The Non-Binary Nature of Internet Adoption

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Abstract

The “technological careers” of Berkeley Freshmen are used to demonstrate that the binary nature of technology adoption in the classical diffusion model is inadequate to understand or articulate the digital divide. Adoption of the internet takes place within a communication infrastructure, and the use of the internet will take place in a social context. Thus, “adoption” of a technology does not necessarily have the same consequences for everyone. This paper analyzes data collected through surveys, interviews, and focus groups of Berkeley freshmen about their “adoption” of the a computer connected to the internet, as well as email and IM. The students in this study from the lowest income groups (families that make less than $35,000 per year) did not typically have much guidance from parents with regards to technology use. The lowest income students were far more reliant on teachers to show them how to use the internet. Sometimes the lowest income students even acted as proxies for their parents and whatever their parents wanted to do with a computer. Adoption of a technology in the Berkeley freshmen case is a complex issue involving who supports their technology use from an resource provision and instructional perspective. Additionally, with computing technology, it is more challenging to study the adoption of a specific technology because technologies are often bundled together.
**Introduction**

Given the perceived importance of the internet, scholars, policymakers and pundits have become concerned with a “digital divide.” The digital divide is generally described as being between those who have access to the internet and those who do not. Much work has been done to describe who has “adopted” the internet, and who has not. Much work has gone into trying to alleviate the digital divide for those who do not have access to the online world. The goal of this paper is to explain how classical adoption models are inadequate to describe the process of technology adoption with the internet, especially when looking at the digital divide. This paper is not meant to address the importance of the internet, but to underscore why simply stating that an individual has adopted or not adopted the internet may not help us to understand the issues of equality that are the concern of the “digital divide.”

In the following section, I will describe some of the facets of the classical diffusion literature, as well as it's shortcomings, particularly when considering the “digital divide.” I will then describe the diffusion research about the digital divide, and the new digital divide research agenda. In the next section I will look specifically at the case of Berkeley freshmen.

**Classical Diffusion Research**

Everett Rogers wrote a book called *Diffusion of Innovations* in 1963 that is now in it's fifth edition (in 2003). It is a foundational book that reviews much of the literature in the field of diffusion research. I will use Rogers' foundational work to establish much of the basic vernacular used in the classical diffusion model. Other perspectives on the diffusion of innovation tend to focus on organizational structure and political perspectives (Sheirer, 1990), though this paper will focus exclusively on the classical diffusion model. Rogers(2003) describes a process of diffusion where “innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2003). Diffusion is essentially a special kind of communication that is about innovations. An “innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption.” For the purposes of this paper, the innovations we will be addressing is the computer connected to the internet, and some of the communications applications such as email and IM that you might use on a computer connected to the internet.

The innovation-decision process as described by Rogers (2003) is essentially an information seeking and processing activity that results in a decision to adopt or reject an innovation. Rogers (2003) summarizes the innovation-decision process and the steps that lead up to adoption as “knowledge” and “persuasion.” The stages are not necessarily sequential. He describes the prior conditions leading up to this process as including the individual's previous practices, their felt needs and problems, the individual's innovativeness, and the norms of the social system (Rogers, 2003). The knowledge stage of Rogers' innovation-decision process includes the characteristics of the decision making unit as socioeconomic, personality variables and communication behavior (including that individuals only hear what they want to). Individuals who know about a innovation earlier typically have more education, higher social status, more exposure to mass media, more exposure to interpersonal channels, more contact with change agents, more social participation, are more cosmopolitan. Following the knowledge part of the adoption process is persuasion (Rogers, 2003). In both the knowledge and the persuasion stages, the individual is seeking information that may help them make a decision, but in the persuasion stage, an individual looks at the perceived characteristics of an
innovation: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). The outcome of the persuasion stage is typically an attitude about the technology. At a certain point, however, adoption of an innovation might take place. Adoption is “a decision to make full use of an innovation as the best course of action” (Rogers, 2003).

