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ARTICLE

The young and techless? Investigating internet use and problem-solving behaviors of young adults in Singapore

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Abstract

This article critically examines the technologically-savvy image of young adults by investigating the digital divide issues underlying youth internet use, including their daily computer and internet problem-solving behaviors. The study draws on data from a web-based questionnaire and face-to-face interviews with young adults in Singapore, a country where internet adoption is pervasive. Contrary to popular conceptualizations of youths as a cohort of technically-savvy experts, the findings showed considerable variance in their internet expertise and problem-solving behaviors, with some demonstrating limited knowledge of internet use and awareness of troubleshooting strategies. The analyses also showed that internet skills and self-efficacy in internet-related problem-solving behaviors were significantly related to the internet practices of young adults. The findings suggest that in wired contexts, variations in post-adoption patterns may reflect more accurately the extent and presence of social stratification, extending the meaning and scope of the digital divide.

Key words
digital divide • internet use • problem-solving behaviors • Singapore • young adults

Images of Singapore's young wired generation abound in popular media. They have been called the 'Internet Generation', the 'tech-whizzes' and 'always connected'. Accompanying these portrayals are often celebratory rhetoric regarding the e-lifestyle of young people who have grown up with computers, the internet and cellphones and are known to be using these technologies to communicate anytime, anywhere (Sng, 2001). According to Don Tapscott in *Growing Up Digital*, 'The Net Generation has arrived! … For the first time in history, children are more comfortable, knowledgeable and literate than their parents about an innovation central to society' (1998: 1–2). But how are contemporary young adults embracing the so-called 'wired lifestyle' in their daily lives, and are some of them lagging behind others in terms of their internet use?

Recent studies in the USA and abroad indicate high internet adoption rates among the younger generation. For example, reports compiled by the Pew Internet & American Life Project found that nearly 90 percent of young people aged 12 to 17 in 2004 had online access, up from about three-quarters of youths in 2000. By comparison, about 66 percent of American adults in 2004 used the internet (Lenhart et al., 2005). A recent 2007 survey showed that 85 percent of teens between 12 and 17 years engage at least occasionally in electronic personal communication via email, text messaging and posting comments on social networking sites (Lenhart et al., 2008). Research by the UK Children Go Online project found that most of the youths aged 9 and 19 years have access to the internet at home, and almost all have access at school (Livingston et al., 2004). In the past decade, internet adoption has burgeoned in the economically developed cities of Asia (Internet World Statistics, 2008). In Singapore, the majority of youths have access to computers and are using broadband internet connections both inside and outside of their homes (Jung et al., 2005; Kuo et al., 2002). These high penetration rates have led some commentators to dismiss the digital divide 'myth' in confidence that adoption and usage figures will progressively rise due to declining costs of computers and information technology (Compaine, 2001).

The digital divide, defined by conventional access and computer ownership terms, seems to be a transient, even irrelevant, concept in this information age. However, this article argues that high penetration rates do not equate automatically to the demise of the digital divide. On the contrary, other aspects of the divide may endure and be deepening due to widening inequalities in

economic resources, social support and technical skills for internet use. The internet is becoming so ubiquitous, even banal, that successful bridging of the digital divide is taken for granted often in most industrialized societies. Yet, paradoxically, notions of internet 'access' and 'use' have received less critical attention. As Stephen Graham reminds us, the need to address the invisibility of sociotechnical power is a 'critical challenge because of the growing importance of truly opaque and invisible systems of social control that are based on the continuous use of automated software in order to mediate all sorts of social relations' (2004: 24). In particular, researchers of the UK Children Go Online project have urged for attention to the variation in the quality of internet use among young people, since 'the blanket label of 'online experts' gives children confidence but may deny them the attention and guidance that could benefit them' (Livingstone et al., 2005: 5).

The purpose of this article is to examine critically the technologically-savvy image of youths by investigating the digital divide issues underlying the internet use of young adults in Singapore, including their computer and internet problem-solving behaviors. More than two-thirds of Singaporeans have adopted the internet, a proportion comparable to the USA and higher than Australia, the UK and many countries in the European Union (Internet World Statistics, 2005). These high penetration rates make Singapore an interesting context in which to examine the social variations associated with post-adoption digital divides. Insights from the study extend to other wired societies where internet adoption is pervasive, especially among young persons. Given that the internet is utilized increasingly to create and disseminate information, the digital divide phenomenon raises important concerns about social stratification for young adults seeking economic and political participation in mediated contexts (Norris, 2001).

First, this article reviews some of the relevant literature concerning the digital divide. Second, it presents the responses from survey research and a complementary analysis of responses from interview research among youths. Finally, it concludes with a discussion of the results and policy implications.

