“You are too out!”: a mixed methods approach to the study of “digital divides” in three Chinese senior secondary schools

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Abstract

This sequential mixed methods study investigates the differences in adolescent engagement with Information and Communication Technologies (ICT) such as computers, mobile phones, and the Internet. The multi-case project involves 698 second year high school students from three socioeconomically, ethnoculturally, and geographically specific schools in China. It examines the ways in which social factors, such as ethnicity and rurality/urbanity, shape technology access and use before analysing social and educational consequences of youth interaction with ICT. While the quantitative strand lends its power to reveal structural inequalities in the levels of access and use, the qualitative interviewing sheds light on the diversities in use and gives voice to individuals as they encode technology with values and meanings. The research finds that urban students in Shenzhen have the highest level of access to technology and support, use ICT for the widest range of activities, and are most likely to treat them as "life" and "thought" companions for psychosocial, emotional, and intellectual gains. On average, Tibetans are disadvantaged; but the most digitally marginalised teenagers are mainstream Han students with parents having no more than six years of education. Nonetheless, the return to parental education is by far greater for Han students than it is for Tibetans. While the probability of students reporting underachievement decreases as parental education increases, Tibetans are significantly less likely to report "Below average" or "Bottom 10%" in class. The study also discovers that access to ICT strongly correlates with socioeconomic status, but use of them articulates ways of learning and living, which are often resistant to change. As the global and fast-changing ICT become more prevalent, oftentimes adults highlight what they might do *to* students, while teenagers emphasise what they can do *for* them. So technology and culture regularly clash. When ICT are introduced to schools by adults, they rarely satisfy the needs of adolescents; and when they have any effect on learning, usually it is not because of what students *have* in school, it is because of what they *do* elsewhere — at home or in Internet cafés.

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List of Abbreviations

Baidu A Chinese equivalent of Google.

Baoye The practice of spending whole nights in *wangba*.

BS School Basum in Tibet

Gaokao College Entrance Examination

HS School Hengshan in Hunan

Hukou Household registration system

ICT Information and Communication Technologies

MMR Mixed Methods Research

NetEase A leading Chinese Internet company providing a wide range of services such as news, gaming, and micro-blogging.

NS School Nanshan in Shenzhen

QQ A popular Chinese social networking software package that can run on either computers or mobile phones for users to chat either synchronously or asynchronously. Nowadays, people adopt it for much wider ranges of purposes other than chat in China.

SAT Scholastic Assessment Test, a standardised test for college admissions in America.

SCT Social Construction of Technology

SES Socio-Economic Status

TAR The Tibet Autonomous Region in China

TOEFL Test Of English as a Foreign Language, required of students with native languages other than English to attend universities in English-speaking countries.

Wangba Internet cafés in China

Weibo A Chinese equivalent of twitter, which is blocked in China.

Acknowledgements

This thesis is a labour of love and frustration, and I have lived with it for years. Many a time I felt I was able to draw an end to it, and yet it seemed to have no end. I am glad that I am finally reaching the stage of submission, although I still feel it is far from perfect. While I am solely responsible for any errors or inaccuracies one might encounter throughout the thesis, I must recognise that anything I have achieved thus far is not wholly my own doing.