There are some acknowledged shortcomings of the classical diffusion model such as the pro-innovation bias and the individual blame bias. The classical diffusion model is also problematic in that it doesn't take into account how an innovation might change, or how innovations can be bundled. Rogers (2003) talks about how there is often reinvention of an innovation which is generally not included in the diffusion in networks model. For example, in the instance of a computer, the meaning of owning a computer changed drastically as the internet became available to individuals in their homes. The types of technology that one adopts may be tightly related to each other, and treating the technologies as discrete adoption events is not appropriate. For example, one cannot use IM technology without a computer connected to the internet, so it might be misleading to describe IM adoption because there is an pro-innovation bias, which assumes that everyone has access to the internet.

Furthermore, the relationship between ownership and access with regards to adoption of a computer is not always clear. Ultimately, the biggest problem with the classical adoption and diffusion models is that they treat adoption as a binary activity – either one has adopted a technology or not.

When exclusive emphasis is placed on owning or having access by using these dichotomous have/have-not comparisons, the assumption is that either all haves will incorporate the technology into their everyday lives in the same manner and to the same degree or that the difference in the quality of Internet connection among the haves is unimportant. In other words, these measures introduce an element of technological determinism that ignores the social context in which the technology is incorporated.

(Jung et al, 2001)

One cannot adequately understand the importance of technology adoption by treating it as an on/off variable. In policy work on the “digital divide,” adoption will be a complicated process that doesn't have an necessarily expected outcome. A more nuanced understanding of what it means to adopt a technology can help “bridge the digital divide.”

**Digital Divide Research**

According to Chen and Wellman (2003), there have been three phases of research about internet diffusion and the digital divide. The first phase was in the early 1990s when pundits claimed that the internet would “level the playing field.” In reaction to this, others claimed that the internet would

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1 The individual blame bias is the “tendency to hold an individual responsible” for their adoption or non-adoption of an innovation rather than the social system the individual acts in (Rogers 2003).
2 There is almost an assumption that everyone is a possible user of an innovation, and the fact that someone's lifestyle might be incompatible with an innovation is completely ignored. This is described as an aspect of the pro-innovation bias of the research (Rogers, 2003).
3 Thompson (1967) discussed reciprocal interdependence as “the situation in which the outputs of each become inputs for the others.” Thompson distinguished reciprocal interdependence from sequential interdependence (“when the order of interdependence can be specified”) and pooled interdependence (where “each part renders a discrete contribution to the whole and each is supported by the whole”). It seems that with many information and communication technologies, there is a problem of both reciprocal interdependence, and sequential interdependence.
reproduce all inequalities. The second phase of internet research began in the late 1990s when more rigorous, empirical research demonstrated a “digital divide” between groups according to gender, socio-economic status, ethnicity, age, and geographic location.

The third phase of internet diffusion and digital divide research began after 2000 when internet scholars start to develop a more realistic picture of what the digital divide means and what is the impact of the internet (Chen and Wellman, 2003). This new phase of research has set forth what I will describe what I see as the “new” internet diffusion and digital divide research agenda. In the new agenda, some researchers looked at “openness” of a society in terms of civil liberties with cross-national studies and found that openness seemed to have an influence on internet diffusion (Beilock and Dimitrova, 2003). Agricultural innovation diffusion researchers argued for more focus on how national policy influences adoption (Feder et al, 1985). A few diffusion researchers looked at how innovations can be bundled, and how adoption decisions about a particular technology are not completely independent (e.g. Feder et al., 1985; Rangaswamy and Gupta, 1999). The new agenda is not just focused on who is using the internet, but also how people are using the internet. Some researchers are examining how people use technology in different ways (e.g. DiMaggio and Celeste, 2004; Robinson et al., 2003). There is also agreement that people use the internet differently because they have different skill levels, and researchers look at how to measure those different skill levels (Hargattai, 2003). However, despite the fact that the new agenda addresses the larger context of internet use, it is still generally acknowledged that income is the strongest determinant of internet adoption (Beilock and Dimitrova, 2003; Chen and Wellman, 2003).