LITERATURE REVIEW

Investigating the digital divide: beyond access to internet use and problem-solving behaviors

Over the past decade, digital inequality has been associated most commonly with the digital divide. The earliest phases of the debate on the digital divide, as popularly discussed in America, focused on the 'information haves and information have-nots' (Lynch, 2001) and between heavy and light internet users based on time spent online. However, calibrating the digital divide using computer ownership and time online indicators may be misleading, as people of different skills and motivations use the internet in varied ways (Kling, 2000).

As a corrective sequel, another area of scholarship has examined the multidimensional nature of the digital divide and highlighted the influence of social context and relationships on internet use (e.g. Cheong, 2007; Cheong and Wilkin, 2005; Jung et al., 2001; Van Dijk and Hacker, 2003). After a review of the literature on internet access and inequality, DiMaggio et al. (2004) stressed that future research should focus on inequalities in technical apparatus, autonomy of use, skill, availability of social support and variation in use. For example, Hargattai (2002) conceptualized a second-level digital divide in terms of online skills, as there is considerable variance in the ways in which individuals access and find information online. Consequently, a chasm differentiating between highly-skilled and low-skilled internet users exists, which has implications for users' productivity and the potential benefits that can be reaped from the internet.

Rather than mere physical access to computing resources, internet skills, usage patterns and problem-solving behaviors are the focus of this article, since today's internet users (even seasoned and highly-educated ones) face a growing number of digital opportunities and challenges. Digital opportunities encompass the multiple interactive and creative uses of the internet to obtain, produce and disseminate information. A corpus of research tracking internet use in the USA has shown how the internet has been used by many youths for educational, entertainment and social activities (Lenhart et al., 2005). Similarly, cross-sectional survey research among Singaporean youths also shows that they are using the internet for information-seeking, chatting, playing games, reading news and listening and downloading music (Kuo et al., 2002).

Besides functional or activity-based internet use, part of contemporary internet use also necessitates dealing with computer and internet-related problems on a regular, if not daily, basis. Digital challenges include the perennial threat of computer viruses, chain emails, intrusive cookies and pop-ups, spam and images, with the accompanying need to fix glitches, upload patches and upgrade one's computing systems and software systems to maintain system compatibility with others. Annually, computer parasitic, boot, link and macros viruses, worms and Trojan horse programs cost individuals and organizations millions of dollars. Traditional responses have involved the use of anti-virus software, which remove infections or restrict the transmission of infected communications across firewalls. Yet unprotected systems can become infected and rapidly propagate that infection to other systems, giving rise to multiple social and ethical problems (Neubauer and Harris, 2002). Compounding the effects of actual threats are perceived threats and difficulties in dealing with hoax virus alerts, misinformation, urban legends and even cyberterrorism. As Treese explains, 'in the specialized news of the computer security world, it's nearly impossible to keep up with the flood of

detail about new viruses, worms, spam, spyware, or other attacks against computers on the network' (Treese, 2004: 13). Furthermore, research on web-based information systems illustrates how internet use may be fraught with technical glitches, frustrating internet use. For example, Hara and Kling (2000) documented college students' frustrations in a distance education course due to communication breakdowns and technical complexities, noting the importance of peer assistance in the efficacious use of web-based learning systems. Dutton et al. (2004) also illustrated in a case study how hardware and software problems, combined with the pressure of continual system upgrades, represented a more substantial barrier than anticipated for internet users, thereby slowing the processes of technological diffusion and innovative uses of an online e-learning system among college instructors and students.

Hence, technical skills and internet-related social support become important resources for internet use, especially in the light of potential hardware and software problems and global information flows carrying with it rapidly circulating worms and viruses. In their report, the researchers at the Centre for Competence for Informal Education in Germany highlighted the importance of peer structures as influential social capital for youth internet use and access to new online activities (Otto et al., 2003). 'Social support networks', or the availability of others to whom one can turn to seek social support and enhance one's online skills, may play a crucial role in internet use (DiMaggio et al., 2004). More specifically, the results from a study on internet use among Asian youths found that the availability of internet-related help from others affected the scope of their online activities (Jung et al., 2005). Yet youths' perceptions and actual internet problem-solving behaviors remain under-studied, in part due to the assumption of 'problem-free' access perpetuated by popular culture, which is aimed often at portraying today's internet users to be autonomous, technological experts.