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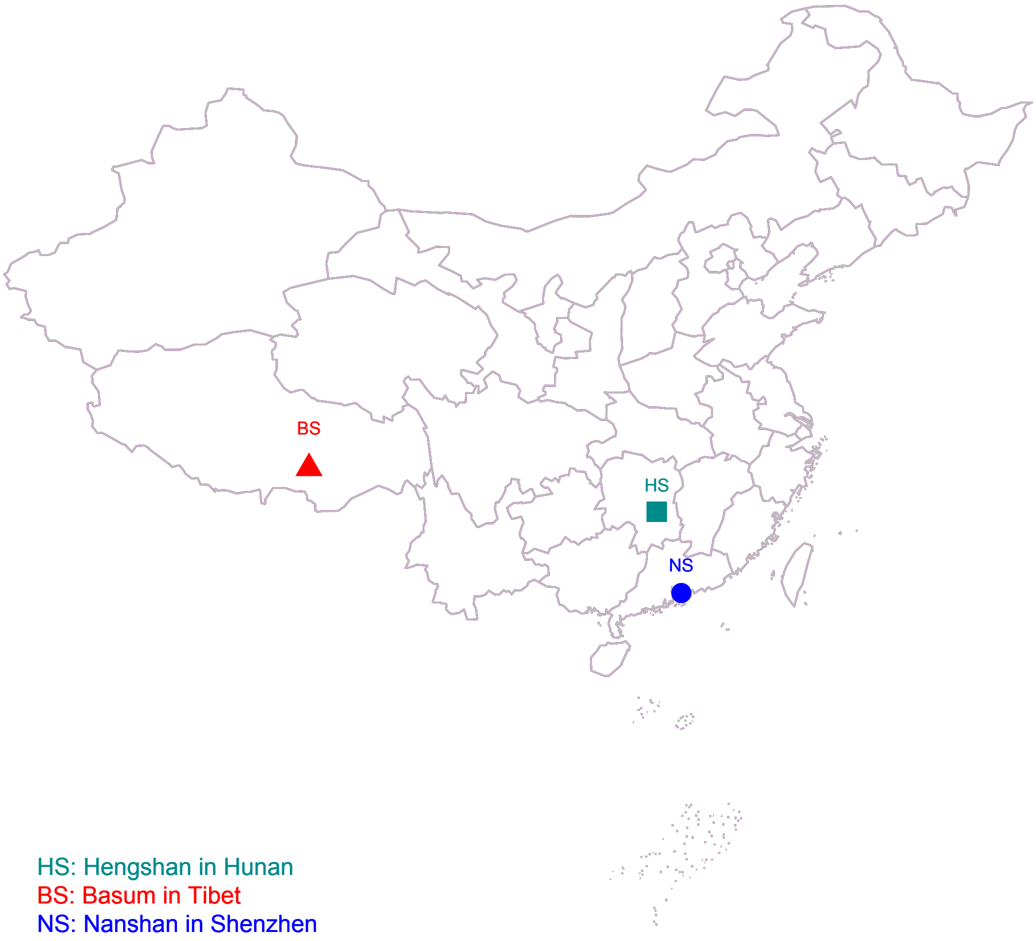
Last but not least, I can hardly find any words to articulate my love and respect for a few significant others, whom I decide to just leave out of this tiny space — some of you are probably never going to see these words, but you know what I mean and how much you mean to me. My thoughts are with you, and will be, for evermore.

To my late mother

The Three Schools in China



HS: Hengshan in Hunan
BS: Basum in Tibet
NS: Nanshan in Shenzhen

Chapter 1

Of Young People and New Media

1.1 A glimpse into the research context

> 就是，这东西从小到大潜移默化这样的，就好像你知道蟑螂是坏虫那样，就是潜意识的那样，就不需要自己去体验。我小学老师就说我们不可以去网吧。小学开始就这样教我们的 …… 现在一般家里每个人都有电脑，就不需要去网吧。一般去都是家里没有电脑吧，就有一些，像，我就觉得一些，没有怎么上学的人去网吧吧；还有一些小孩家里父母管得很严，家里电脑不让用，然后就去网吧。*
>
> It has been internalised since we were little. It's like your first reaction to cockroaches; you don't need to experience it [before you know how disgusting it is]. It is intuitive. We were taught not to visit Internet cafés when we were primary school students . . . Today, everybody has a computer at home. There is no need [for us] to go there. Those who frequent Internet cafés probably don't have home access to a computer, and I feel, like, some who go there are, either not well-educated; or their parents are too strict to tolerate their use at home.

Xiumeng is a second year high school student in Shenzhen, a Southern metropolis in China. Her view of Internet cafés (*wangba* in Chinese) represents many of her classmates', for Shenzhen students like her usually have a computer at home and they rarely, if at all, visit *wangba* during high school. Since they do not have much lived experience with *wangba*, their views of them often converge with media reports about them.