Researchers have come up with a variety of alternative ways to measure adoption, a few of which I will briefly summarize here. The Internet Connectedness Index (ICI) looks at goals, and activities related to the internet and the centrality of the internet to individuals (Jung et al., 2001). The ICI is meant to address inequality issues in more complex ways than just looking at technology ownership, or time spent online by looking at how the internet might increase upward mobility. Another alternative measure looks at internet use as a continuum to better understand non-internet users (Lenhart and Horrigan, 2003). The continuum of non-internet users includes the truly unconnected, net evaders, net dropouts and intermittent users. Each group has unique reasons for not using the internet, and from a policymakers perspective should be understood as such. Lastly, researchers talk about “the second-level digital divide” which is a digital divide in a users' internet-related skills (Hargattai, 2003).

The research framework that I am going to use for the purpose of this paper is that of a “communication infrastructure” (Jung et al., 2001; Jung et al., 2005). The idea of communication infrastructure does not emphasize just the ownership of a technology, but the individual's relation to a technology within their larger web of relationships. The internet is seen as part of a communication infrastructure that includes personal relationships, institutions large and small, and the mass media. In this sense, I will examine the case of Berkeley students and their technological careers within a student's communication infrastructure. The careers of young people will particularly focus on the roles of families, especially parents, and also the role of teachers in a student's communication infrastructure. We will also briefly look at the importance of friends and siblings, and what students are learning on their own. The focus is not so much on who the student is communicating with using the internet, email and instant messenger, but how the communication infrastructure supports the use of technologies.
Case: Berkeley Students

This paper takes the case of Berkeley students in light of the “digital divide” in order to explore the non-binary nature of adoption of computer technologies. Although the non-binary nature of technology adoption might seem like a rather simplistic point, I hope to demonstrate that it has farther reaching implications in terms of understanding what it might mean for a young person to adopt the internet. Below I describe how we collected data about the Berkeley freshmen, the findings relevant to this paper, and some implications of the findings.

Methodology

There were two research sites, University of California, Berkeley and Ohlone College in Fremont, California. Most of the research was done at Berkeley, and Ohlone was used to test some of our assumptions about the Berkeley students, because UC Berkeley is a unique set of 18 and 19 year olds in terms of level of academic achievement. The data presented in this paper is from the UC Berkeley research site, and is data about 18 and 19 year old freshmen collected during their freshmen year in 2005-2006.

Two primary sources of data were collected: quantitative data through surveys and qualitative data through interviews and focus group. The quantitative and qualitative data provide a rich picture of the “technological careers” (DiMaggio and Celeste, 2004) of research subjects at UC Berkeley. Qualitative data gives in depth stories about the young people while the quantitative data made it possible to see trends across the Berkeley campus population. While traditional ethnographic observation yields more accurate pictures of what people are actually doing, observation has a few limitations that for the purposes of this study made it an impractical option. First, the focus of this study is student's stories in how they use information and communication technologies, but also importantly how they came to use these technologies (the student's “technological career”). All of the data in this study presented below is exclusively from the perspective of young people. Thus, statements are made below about the families and parents of young people that might not completely reflect an accurate reality, but do reflect the perspective of the young people in this study, which has its own significance. By asking students to tell stories about technology use and adoption in their own words, a recall problem is introduced. Students may not accurately remember their childhood that they are asked about in the survey or focus groups. Additionally, there is a self-reporting problem. Students often have trouble accurately describing their actions. One way to attempt mitigate this problem is to use the survey results to confirm trends found in the focus groups and interviews.

Yet another reason focus groups and interviews seemed like an appropriate research medium was that most of the information and communication technology we were interested in was either personal communication software on a computer, or mobile devices. It would have been hard to observe students using these technologies without having to sit in students' dorm rooms, or follow students around campus looking over their shoulder, or install tracking software on their devices that could invade their privacy. Thus, simply asking students about their practices was more practical.