THE INTERNET AND THE INFORMATION SOCIETY IN SINGAPORE

Located in East Asia, Singapore is a country that aims to maintain its role as a financial hub by establishing an advanced telecommunications infrastructure (Tan, 1998). The commitment of policymakers to technological development has made this country one of the most wired nations in the world. In 1997, the Ministry of Education laid out a 'Masterplan for IT' to provide an IT-enriched school environment for every student (see www.moe.edu.sg). In 1999, the Infocommunications Development Authority of Singapore was formed to function as a policymaker, regulator and developer of Singapore's infocommunications industry, in order to create an e-government and promote e-commerce (see www.ida.gov.sg). Some programmes that the Authority has implemented include the Singapore One broadband network and 'eCelebrations Singapore', an annual outreach programme designed to

increase the accessibility of the internet. Hence, the case of Singapore illustrates the power of top-down government initiatives to diffuse information technology (Tang and Ang, 2002), thereby socially re-engineering, in some ways, the stratification processes that divide individuals at the micro-level. The results from a national survey of 432 young adults aged 15 to 29 reported that nine out of 10 have personal computers (Wei, 2000). More recently, data from Singapore, Seoul and Taipei show that more than 95 percent of youths are internet users (Jung et al., 2005).

However, it is the contention of this article that high adoption rates do not equate to the demise of the digital divide, since variation of use exists among those who possess the requisite skills and problem-solving behaviors to take advantage of digital opportunities and manage digital challenges. Indeed, past studies in the Asian context have highlighted that cleavages in internet use exist, even among and within Japan, South Korea and Singapore, which have been classified as 'high-access countries' by the International Telecommunications Union (Ono, 2005). According to an analysis of national data collected in 2000 in South Korea, almost half of the population had low digital skills and about one-third cited 'complex and hard to use' as a reason for not using a computer. These findings highlight the presence of new and widening gaps in digital skills among Koreans despite the aggressive promotion of information technology (IT) and broadband access in the last decade (Park, 2002). Building upon prior research, this study takes the view that stratification processes cut down even to the level of internet skills and internet problem-solving behaviors. Therefore, this study investigates the following questions.

> In what ways and to what extent do young adults experience computer and internet problems?
> In what ways and what resources do young adults use to solve their computer and internet problems?
> How do demographics, internet skills, internet problem-solving behaviors, individually and collectively, affect internet use?

METHOD

Data

The data for this article were collected as part of a larger project on the internet among young adults (aged 15 to 29 years), supported by the National Youth Council of Singapore. The study employed a multi-method approach where surveys were administered, followed by a series of interviews with a subset of youths. In compliance with the interests of the National Youth Council, data collection targeted young adults who were current students in local institutions of higher education (including universities, polytechnics and institutes of technical education). The data collection process took place between July and September 2005. For the survey, cooperation was sought from various lecturers

to email invitations to their students to solicit their participation in a web-based questionnaire (taking about 15 minutes to administer), asking for information such as their overall media usage, problem-solving behaviors and social relationships. The youths were directed to the questionnaire hosted at the National Youth Council website. In compliance with research regulations, the respondents were asked to read an instruction page explaining the study and had to click a box verifying that they were Singapore citizens, understood the instructions and were eligible to participate. The respondents were offered a movie ticket as an incentive to participate. In all, 767 responses were collected. Surveys were complemented by interpersonal interviews with a subset of 38 youths from the survey population. Semi-structured interviews were constructed to provide in-depth information from the youths' point of view. Researchers arranged the interviews at the site of the respondents' convenience and the interviews typically lasted an hour.

Quantitative measurement

For the survey, the following variables were used to measure internet use, internet skills, internet-related problem-solving behaviors and demographic information.

Internet use was measured by two forms of online behaviors: interactive and creative uses of the internet. Interactive use of the internet was a composite variable created by a summation of 10 online activities adapted from a report on youths and internet use (Livingstone et al., 2004). Responses were derived from the question, 'Here are some of things people do on websites. Do you ever do any of these things?' Activities included: do a quiz, send an email or SMS to a site, vote, send pictures or stories to a site, contribute to a message board, offer advice to others, fill in a form, sign a petition, seek information, seek advice. Creative use of the internet was measured by asking the respondents, 'Have you ever created a website by yourself?' The respondents who were website creators were coded as '1', non-website creators were coded as '0'.

Perceived internet skills were measured by responses to the question, 'On a scale of 1 to 10, where 10 represents extremely good computing and internet skills and 1 represents very poor computer and internet skills, how would you rate yourself?'