* Please see Appendix F for an explanation of why I provide interview excerpts in Chinese along with their English translations.

> 以前开机关机都不晓得 ...... 现甲哈可以，就是打字好慢 ...... 就是，有些行乱打字，有时看不懂。有些行硬素字代表【汉】字。两甲八字就是“Bye-Bye。” 那天别个发两甲八字得呃，呃老是问唧吗意思。唧咣：“你太 OUT 哒！” 因为唧发个来呃不晓得吗意思，不晓得。
>
> I didn't even know how to switch on or off a computer ... Now it's okay. I am just slow in typing ... It's because people communicate differently in typing, which I sometimes find hard to understand. Some use numbers to represent words, for instance, two 8s mean "Bye-Bye." The other day, somebody sent "88" to me. I kept asking what he meant. He replied: "You are too out!" Cos I didn't know the meaning, I had no idea.

Also a second year high school student, *Guoyu* has no access to a computer at home in Hunan, an interior province with a large rural population. As many of his classmates do, he usually visits *wangba* on weekends during term time. Like many others in his school, it is in *wangba* that he learns most of the operational skills associated with computers and the Internet.

> 呃记得有一乏趄【网吧】，唧把呃拽曲来哒，那是呃爷爷咯。呃爷爷思想好封建嘛，呃唠刚进趄，就被拽曲来。【呃】坐得那里，【唧】把呃拖曲趄哒 ...... 呃娘呀都冒咣，举要是呃爷爷。呃爷爷思想好封建，老是不钧呃趄，幔都不捻呃幔，就咣：“徐咯你老趄网吧跟别个学坏，就莫想读须哒！” 呃爷爷唧嘛，思想封建，唧咣，到网吧趄就会学坏。呃娘呀倒冒咣，【唧俩个】咣【呃】两纠哉放一次假，趄一乏哑冒码关系 ...... 唧【爷爷】老是一副那个样子，唧思想好古董嘛，就不钧别个趄，板起脸那样子。呃酿唧咣，唧咣噶哒兹后呃教样趄。
>
> I remember once he caught me and then dragged me out of it. It's my grandfather. His thoughts are very feudal. Shortly after I found a seat there, he appeared in front of me and then pulled me out of my seat ... My parents do not say much about it. It's mainly my grandfather. He is too feudal to see me in *wangba*. He cannot even condone me having a look at it. Sometimes he threatens me: "Stop thinking of continuing your study if you keep going there and *learning bad*!"* He is too feudal! In his view, you would be contaminated as soon as you enter *wangba*. My parents, however, know that we have only two days off every two weeks; they normally do not

* The term refers to negative peer influence. Literally, I prefer this simple translation, though it may be grammatically inappropriate.

> say much about it and in their opinion, paying a visit to *wangba* is not bad at all. My grandfather's view is too old-fashioned. He always opposes it by showing a rigid face. But I simply ignore him and continue to do what I want to do.

Qinxiao, another second year high school student in Hunan, is not alone in her troubled negotiation with her grandfather about access to digital technology, for many of her classmates live with and under the guardian of their grandparents throughout the year while their parents work as migrant workers far away from home. Although *wangba* are close to the lives of many high school students in Hunan, those teenagers, as well as their parents and teachers, share much of the negative attitudes towards *wangba* as reported by *Xiumeng* in Shenzhen. In other words, many Hunan students are acutely aware that *wangba* are not appropriate places for them to frequent, but they do spend a lot of their spare time there, notwithstanding the psychosocial burdens and sometimes even disciplinary actions against them.