The first version of this study took place in March 2005. Although, the results of this study are not reported on here, the data from the first study strongly informed future studies, so high level details about the data collection are provided here. 22 open-ended interviews lasting from 60 to 90 minutes were conducted with Berkeley Freshmen in the first phase of the study. These Freshmen were recruited from a base of students who had responded to a survey. We distributed a survey to a random sample of about 500 Berkeley freshmen, for which we had 80 respondents. The survey aimed to get a overview about how Berkeley freshmen used technology. The list of technologies and questions for the
survey and interviews were generated from our pre-test subjects. The March 2005 interviews provided a base understanding of what the Berkeley experience was like for freshmen, especially in terms of their technology use. In March of 2005, the research particularly focused on social aspects of technology adoption and how students used information and communication technologies to support their social network. The data from the March 2005 study was used to write survey and focus group questions for the work done later in the year.

In the March of 2006, 8 focus groups were conducted varying in size from 2 to 5 students. A total of 32 Berkeley freshmen participated in the focus groups. The focus group participants were recruited based on responses to a survey conducted by Berkeley’s Office of Student Research. The Office of Student Research gave an online survey in August of 2005 to all of the incoming freshmen. There were 2921 responses out of 4105 new students. The final version of the survey asked questions covering when the students began using technologies, how often they use them, who taught them how to use those technologies, and how they thought that their technology use compared to their high school peers. A response bias might exist as students who are more heavy email or internet users might be more likely to respond to an internet based survey. Additionally, by recruiting students over email, we might have biased the survey to those who check their email more frequently, or read their email more thoroughly.

Four of the March 2006 focus groups (which included 17 of the students) were composed of students who claimed on the OSR survey that they came from households that made less than $35,000 per year and who responded they were “very confident” about this response (roughly 266 responses). This pool of the “lowest income” students was divided into four groups, and we recruited for the focus groups from each of the four groups. One focus group was recruited from those who responded that they updated their blog at least once a day. Another group was formed by students who either started playing video games at an early age (before the age of 13), or play games very frequently (at least once a week). The last two groups were formed by randomly dividing the remaining students into two segments. The students were not told how they were selected for the focus groups other than it was “based on their responses to the OSR survey.”

Although income is still considered the strongest predictor of internet use, one can raise questions about dividing focus groups along income lines, as that is considered a somewhat passe method for examining the digital divide. The income range that I chose to look at was somewhat arbitrary, but was in accord with the two lowest income levels that could be selected on the OSR survey. In any way, this is looking at the digital divide through the old school ideas about a digital divide – namely that it was a divide between the haves and have nots, when it is obviously a much more complex issue than this. The interesting aspect of looking at the lowest income students is not necessarily that they are on the have not side of the digital divide in terms of adoption. The fascinating aspects of the findings is that the nature of the lowest income student's adoption of the internet is somewhat different than that of the higher income students. Some students in the lowest income focus groups commented that they felt that their technology use was strongly influenced by the fact that their parents were immigrants to the United States. Interestingly, 85% of the students in the lowest income groups had at least one or both of their parents were born outside of the United States (compared to 68% of the overall student population). Thus, family immigration status might also strongly influence internet use, but it is not the focus of this study.

In my explication of the experiences of the lowest income students below, I hope to show why looking at the digital divide in terms of simply adoption is inadequate to understand the digital divide's importance.
Results from Focus Groups

Naturally, one cannot lump all students from a certain socio-economic profile into a single persona that is represented by a single person. I will describe some of the issues that seem to confront students from the lowest income group using quotes from this student group. I don't want to imply that there are not issues like this for students from non-lowest income groups or that all students from the lowest income group face the exact same experiences, but the issues described below seem to consistently face students from the lowest income groups. I will describe aspects of technology adoption that will hopefully clarify the experience of students from the lowest income group.

First experiences with a computer in school

Many students in the lowest income group remembered first using computers in an institutional setting, typically in classrooms at school. Oftentimes students didn't have a clear memory of exactly when they first saw computers, but it is clear that many of their first experiences using a computer were at school. Some students first experience was with with computer games such a “Oregon Trail.” Others described experiences with math oriented games like number munchers. Paolo describes his first experiences with a computer in fifth grad at school:

> I believe - in our elementary school we had computers, and we started - they introduced you to a computer. At first it was painting. Making art on the computers... then writing little short letters.

The experience of Paolo and many other students underscores the importance of computers in the classrooms for students whose parents don't have computers at home.