Self-efficacy and social support in problem-solving behaviors were measured by two types of problem-solving behaviors: by oneself and social support from one's significant others and friends. First, self-efficacy in problem-solving was measured by responses to the following statement: 'I am very confident with solving computer problems by myself'. Responses were measured on a Likert scale of agreement with the statement (where 1 = 'strongly disagree' and 5 = 'strongly agree'). Second, computer and internet-related social support was measured by the average of the summed response to four statements adapted

from a general social support scale measuring the perceived availability of help, that a respondent feels that they have someone to turn to in times of need to fit the context of computing and internet use (Sarason et al., 1987). The statements were: 'I have a special someone on whom I rely on when I need to solve computing problems', 'I can count on my friends when things go wrong with my computer', 'I have a special person who is a real source of help to me when I encounter problems with my internet', and 'I have friends with whom I can share my internet related problems'. Responses were measured on a Likert scale of agreement with the statement (where 1 = 'strongly disagree' and 5 = 'strongly agree'). A principal components analysis with Varimax rotation yielded a single factor with an Eigenvalue of 2.3, explaining 57 percent of the variance. Cronbach's alpha for the scale was acceptably high at .75.

Computer and internet problems The respondents were asked whether and how frequently they experience computer and internet problems. The question involving computer problems was phrased as follows:

> Computer problems cover hardware and software problems. Examples of computer problems include instances when your computer stalls, your programs will not boot, occurrence of beep codes and bio error messages, when you cannot load programs, open programs, or upgrade a software, etc. How often do you experience computer problems?

The question involving internet problems was phrased as: 'Internet-related problems refer to virus and email issues. How often do you experience internet-related problems?' Responses were grouped into eight categories, ranging from 'never', to 'once in five years', to 'several times a week for both questions'.

Resources for problem-solving behaviors Following each of the above questions on computer and internet problems, the respondents were asked about the resources they utilize to solve their internet and computer problems. The responses included family members, friends from school, co-workers, customer service, books and references, technical support, online friends or virtual communities, newsgroups or online forums, no one or solve oneself, and website or online documentation. Multiple responses were accepted.

Demographics The respondents were asked their age on their last birthday. Education was measured by a single item, 'highest level of education attained', with six response categories from 'GCE 'N' level' (equivalent to middle school and below) to 'Masters' degree'. Income (total gross family income per month) was measured by eight response categories from '$1,000 or less' (equivalent to US$615) to 'above $7,000' (equivalent to US$4,300). Male gender was coded as '1' and female was coded '0'.

Qualitative research

The respondents were asked if they had ever encountered any computer and internet-related problems and to describe the nature and consequences of

their most recent problems. They were asked what they did to solve their internet-related problems, the resources that they used or the people that they approached for help (if any), and how long it took to solve their most recent problem. Also, they were asked if anyone else has ever asked them for help to solve their computer and internet problems.

Analysis

Quantitative and qualitative data were triangulated to allow comparison of information sources and the verification of the validity of information received (Tashakkori and Teddlie, 1998). Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) 12.0 and employed a .05 level of significance. Descriptive statistics (frequency counts) were used to examine the frequency and nature of computer and internet problems and resources used to solve the problems. Descriptive statistics (means, standard deviations) and Pearson product-moment correlations were used to explore the rest of the study factors. Regression analyses were tested using hierarchical analyses to control for their intercorrelations and to identify the variance explained by each block. Block 1 contained the demographic variables age, gender, income and education. Block 2 contained the perceived internet skills factor and block 3 contained the self-efficacy and social support in problem-solving variables. The interviews were transcribed in full for textual analyses as well as the use of verbatim quotations for reporting the research (Barone and Switzer, 1995). For the purposes of this article, quotes are used to provide descriptive data to complement the survey analysis, in order to elucidate young adults' variation in computing and internet problem-solving behaviors.

RESULTS

Sample

Table 1 summarizes the characteristics of the sample with regard to gender, age, education, internet skills, problem-solving behaviors and internet use. Of the total 767 respondents who were internet users, 470 (61%) were male and 297 (39%) were female. The average age of respondents was 22 years. Of the sample, 15 percent received less than a high school education, 45 percent attained a high school education and 20 percent attained at least a college degree. The respondents' household income ranged from fewer than $1,000 to more than $7,000 per month, with a median household income in the range of $2,001 to $3,000 per month.

Relationships between internet skills, problem-solving behaviors and internet use were moderately positive. As shown in Table 2, correlations between the variables were small, ranging from .04 to .54. The respondents who indicated that they had good computing and internet skills were more likely to be males, older, of a higher education and more confident of solving computing problems by themselves. The respondents who rated themselves as

• Table 1 Means and standard deviations for internet use, internet skills, internet problem-solving behaviors, frequency of internet and computer problems and demographic variables ($N = 767$)

VARIABLES	MEAN	SD
Interactive internet use	7.0	2.2
Creative internet use	.54	.5
Perceived internet skills	6.6	1.6
Self-efficacy in problem-solving	2.9	1.0
Social support in problem-solving	3.3	.8
Age	21.8	3.2
Gender	.4	.49
Education	3.5	1.0
Income	3.7	2.2

being confident in independently solving computer problems were more likely to be males, older and had attained a higher education.

