially led and contextualized activity, school is often the only place isolated rural children come into contact with adults and peers that create this social context. The school library plays and will continue to play a vital role in providing a third learning space that bridges home and classroom.

6. Conclusion

In contrast to thinking of informal learning as something that must take place outside of the school building, for children in rural areas, inside school spaces may be their only opportunities to access informal learning opportunities. For rural children, the geographic accessibility of their schools plays a number of roles that other institutions and organizations play in urban and suburban environments. With uncertain access to public library, café, and community centers, access to broadband in school but outside of formal classroom learning means that

> Cultivating collaborative and meaningful school/community development will be a hallmark of good public schools that can meet the challenges facing rural communities and their students in the 21st Century. Collaboration must extend beyond a singular focus on student achievement to a blended community and educational leadership strategy that takes as a fundamental assumption that ensuring the academic success of students, on the one hand, and the social and economic vitality of the rural community, on the other, are not mutually exclusive priorities, but are instead deeply and indeed inextricably connected. (Harmon and Schafft 2009, 9)

School access to broadband outside of formal classroom learning time is an important equalizer for rural children because it provides, as Vygotsky

proposes, a 'zone of proximal development', where informal learning becomes an extension of formal learning. School use must complement home use in order for digital literacy to be attained through practice and application (Somekh 2007). Questions about the appropriate balance between informal and formal learning are part of a deeper discussion about the nature and purpose of schooling in the twenty-first century where children have unprecedented opportunities to act as content creators, collaborate without spatial or temporal limitations, construct meanings across a vast array of media, and communicate their ideas via Web 2.0 and social media. Children should have input into the kinds of experiences they would like to have and the kinds of rules that are reasonable to balance safety with responsible risk-taking (Hope 2012).

These discussions should prompt fresh examinations into the preferred locations and means of obtaining knowledge (Hope 2012) as well as how to offset the disadvantages that children without home broadband may face. While the value of informal learning cannot be ignored, its best application may be as a companion to formal learning. As Selwyn (2011b) reminds:

> For all its intuitive appeal, the widespread valorization of informal learning and the curricularization of children's digitally-based leisure activities dangerously depoliticizes the act of learning – over-emphasizing the technology-empowered individual learner and distracting attention away from matters of structural inequality and oppressions . . . formal schooling also fulfill[s] a societal purpose as a valuable source of 'powerful knowledge' and social mobility for all, not just the technologically-privileged few. (133)

The results of this study suggest that longer term, more granular, and interoperable data must be collected to help researchers and policy-makers know the differences broadband can influence (Carmichael et al. 2012). A focus on making informal learning spaces in schools accessible and documenting that access via better connectivity data will raise awareness of the importance of home broadband. Together, these improvements in data and access can promote the digital literacy that may offer children a choice to embrace rural life for, as Dillman and Tremblay (1977) observed, what it has or work toward attaining what it does not have.

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Notes

1. Data collection instrument available at http://www.census.gov/apsd/techdoc/cps/cpsoct10.pdf.
2. Data available at http://smpbff2.dsd.census.gov/pub/cps/supps/oct10pub.dat.gz.

3. Data available at http://www2.ntia.doc.gov/files/broadband-data/All-NBM-CAI-December-2011.zip.

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