Students drive family technology purchases

One marked difference between students in the lowest income group and students in higher income groups was in the purchase of a family computer. Typically, the with the lowest income groups, the computer was bought for educational purposes for the kids. This is quite unlike students from other income levels where parents might use a computer for work, and therefore have one at home. Some of the students in the lowest income group described that they started using one early on because their families had a computer for older siblings.

Parents seemed to believe in the educational value of computers. Although Maria's parents didn't use a computer, they made sure that she got one. Here she describes how she got her first computer:

> But I remember when I got my first computer, I was 10 or 11, and it was through one of my parents’, really really close friends (he built computers). So we went to his house, and we were ready to pick up my computer. And he said, “Oh, type in your name.” And I was like – [imitates typing with two fingers]. Yeah, I remember that very well. That was quite an experience.

It is interesting is that students from the lowest income group often had clearer memories of when they first got a computer at home, where some students from other income groups didn't remember when their family got their first computer – it was something that was always there that one of their parents (typically the father) used for work purposes.

Some of the lowest income students regularly used the internet at school or at the library until
their parents got it at home (sometimes not until late in high school). Similar to the purchase of a family computer, getting the internet at home was typically driven by the students needing the internet for educational purposes.

Joseph: I had to install the internet service myself because my parents don’t know anything about computers. So basically I had to set up everything myself and I remember I got it senior year too. I needed it for school.

Moderator: How did you first get your parents to get it for you?

Joseph: Oh it was hard. They didn’t know what it was. I said “I need it for school. That’s all you need to worry about. Just pay for it.”

Although many students used the internet for recreational purposes it seemed that they all felt that it was necessary for school purposes. Students who didn't get the internet until late in high school were more apt to describe it as a necessity for educational purposes. Students who got the internet at home earlier on were less likely to talk about getting the internet for educational purposes. Eric described why he and his mother got the internet in sixth grade (about 1999) and he got his first email account:

Probably [I got the internet] just for school, I guess. But you know - it was touted as good for children’s education and they can research things and stuff. So I guess I really don’t know why. We didn’t need it. None of our family had computers or anything or email and I never got emails when I was a kid. The only ones [emails] I got were like from AOL, the CEO guy, that said, “Welcome,” and that was it.

Students from lower income families might not have had the same social network online that many other students had at an early time. Interestingly, getting the internet at home corresponded with getting an email account, but this did not correspond with the student really adopting a practice of emailing others.

Mediating the parents technology use

Students from the lowest income group described getting the internet at home because of their needs, and they often were the people at home who had technological expertise about the internet and its features. Monica described her parents computer use:

My dad is pretty computer-literate. But my mom is completely not – I write all her emails, and I had to teach her how to use it, how to send emails. I’m still in the process of trying to make her be more computer literate.

Students not only try to aid their parents using the computer, but often use the internet on their parents behalf. Heather described trying to teach her mom how to use the computer:

I try a little bit, but she’s like, “Can you just do it?” Like she won’t look at something online. She’s like, “Can you just do it?” I try to show her, but it's “Can you just do it and tell me, or show me when the page is up?”

Students even acted as proxies for their parents making purchases for them online. Tom described how his parents use his email account to send email, and he pays his parents taxes online. A few students in the lowest income group described their parents having some fear of computers, and actively avoiding
it. One student, Nicole, felt that her parents have trouble using the computer because they are not fluent in English. Nicole also described how parents who taught their kids to use computers might also be more supportive of academic endeavors in general:

Parents who teach their kids [to use the computer], well, if they weren’t born here, their parents are computer engineers or something, and so their families are very academic and very academic oriented. And my parents aren’t. And so I feel like because their parents have all these high degrees and work in such high tech fields- I see it a lot where the parents are really smart and like we’ll say there’s two professionals, and the kid is more likely to do well academically just because in that household. You go home, you study. That’s the way you do it. But in other households, just to make the effort, that’s not normal. So you have to make more effort to do it. But I think I turned out okay.

However, many students didn't feel that they were at a disadvantage with parents who were unfamiliar with the computer because they were forced to learn things on their own through experimentation and trial and error. I also wonder if by being a computer expert within the household, students developed better skills with difficult computing problems.