Frequency of computer and internet problems

The first research question concerned the ways in, and the extent to, which young adults experienced computer and internet problems in their everyday lives. The survey responses showed that almost all of the respondents had experienced computer problems involving hardware and software problems. More than 90 percent of the respondents reported experiencing computer problems at least once a year, about 30 percent of them experienced problems once in three months and about one-fifth experienced problems several times a month. With regard to internet problems, the survey responses showed that more than 85 percent of the respondents reported experiencing internet problems at least once a year. About one-quarter of them experienced virus and email problems once in three months, and about 20 percent experienced internet problems once a month. About nine percent of the respondents reported experiencing internet problems several times a week. Therefore, the survey responses reveal that computing and internet problems were a familiar, if not common, phenomenon for almost all respondents.

Resources for computer and internet problem-solving behaviors

The second research question sought to investigate the ways and resources that young adults utilize to solve their computer problems. As summarized in Table 3, more than half of the respondents relied on their friends, 37 percent relied on their family members and 19 percent relied on technical support. Of the respondents, 22 percent did not seek help from others for their computing problems. Fewer than 10 percent used print resources such as books, references and online documentation. With regard to internet problems, about half of the

• Table 2 Pearson correlation coefficients for internet skills, Internet problem-solving behaviors and demographic variables ($N = 767$)

VARIABLE	1	2	3	4	5	6	7	8	9
1. Age	–	.64**	.24**	.10**	.13**	.20**	−.08*	.03	−.04
2. Education		–	.04	.14**	.19**	.17**	.00	.04	.01
3. Gender			–	−.13**	.14**	.36**	−.08*	.03	−.05
4. Income				–	.06	.04	.05	.02	.06
5. Perceived internet skills					–	.54**	.04	.18**	.30**
6. Self efficacy in problem solving						–	.04	.21**	.28**
7. Social support in problem solving							–	.01	.06
8. Internet use (interactive)								–	.21**
9. Internet use (creative)									–

Note: *$p < .05$, **$p < .01$ (2-tailed).

respondents relied on their friends, 35 percent on their family members and 17 percent utilized technical support. About 18 percent of the respondents solved their internet problems by themselves. Hence, interpersonal resources including one's friends and family members were the most common ways in which young adults sought help. Fewer than one in four of the respondents reported to be independent problem-solvers when they encountered problems.

The responses from the respondents illustrate in more detail the ways and the extent to which youths perceive, experience and solve their problems. Most reported having faced computing hardware and software problems and being familiar with computer crashes due to malfunctioning and incompatible hardware and software. Contrary to research in the USA among adult internet users, who said that they are receiving more spam than before but are minding it less (Fallows, 2005), a large proportion of the young adults interviewed said that they were constantly frustrated by junk mail, pop-ups, viruses and spyware. A number of them said that they had enduring problems in dealing with spam and junk mail in their email accounts and were troubled that they had to monitor their inbox and clear mail daily to avoid their inboxes being jammed. In addition, several detailed the consequences of their problems, including comments such as: 'I travel around with this device – if this device

• Table 3 Sources of help for internet and computer problems* ($N = 767$)

Sources of help	Computer problems (%)	Internet problems (%)
1. Friends from school	58.5	54.2
2. Other family members	37.4	34.9
3. No one (solve by myself)	21.9	17.7
4. Technical support	19.3	16.8
5. Customer service	17.5	13.3
6. Books and references	8.2	5.3
7. Co-workers	8.6	7.0
8. Online friends/Virtual communities	5.6	5.3
9. Website/online documentation	2.9	4.7
10. Newsgroups/online forums	1.2	1.7

Note: *Multiple answers accepted

doesn't work, it is a big part of myself lost', internet problems 'wasted a lot of my time and effort' and 'To me, it's losing information that is important'.

Thus, most respondents could relate to experiencing internet-related hardware and software problems. However, when asked to describe their most recent computer and internet problem, the majority of the respondents gave vague and unclear descriptions. Some of them sounded hesitant and several were unaware of the reasons and processes leading to their computer breakdowns. For example, some could not define their computing problems in specific ways. The most common phrases appeared to contain elements of surprise and confusion, for example:

> I don't know what went wrong.
> The computer just crashed or jammed.
> Sometimes I go onto some certain websites and something like that, and suddenly I don't know what buttons I press, and I get an error message.

A few respondents even expressed bewilderment at the 'weird beeping sounds' emitted by their computers. Those who gave imprecise descriptions of their computing problems also tended to be puzzled about the ways and resources that they could employ to solve their problems.