> 以前觉得家里有电脑很酷，现在无所谓了，就摆在那里。以前跟妈妈说如果家里有电脑永远都不去网吧了，但是有了之后还会去，因为网速太慢。网吧多，这么小的城市差不多有十几个 . . . . . . 【学校没什么娱乐?】对，主要娱乐就是网吧 . . . . . . 网吧是挺重要的，现在有些没去上网的，都是，打个字要ABC去找键。感觉今后要是工作了，也需要，有利无害嘛 . . . . . . 现在都挺开放的，孩子去了吧，他们也不会管。现在已经形成一种什么说，一种观念了，觉得很正常，跟日常生活一样，跟菜市场买菜一样。很平常的一件事情，现在都开放了。
>
> I used to think it would be cool to have a computer at home. Now it doesn't matter that much any more. It's just there. I promised to my mother that I would never ever visit *wangba* if we had a home computer. But after we bought one, I kept going there, because the speed [of my home Internet] was too slow. There are many *wangba* [here], we have over ten in such a small town . . . [In school, there isn't much entertainment?] Yes, the main space for fun is *wangba* . . . *Wangba* are rather important to us. Those who never visited one would struggle to find keys like ABC. Such skills would only do us good in future when we start to work . . . It [Tibetan society] is quite open nowadays. They [parents] wouldn't be bothered if their children frequent *wangba*. It's now, how to put it, a norm, a way of life; it [visiting *wangba*] is like buying vegetables from an open market. It is so normal that it is no longer a big deal, it's all open.

Dunzhulaba, a second year in Tibet, reports that *wangba* have become an integral part of his high school life. Actually, many students in his school echo the same point.

	Shenzhen	Hunan	Tibet
Frequency of visits to Internet cafés	0.41	1.65	1.83
Negative views of Internet cafés	2.12	1.80	1.70

Table 1.1: *Average visits to and negative views of wangba*

Since the views presented above are from four students in the three schools studied (see the Field Sites Map in page XV), it is better to report here how often on average students visit Internet cafés and how negative on average their opinions are about *wangba*. As shown in Table 1.1, Tibetans harbour the weakest negative attitudes towards Internet cafés. While they visit *wangba* almost as much as those students in Hunan do, they rarely report conflicts with adults in their negotiation of access to the very same technology. Shenzhen students are least likely to visit *wangba*, but they hold, on average, the strongest negative views about them. This begs the following questions: Why do second year high school students in different regions of China visit and view *wangba* in so different ways? What roles on earth do digital technologies such as the Internet and computers play in the students' daily lives? What implications the level and nature of access and use have upon students' learning and life experiences in and out of school? Searching for answers to such questions lies at the centre of the study.

1.2 Is there a generational divide?

As Information and Communication Technologies (ICT)* become ever more prevalent, various terms have been created to describe today's youths who are "so bathed in bits that they think it's all part of the natural landscape" (Tapscott, 2009a, p. 2). These terms include, but are not limited to, "Millenials" (Howe & Strauss, 2000), "Digital Natives" (Prensky, 2001), and the "Net Generation" (Oblinger & Oblinger, 2005; Tapscott, 1998). Through the use of ICT, the Net Generation, as Don Tapscott claimed, are "superimposing" their culture on the rest of the society, and becoming "a force for social transformation" (2009a, p. 2). Young people who grow up surrounded by new technologies are also believed to be fundamentally different from their elder generations – they think, learn, work, socialise, and create, as people who accept the implications

* Unless otherwise specified, I will use ICT interchangeably with "new media," "new technology," or "technology" throughout the thesis. This term specifically refers to the Internet, computers, and mobile phones in the study.

of those terms relate, in so profoundly different ways that there appear a "generational divide" (Herring, 2008, p. 71) and an emergent need for educators and parents, or "Digital Immigrants" as Marc Prensky (2001) called, to rethink or even "overhaul" their conventional ways of raising, educating, and interacting with today's youths, for those "Baby Boomers" (Tapscott, 2009a) can never possibly reach the level of aptitude and skill that the natives have naturally developed (Prensky, 2001).