Currently, parents are encouraged to talk to their children about internet use and how to use the internet in a non-harmful manner. Students in the lowest income group were not only getting no guidance from their parents, but seemed to navigate their parents computer usage as well, making it difficult for the students to imagine their parents cautioning them about certain risky practices on the internet. Students in the lowest income group rarely spoke of restrictions on their computer use. When the lowest income students were asked if they were ever concerned about their parents seeing their MySpace or Facebook (social networking sites) profiles, most of the students dismissed the question because they believed that their parents had no idea what internet technologies are. Some students who were older siblings spoke about monitoring their younger siblings' computing activities as though they were parents. Robert was very concerned about his brother's video game playing:

When I used to play games, he[my brother] would just be watching me and be fascinated by what I’m doing. But then as I grew up, as I went into high school, there was more him playing games, then me trying to stop him from playing games? So in that sense, there was a lot of, I guess, arguments.....He promised me that he won’t [play games]. We have this verbal contract thing. But I’m calling him, and hopefully he’s not playing. He’s telling me he’s not. So I’m trusting him..... The thing is, my parents have almost no control over him. ‘Cause he’s a very rebellious guy. He’s in seventh grade. And the fact that my parents are always working and there’s nobody to look after him. So yeah, we all look to him to decide.

Robert was somewhat unusual in that he had decided he didn't like technology and refused to own a computer.

Students from the lowest income group were in a somewhat unusual position in that computing for educational purposes was certainly sanctioned, however computing for other purposes was more of a grey area in that their parents had very little exposure to issues that the students might have encountered.
Buying a computer for Berkeley

When it came time to buy a computer for college, many students from the lowest income group buy their computers for school with money that they have made from their own jobs. One student commented that he might not have bought a computer for school if he was able to find computer labs at Berkeley that were open 24-hours a day. Another student convinced his parents to get the first family computer when he was in tenth grade and uses that computer for Berkeley. He would like to buy a new computer but is waiting to see if his appeals for more financial aid money were successful. Because many students are spending their own money on their computer, some of them are more sensitive about the quality of the products. Here, Bob describes how he has bought several computers and returned them because he wasn’t satisfied with the quality of the computers:

I bought a laptop - I actually sort of went through three of them. Well, I didn’t keep all three. While I was at home, I was working over the summer, and that’s where my first paychecks went. And I bought it [the first laptop] at a brick and mortar store, Best Buy or something. And then I didn’t like it, so I took it back a few days later… And then I ordered another one online from HP, and then I used that for about two or three weeks. And then I didn’t like it, so I returned it again. And then I finally bought a third one online from Sony this time, and that’s the one I’ve kept. I would have returned it, but literally the day before I returned it, I was getting up into my bed in the dorms, and I smashed the lid on top of the beams, and it scratched the lid. So if I returned it, I knew I wouldn’t get all my money back, so I said forget it, and I’ll keep it. And then I also bought a digital camera for recreational uses. I realized that everyone else was taking pictures of everything, and I didn’t have pictures of anything, so I bought a digital camera.

In Bob’s comment about his purchases, we can see here that students may care about having their technology use be on par with that of other students. In future studies, it might be interesting to look more into the material attraction of technology. In general though, many students from low-income groups either owned older computers, or had purchased computers themselves for school.

Results from Survey

This analysis will use descriptive statistics to address some issues from the qualitative study. Although the August 2005 survey to incoming Berkeley Freshmen asked about 19 different technologies, the focus is on three: using a computer connected to the internet, using email, and using IM. For each of these technologies, the age that a student first used a technology will be examined relative to income. The other aspect of each technology examined is how students learned how to use technologies relative to income.

Illustrations 1 and 2 in the following pages show when students first used the internet and who showed them how to use it. It appears that students from higher income groups tended to get online at

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4 The question was phrased: “Think back to when you first started doing the following. How old were you when you did each for the FIRST TIME?” (For all of the graphs presented below, when respondents answered “don’t know” or the respondents did not respond to the question, their responses are not displayed in the graph.)