For example, Adelyn is a 20-year-old college student who uses her computer for schoolwork and utilizes her email regularly to communicate with her friends abroad. When asked about her last computing problem, she said: 'When the hardware gets too overloaded … to be honest, I have no idea, I just know the computer is very slow.' She said that her first reaction to a computing problem is to 'whack the computer' and then 'shout' to her brother 'to ask him to solve the problem'. She usually approaches her 18-year-old brother, whom she regards as being 'more well-versed' in the computer than herself, but she does not have any idea what her brother does

to her computer. A self-professed 'computer idiot' who 'knows nothing about computers', Adelyn struggled with describing her internet problems, although she shared her frustration in trying to deal with 'weird viruses and those visible worms all the time'.

According to Tapscott (1998), young people are perceived to be more technically savvy than their elders. Yet ironically, some youths said that they looked to older adults and parents to solve their computing and internet problems. For example, Jasmine recalled that she had to reformat her computer last year but was not sure why she had to do it. She said, with an embarrassed look: 'I'm not very tech-savvy person – I just leave it [all computer issues] to my father.' At the point of the interview, she had an ongoing problem with her home computer. She said:

> For my home desktop, there are a lot of pop-ups and there's this debugging thing, but I always click 'No' as in they'll tell me that my computer is bugged or something like that. But I'll just click 'No', like once or twice, that it goes away [sic]. Yeah, but I don't know what it is.

She is perplexed that this problem has lasted for 'quite long, a couple of months' and is still unresolved. She said:

> I don't really know how to solve the problem. Because when I don't, I think my father tried fixing it before, but I think it just came back. So in the end we just left it. Because in a sense, okay, you just click 'No' twice, it'll go away.

In line with the survey results, most of the young adults interviewed relied on their friends from school for help. Most said that their peer networks were very important resources and many pinpointed specific friends to whom they could turn for help. One particular example came from the accounts of Sylvia, a 17-year-old biomedical science student. Her last computer problem occurred a week before the interview, when she bought a firewire to connect her video camera to her laptop, but the wire did not work. She described how she tried to resolve the problem:

> I was at the computer, like eight hours long, continuously trying to solve it, but it just didn't work. I don't know, it just cannot, like, [it's] not responsive to the thing I inserted into the laptop.

She then relied on her friend to help her, she said:

> My friend is very good at computers because he scored a perfect score at a computer programming module. However, my friend was trying to help me detect the software but it still cannot work.

To solve her problem, Sylvia related that she had to bring her friend along with her to the shop where she purchased her firewire because she was

unsure of how to explain her predicament and needed her friend's assistance to explain the problem to the electronics shop owner.

The above responses illustrated the perceptions and actions of young adults who were less technically aware and skilled at problem-solving. These responses showed how some youths are unaware of technical operations and rather confused, especially when they encounter computer and internet problems in their everyday lives. On the other hand, there were a few respondents who appeared to be more familiar with the hardware and software configurations of their computing equipment and were able to articulate their problems and the ways in which they sought help. For example, Jacqueline, a 19-year-old college student, said that she encountered her last problem when her computer slowed down considerably due to viruses and Trojan horses that entered her computer via a peer-to-peer network system. With regard to email, Jacqueline displayed an awareness of her university's internet development policies. She said she was concerned about her university's email system, as

> it does not have a spam filter, They just recently, like, last week, introduced the spam filter, but they're still, like, working on it, so we can be exposed to spam and viruses through the school emails.

She said that people around her usually ask her to solve their problems, 'simple IT questions like how to set up a blog, how to write the HTML code for your blog schemes, like that, simple IT questions'. She occasionally relies on a close friend to help her with any computing and internet issues.

There were also a few others who expressed confidence in their technical and troubleshooting skills. For example, Marcus is a 25-year-old student who also works in a music production company. He said that he is usually 'independent' and did not approach anyone for help with his last computer problem. He also stressed that he is careful in his personal internet use to avoid future problems:

> Most of the time, I take care of viruses by not opening attachments … unlike some people who happily open attachments. I don't anyhow download stuff, have a lot of precautionary measures.

Marcus explained that he maintains several email accounts 'with different inland and offshore webhosting servers, in the event should one of my inboxes become flooded with spam or becomes inaccessible' so that he can continue with his work. When asked if anyone has asked him to help with their internet problems, he said:

> Most of the time, I am the computer guy in the office, although for some strange reason I'm not trained to do computers. I'm the default wireless administrator because I am the only one who knows how to configure the wireless modem … Other than that, a lot of problems that people come to me have to do with software issues like, 'I don't know how to use this software',

> 'How do you do this?', 'What's the problem, I can't seem to print', and its just configuration, nothing that the user cannot handle.