Furthermore, Baby Boomers or the "TV Generation,"* as Tapscott (1998) depicted, are quite conservative, inflexible, and hierarchical, for the technology they grew up with was a passive "push" medium, which "dumbs down" and isolates its users and broadcasts a singular and authoritarian view of the world through an undemocratic and one-way channel. As such, the TV Generation is antithetical to the Net Generation, just as television is antithetical to the "pull" Internet, which is active, interactive, and conductive to intellectual development and democratic spirit. This is particularly true when the functions normally associated with television and the Internet all link to one device – the mobile phone, which presents young people new and more opportunities by gradually breaking down the boundaries between what David Buckingham described as the "push" and "pull," as well as "mass" and "interpersonal" communications (2008, p. 13). These differences thus lay out a fundamental divide, as conventional wisdom implies, between those who migrated to the Internet (e.g., parents and teachers, or "adults" in the study) and those who are its natives (e.g., students in the study).†

This generational divide, though "produced by technology alone" (Buckingham, 2008, p. 13) as Tapscott's viewpoint suggests, is said to have wider implications. In education for instance, today's youths are portrayed as disliking the industrial age, one-size-fits-all, and teacher-dominated lectures. As a result, education systems should change accordingly. Instead of focusing on teachers as "broadcasters" and "sages-on-the-stage," today's schools, advocated Tapscott (2009a), should value interaction and help students discover for themselves, unearth their strengths, and collaborate with others. In the words of Palfrey and Gasser (2008), schools should "adapt to the habits of digital natives and how they are processing information, educators need to accept that the mode of learning is changing rapidly in a digital age" (p. 239). Only in this way, asserted Tapscott (2009a), can we expect to narrow the "generational divide" between how the digital natives learn

* This generation are probably too old today to be called "Digital Immigrants," so I use the term to refer to those who enter cyberspace as grown-ups and have been "playing catch-up with their children" (Turkle, 2011, p. 201).

† For a similar point, see Turkle (2011, p. 201)

and most teachers teach, for the natives "are not content to sit quietly and listen to a teacher lecture . . . [They] expect to talk back, to have a conversation. They want a choice in their education, in terms of what they learn, when they learn it, where, and how . . . They want it to be interesting, even fun" (p. 126).

By extending the above line of argument even further, Prensky (2001) contended that digital natives process information in radically different ways because of their long and intensive interaction with ICT. For instance, they are used to receiving information really fast. They crave parallel process, random access like hypertext, and multitasking. They choose graphics over texts and function best when networked. They thrive on instant gratification and frequent rewards, and prefer games to "serious" work (p. 2). They are, Prensky maintained, "all 'native speakers' of the digital language of computers, video games and the Internet" (p. 1). Fundamentally, digital natives are said to have a different brain structure from that of digital immigrants, as if the technology has "precipitated a physical evolution within a decade or so" (Buckingham, 2008, p. 13).

Unfortunately, such positive claims about the younger generation are problematic in several ways. First, they have lionised the young for their capabilities in doing many things at a time, which was "once seen as something of a blight" (Turkle, 2011, p. 162). Now it appears that, reasoned Sherry Turkle, multitasking has been viewed as a crucial skill in learning, working, and the daily life of the digital age,* despite it might be the neurochemicals, a "high" often generated by human body as a result of multitasking, that have induced multitaskers into believing that they are highly skilful and productive (2011, p. 162). As such, the claims seem to have ignored the criticism that students today are reported to have very short attention span and those with their laptops open in class, according to Turkle (2011), do not usually perform as well as others do (p. 163), let alone the fact that multitasking tasks such as texting-while-driving have caused numerous accidents (pp. 330 - 331).

Nevertheless, the heroic narratives about digital natives have implications for education. For instance, they extol virtual reading with links and hypertexts and disparage traditional reading as linear, exclusionary, and disconnected, just as Burbules argued: "printed texts are by nature selective and exclusive . . . hypertexts on the Web are by

* The term "digital age" I use in the thesis refers to a time relative to "pre-digital" times. It is characterised by the processes in which digital technologies, such as computers, the Internet, and mobile phones, reconfigure, refashion, or even surpass social arrangements and relations for better or worse (Selwyn, 2011a, p. 7).

nature inclusive" (1998, p. 103). This disparagement thus overlooks the call from academics for "an alternative to the traditional reliance on clear authoritative sources and long-established learning practices" (Livingstone, 2009, p. 86) in the age of information abundance where nothing being socially negotiated remains "the single most attractive feature of hypertext" (Douglas, 1998, p. 160). Moreover, the extolment of electronic reading disregards the fact that most parents in the UK for example, noted Sonia Livingstone, still think books are more likely to help their children do well in school than is the Internet (2009, p. 68), and that online reading often leads students to somewhere else, if not somewhere less. As such, those triumphalist narratives sound as if what ICT have to offer means only opportunities, has no risks, or would never meet with human vulnerability such as youth anxiety (Turkle, 2011, pp. 241 - 242); and as if the social mores have changed – what once seemed "ill" has become normal (p. 178).