5 The questions was phrased: “Please indicate from whom you learned how to do the following. Choose the most important source for each activity” (For the question about how students learned to use a technology, responses of “Never/Not applicable,” “Don’t Remember” and “From the Internet” or when students did not respond were not represented in the graphs below.)
an earlier age than students from lower income groups. Students from higher income groups appeared to be learning how to use the computer from their parents, where students from lower income groups learn on their own, and learned more from teachers and siblings than students from higher income groups. For kids who are not going to see a computer at home, this points out the importance of having computers in classrooms and knowledgeable staff to help students use the computers. This in some ways reiterates what we found in the qualitative interviews in that students in the lowest income group often had their first experiences with computers at school (but not necessarily computers connected to the internet). It also strongly echoes the idea that parents of the lowest income students provided less guidance with regards to internet use.

The second case is that of email shown in illustrations 3 and 4. Again, students from higher income levels are using email at an earlier time than students from lower income levels. There is a slightly greater group of students in the lowest income level who are first using email in the age range of 14-17. However, it appears that most students, regardless of income level are learning to use email at the age of 11-13 (generally, middle school). Again, parents seemed to play a much bigger role teaching the students from higher income groups to use email, where students from lower income groups mainly learned on their own. Some researchers hypothesize that people from low income groups use email less because they don't have as many people in their social network online and available to email (e.g. Jackson, 2003). Interestingly, it again seems that students from the lower income groups rely on the their siblings more than the higher income students. It seems that teachers don't seem to have much of a role in showing students how to email, however, it is not entirely clear to me whether schools played much of a role in student's emailing for the first time.

The last case examined is that of instant messenger (or IM) in illustrations 5 and 6. Again, we see that students from higher income levels tended to start using IM at an earlier age than the lower income students, although the relationship between income and the first time using IM is not strong, or as consistent as with getting a computer connected to the internet. Again, the lowest income students are most reliant on learning about IM on their own. Interestingly, students from lower income groups seem to again be learning about IM more from their siblings than the students from higher income groups. IM is typically used by students to communicate with their peers, it is not surprising that students would learn about IM from their friends. Interestingly, students from higher income groups seem to learn about IM more from their friends. I wonder if this is because students from higher income groups have friends who are also from higher income groups, and thus are more likely to have access to internet connections and to instant messenger.

Discussion

When we take the findings from the qualitative focus groups together with the survey, we are able to understand something about the experiences with the internet of Berkeley freshmen from lowest income families. The case of Berkeley freshmen can help us to understand some issues in the classical model of adoption as well as understand some current “digital divide” issues. Below I discuss several of the findings from the study and their relationship to the current understandings about technology adoption with the lens of the communication infrastructure framework.

The importance of communication infrastructure

The communication infrastructure framework looks at the interpersonal relationships of the individual, the institutions that they belong to, and the impact of the mass media. It seems that parents play an extremely important role in students’ experience with the internet both by providing resource support
and instructional support. Parents can be very important parts of a higher income student's communication infrastructure because of the resource support that they can provide the students (by providing students with a computer with an internet connection at home). Additionally, parents of higher income young people provide instructional support, showing students how to use the computer connected to the internet. It seems that the communication infrastructures of lowest income students is somewhat different; teachers and siblings provide some instructional support to students from the lowest income groups, and parents provide almost no instructional support.

I am not sure why students from lower income families are shown by siblings how to use internet technologies more than the higher income students. Perhaps students from lower income families did not have peers outside of their household that knew about internet technologies such as IM, so the lower income students found help from the only peers that had the same resources as them – their siblings. Further research is needed to specifically understand the role of siblings in learning about technologies.

Additionally, once students learned how to use internet technologies, most of the lowest income students had to take a lot of responsibility with their internet use. Learning on one's own was often seen by the students as positive because they were forced to learn through experimentation, but it also raises issues about how parents are supposed to educate their children about technologies such as MySpace when they don't know about these technologies themselves.

It seems as students get older and start to use more social technologies such as IM (and perhaps gain more comfort and skill with the computer), parents and institutions become less important. With the case of IM students from lower income groups are again experimenting and learning more on their own, and students from higher income groups are able to rely on their more resource rich peers.