In sum, qualitative evidence yielded several interesting insights about young adults and their computing and internet behaviors. There appeared to be a marked difference in the ways in which the more and less technically-savvy youths defined and approached their problems. Those who were less technically savvy tended to be surprised and caught off-guard by computing problems. Some of them relied on temporary methods such as 'pressing the control–alt–delete with my fingers', or expressed their helplessness over an 'indefinite problem that has gone on for years'. After encounters of computing and internet problems, their efficacious use of the internet was dependent on the assistance and actions of others. On the one hand, there were a few other respondents who exhibited the tendency to give up after first experiences of failure and to desist from engaging the apparently incomprehensible internet hardware and software issues. On the other hand, there were youths who appeared to be more cognizant of troubleshooting strategies and were more confident of their internet use. Young people from the latter group showed greater awareness of, and concern about, IT security issues (e.g. viruses and hackers). Consequently, they reported to have anticipated problems actively and practised preventive strategies to protect their computing systems from breakdowns.

Demographic, internet skills and internet problem-solving factors affecting internet use

The second part of the study sought to examine the relationships between demographics, internet skills, internet problem-solving behaviors and internet use among youths. As indicated in Table 4, the results show that demographic characteristics did not make a significant difference in scope of interactive internet activities online. The findings show that, after controlling for the effects of individual demographics, perceived internet skills was associated significantly with individuals' breadth of online activities ($R^2 = .03$, $F(5,762) = 5.15$, $p < .01$). Supporting the findings from existing research in the realm of secondary digital divides in terms of internet expertise (Hargattai, 2002), the results show that those who considered themselves to have good computing and internet skills were more likely to use the internet more effectively – in this case, for a larger scope of activities ($\beta = .18$, $p < .01$). Results from the third regression showed that individuals' self-efficacy in problem-solving significantly predicted online activity scope ($\beta = .17$, $p < .01$), while computing and internet-related social support from others was not a significant predictor ($R^2 = .05$, $F(7,760) = 5.9$, $p < .01$).

The study also set out to test the variations underlying a creative aspect of internet use. Logistic regression analyses were conducted to test the

• Table 4 Hierarchical regression analysis of predictors of internet use (scope of interactive activities)

	STEP 1	STEP 2	STEP 3
Demographics			
Gender (Male)	.03	.00	−.05
Age	−.01	−.01	−.01
Education	.05	.01	.01
Income	.02	.01	.00
Perceived skill	–	.18**	.10**
Self-efficacy in problem-solving	–	–	.17**
Social support in problem-solving	–	–	.01
R^2		.03	.05

$N = 767$, *$p < .05$, **$p < .01$

associations between demographics, internet skills and internet-related social support for those who have and have not used the internet to create their own website. The results show that demographic characteristics did not make a significant difference in the ways in which respondents used the internet for website building purposes. As illustrated in Table 5, the findings show that perceived internet skills were significantly associated with creative internet use, after controlling for the effects of individual demographics. In addition, the third regression analysis showed that self-efficacy in problem-solving and computing and internet-related social support from others were associated significantly with creative internet use, after controlling for the effects of internet skills and individual demographics. The logistic regression analysis of the predictors of creative internet use revealed that about 15 percent of the variance was accounted for by the three predictor blocks.

DISCUSSION

This article set out to explore the digital divide issues underlying young adults' internet use and problem-solving behaviors in Singapore, a context where a high proportion of the population have attained internet access. Accordingly, it investigated the relationships between sociodemographics, internet skills and the internet problem-solving behaviors of youths. The survey results showed that almost all young adult internet users have experienced computing and internet problems and a fair proportion of them face these problems rather frequently, i.e. on a monthly or weekly basis. The most popular forms of help for their problems came in the form of interpersonal resources and expertise from their friends and other family members. About one-fifth of the youths said that they usually solved their problems by themselves. Few utilized published resources such as books, references and online documentation.

• Table 5 Logistic regression results for predicting internet use (website creation)

Individual characteristics	β	SE β	Wald	OR(95% CI)
Gender (Male)	−.06	.19	15.33**	.48 (.33–.69)
Education	−.05	.10	.23	.95 (.78–1.61)
Age	−.06	.03	2.93	.94 (.88–1.00)
Income	.04	.04	1.03	1.04 (.97–1.11)
Perceived skill	.28	.06	21.81**	1.33 (1.18–1.50)
Self efficacy in problem-solving	.56	.10	31.02**	1.75 (1.44–2.12)
Social support in problem-solving	.12	.05	5.62*	.78 (.70–.88)
R^2				.15

β = Standardized Coefficient, $N = 767$

*$p < .05$ ** $p < .01$

Contrary to popular conceptualizations of youths as being a cohort of technically-savvy experts, qualitative evidence from the interviews showed considerable variance in youths' internet expertise and problem-solving behaviors. A significant proportion of the young adults interviewed were unfamiliar with the ways in which computing technologies work and were unable to troubleshoot or solve their computing problems. Some young adults even professed to be 'computer idiots' and 'not savvy when it comes to technology'. On the other hand, there were several young adults interviewed who expressed greater knowledge and expertise about their daily internet use. They also expressed greater awareness of computing and internet problem-solving strategies. Some of them said that they usually managed to diagnose and solve the problems, or approach technical support staff on their own.