Second, those extravagant claims about digital natives have failed to recognise that continuities and interdependencies do exist between new and old media – the Internet might have changed certain functions of television, but it has not completely displaced it; they both have successfully seduced people into spending a lot of time in front of their screens, have enjoyed unprecedented reach, and been utilised to advance glorious as well as problematic agendas; and indeed, they both seem to have defined two generations (Herring, 2008, p. 85). In addition, as Buckingham (2008, p. 14) noted, many of the Net Generation do spend a lot of their time on TV, and the TV Generation also surf the Internet quite often. While some generational differences do exist and different experiences of different generations may result in the so-called generational divide, it is inappropriate to isolate the age gap and technological change from other social and political developments (Buckingham, 2008, p. 15), so is it to eroticise what is new in new media and their associated affordances.

Third, as Turkle noted too, the immigrants and natives actually have a lot in common, and among what they share is the feeling of being overwhelmed – students overwhelmed with expectations for academic and relational performances; parents overwhelmed with ever increasing demands from life and work and a growing desire "to exert greater control over what reaches them" (2011, p. 202). Furthermore, both adults and students today would probably agree that connectivity through the Internet can be better than nothing (e.g., when many Chinese families in the study cannot easily unite) and sometimes better than something (e.g., letters via China Post or telephone). And gradually people seem to prefer making phone calls to getting together, and then prefer texting to talking (for instance, Apple's iPhone 4S can now transcribe voice messages to texts), for in talking and texting (including email and text messages), argued Turkle (2011), they can hide what they do not want others to see and show what they want others to see, and they can "process" people whenever they want to – meeting people simply takes too much time and listening to others really slows you down (pp. 206 - 207).

Therefore, to ground policies and practices on those claims about generations runs the risk of losing a more complete sight of the picture in light of the phenomenon's broader social-political and cultural-historical contexts, and a more balanced account about the continuities between the so-called old and new media and the similarities between the immigrants and natives. Even if we are willing to let go of the above mentioned risks, reasoned Susan Herring, the views presented by those optimists such as Tapscott make them sound as if they are examining the Internet as men of 100 years old – as if they come from an era "before the conception of the Internet" (2008, p. 82).

1.3 Opportunities and risks in cyberspace

While the divide in knowledge and experience of ICT between generations may not be as wide as the one suggested in those generational claims, significant differences in the perceptions of what ICT can do for the young do exist within and between generations.[*] According to Livingstone and Bober (2006, p. 95), many parents are torn between their belief in ICT's empowering nature, which they can hardly miss out, and the anxiety they often harbour about the risks that new technologies may pose to their children – risks they can hardly give house room. In her anthropological study about Latino immigrant parents' regulation of their children's engagement with technology, Lisa Tripp (2011) tellingly revealed how and how much parents of low socioeconomic status in the US struggled to satisfy as well as to regulate their children's digital needs, and the ways they employed to monitor access and use actually reflected the ambivalence many adults held about ICT.