In general, more work needs to be done to understand the long term impact of the different communication infrastructures on technology use. Additionally, more work is needed to understand the impact of learning to use a technology on your own versus learning to use a technology from another person. The fact that all the students that I interviewed were at Berkeley shows that the different experiences may not have had a terribly long term impact on the students, however, the Berkeley student population is unusually high achieving when it comes to academics. One could take the position that the lowest income students are exceptionally high achieving and that their low income secondary school peers might not have the same experience with internet technologies. However, on the August 2005 survey students were asked to compare their use of the same 19 technologies to that of other students at their high school, and there was no noticeable difference in the way that the lowest income students thought they compared to their peers and the way that the highest income students compared themselves to their peers.

**Bundled internet technologies**

Since IM and email necessitate a device (usually a computer) with an internet connection, it is interesting to focus on access to the computer with an internet connection because it has the greatest cost. One lingering question is whether families from the lowest income groups got a computer strictly because students needed the computer for educational purposes, or whether computers also became more financially accessible to people from this income group in a certain time period. Based on the focus groups, it seems like the lowest income families were motivated to buy a computer for educational purposes, but there were often stories about how families found reasonably priced computers (such as Nicole's family friend who built her a computer).
One does not necessarily need to own a computer to use computing technology, but owning a computer might create a different adoption experience. When does adoption necessitate ownership of a computer? I would argue that ownership is not necessary for adoption, however, with a recreational application such as IM, owning a computer might greatly facilitate its use if one only has access to a computer in educational settings (where the computer is meant to be used for educational purposes). So if one only uses IM technology on a public access computer, has that individual adopted a computer connected to the internet, and has that individual adopted IM technology? If the answer to each is yes, then is it then appropriate to assert that the individual who owns a computer connected to the internet and the individual who uses the public access internet connected computer have both equally “adopted” the computer? Probably not because their experiences using the computer could be vastly different.

In the case of the lowest income students, if they first used a computer connected to the internet at a later date than their higher income counter-parts, then naturally, they will not adopt IM or email until a later time. So, if one is to ask whether students have adopted IM or not, one must also ask how students access the internet, and thus looking strictly at the adoption of IM technology makes the mistake of assuming that everyone has the same opportunity to adopt IM. Also, while the cost of a computer with an internet connection is quite high, the cost of email and IM is nothing. The price of email and IM might help to explain why the age students first used email and IM is somewhat more similar regardless of income as compared to the age students first used a computer connected to the internet.

I wish that the survey had asked specifically about where students first used email, IM, and a computer connected to the internet, and also when students first had a computer connected to the internet at home in order to understand issues of adoption with bundled technology. From focus groups, I can infer that for children from higher income families, parents enable use of the internet by providing computers to the students and show them how to experience the internet. Students from lower income groups more frequently use institutional resources to both gain access to a computer connected to the internet. However, unfortunately, it is not clear to me exactly where lowest income students are first using IM and email.

Conclusions

The “digital divide” for lower income students is not so much in their ability or inability to access a computer connected to the internet (or email, or IM) but in the different ways that the students experienced using the technology. Students from higher income groups had a communication infrastructure such that they did not learn to use technologies on their own as much as the lower income students did.

I believe that the case of the Berkeley freshmen demonstrates that to simply describe a technology as being “adopted” or not will not adequately describe the experience of adopting a technology. Assuming that “bridging the digital divide” is as much about the experiences that individuals have with a technology as is about simply having access, it seems that it is not adequate to simply ask whether a student has adopted the internet or not. It is important to see the entire communication infrastructure that the student exists in. It is important to consider who a student has to communicate with, the support offered by a student's family, and the institutional support that a student might get.
Illustrations

family income and age of first internet use

Illustration 1: family income and when students first used a computer connected to the internet
Illustration 2: family income and from whom a student learned most about how to use a computer connected to the internet
Illustration 4: family income and how a student learned how to use email
Illustration 5: family income and when students first used IM
Illustration 6: family income and how a student learned how to use IM
References