In this way, the findings support recent research evidence which highlights how a proportion of young people are challenged by various complexities of internet access and most use the internet for a narrow range of activities (Livingstone et al., 2004). The findings of this study further contribute to deconstructing the image of the empowered internet user who is autonomous and technologically competent. More specifically, they show that only about one-fifth of young adults solved computing and internet problems by themselves. These findings challenge the free-agent, self-sufficient image of young technical experts. Specifically, the results of this study illustrate how some young adults are still embedded in their peer and family networks and are highly reliant on their existing social support networks for technological assistance and know-how.

The results from regression analyses showed significant variations in youths' internet use for interactive and creative purposes. However, the results of this study did not show the salience of individual demographics on internet use. The findings here suggest that age, gender and socio-economic status may not be as relevant as other factors such as internet skills for post-internet adoption

behaviors in wired contexts such as Singapore, where the internet is reaching maturity and growth rates are stabilizing. Instead, the analyses showed that factors such as the level of internet skills and internet-related problem-solving efficacy to be associated positively with internet use. Hence, although computer ownership is pervasive in Singapore and most of the young adults have adopted the internet, differences exist in levels of technological proficiency and social resources, which in turn may frustrate or facilitate internet use.

Taken together, the findings of this study highlight the presence of secondary digital divides pertaining to the internet experiences of young adults. Digital inequalities in internet skills, problem-solving behaviors and internet usage patterns exist after initial access is obtained. In this way, contrary to popular belief, the digital divide may not be completely bridged in digital societies, as secondary digital divides may be extenuated in these nuclei.

CONCLUSION

Limitations of the study

It is acknowledged that limitations to this study exist. First, part of the data were obtained from a web-based survey with a non-probability-based sample of internet users who are students in local tertiary institutions. This sample is unrepresentative of the general young adult population in Singapore as it excludes non-students (14% of the population between 15 and 29 years old; Statistics Singapore, 2000). In addition, coverage is a concern for web-based surveys, although Couper (2000) noted that there are some communities such as college campuses where connectivity is almost universal, thereby mitigating the sampling bias of web surveys. As noted earlier, the internet penetration rate among Singaporean youths is extremely high, making online surveys a low-cost and efficient method of data collection. Moreover, given the exploratory nature of this study, a mix of quantitative and qualitative approaches was employed to gain a textured and more complete understanding of internet use and problem-solving behaviors from the youths' point of view. In light of the dearth of information on youth internet use and their problem-solving behaviors, the ability to generalize is not sought with this sample. Rather, it is hoped that the results of this study will highlight trends in the secondary digital divides underlying youth internet use in wired societies such as Singapore. Second, the survey data is a single-shot, cross-sectional snapshot of youth internet use, thus limiting any ability to draw causal inferences and over-time observations on the relationships among the study factors. Third, measurement of internet expertise is based on a single-item measure and self-reports. Fourth, the model of internet activity scope was statistically significant as a whole but explained a limited amount of variance. Future research could attempt to increase the validity of the study

by examining a wider range of attitudinal or motivational variables as antecedents of internet use.

Future research and policy recommendations

In conclusion, this study provides a critical study of internet use and related digital divide issues by examining internet problem-solving behaviors. By discussing the stratification processes underlying internet expertise and problem-solving resources, attention is directed to the epilogue after a society's chapter of rapid internet penetration. The results here point to another dimension of internet use in everyday life and highlight the need to critically (re)examine and enlarge notions of internet 'use' and 'access', in order to take into account internet-related troubleshooting and problem-solving behaviors. In terms of policy implications, the results from this study suggest that future efforts should focus on building knowledge-sharing networks among youths to contribute to a virtuous cycle of internet help, in order to enhance the quality of youths' internet connections. For example, the National Youth Council could start a mentoring system to pair off youth leaders who are able and willing to help other youths in troubleshooting and utilizing the internet to achieve their educational and social goals. To the extent that young adults regard some of their peers as being more technically savvy, peer-to-peer knowledge-sharing would prove to be an economically viable yet constructive way of closing inequalities in internet usage.

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