On the one hand, Tripp noted, parents value education, believing that a good education

[*] Since high school students are the study's subjects, I use "youths," "the young," "adolescents," "youngsters," "teens," "teenagers," and "young people" interchangeably in the thesis. But sometimes, it is rather difficult to distinguish between childhood, youth, and adulthood, for it is argued that today's children are "getting older younger" (Buckingham, 2005, p. 11), or "staying younger longer" (Livingstone, 2009, p. 5). In that case, I will specify whether I mean children or young adults instead of adopting new words like "preteens," "teens," "tweens," "kidults," or "adultescents" (Buckingham, 2008, p. 4; Herring, 2008, p. 78).

can prevent their children from living the same lives they are enduring, and new technologies are often viewed as a force of liberation and empowerment for young people and seen to be beneficial to achieving their aspirations if the young treat them "seriously" and avoid using them "like a game" (Tripp, 2011, p. 577). Educators too sometimes wax lyrical about the consequences ICT have for today's young learners – they can help increase traditional learning outcomes, compensate for disadvantage and inequality in education, and enable new forms of learning (Livingstone, 2009, p. 76). For instance, they can facilitate a constructivist form of learning that is socially situated within networks of people, artefacts, and technology (see also Selwyn, 2011a, p. 14), motivate disaffected learners by helping them formulate and voice ideas to the extent that they can communicate effectively (Cook, 2005; Livingstone, 2009, p. 83), and support learners to actively construct knowledge, either by themselves or in co-operation with others, and through "personalized" and "authentic" participation in cyberspace (Luckin, 2009). Echoing the same point, Crook (2008) offered a vivid description of how students can benefit from their participatory experience online:

> This is largely about making more opportunities for the user to publish and communicate. It is about uploading rather than downloading. About co-ordination, rather than delivery. So, for learners: it's about more audience, more collaboration, more resource. (p. 30)

Not surprisingly, students today are said to be more "inquisitive" and "self-directed," more "sceptical" and "analytical," more inclined to think critically and challenge authorities than were their parents (Buckingham, 2008, p. 16); and learning in the digital age is sometimes interpreted as the "capacity to know more" (Siemens, 2005, n.p.), rather than "a reliance on the accumulation of prior knowledge" (Selwyn, 2011a, p. 14); and the personalisation of learning means students are now positioned at the centre of learning, just as Green and colleagues noted: "It is the system that conforms to the learners, rather than the learner to the system" (2006, p. 3). However, such celebratory statements regarding non-conventional approaches to education are yet to be supported by consistent evidence (Livingstone, 2009, p. 87). In fact, some do believe otherwise. For instance, Turkle questioned whether technologies had given us more control over our lives; or if our lives, and indeed we, are now in their control (2011, p. 206).

On the other hand, adults are concerned about the costs and risks that are not always quantifiable – they can be much more than just the initial fees and ensuing bills, in fact, they can be addiction to computer games, inappropriate online content, strangers and sexual predators from cyberspace,* and above all the decline of academic performance, which is often a primary source of concern for many adults, particularly those in China today. Such an anxiety is partly due to some adults' limited knowledge of ICT, and partly due to negative media coverage about ICT (boyd, 2008; Golub & Lingley, 2008; Herring, 2008, p. 80; Liu, 2011, pp. 8 - 9; Tripp, 2011, p. 564). Yet adults' unease about their children's interaction with ICT is widespread not just in the US, but also in other countries such as the UK and China, although if and how much the panic is justifiable are still open to debate.

According to danah boyd, academics sometimes link the anxiety to the panic adults used to hold about outdoor space – young people are vulnerable to the dangers of the outside world and they need protection from adults (2008). Likewise, the Internet is now being viewed as a "gateway to harm," suggesting that "innocent" children must be protected from the dangers of the virtual world such as pornography and online paedophiles (Buckingham, 2008, p. 13), and "dangerous" or at-risk young people prevented from causing troubles (Valentine & Holloway, 2001, p. 76) through legitimate forms of treatment (Buckingham, 2008, p. 4). In China, such concerns sometimes cover not just the harms to the the bodies and minds of the young such as addiction, anti-social behaviour, academic underachievement, obesity, and so on. There are moral concerns too.

For instance, some viewed Internet addiction as analogous to the opium of the late Qing Dynasty (1644 – 1911), which corrupted the moral order of families and societies (Golub & Lingley, 2008, p. 6). Like the opium, the Internet today attracts addicts from all backgrounds, be they poor or rich, of high or low social status, employed or not. Yet it is more difficult to control than opium, for it is associated with science and technology, which render the "spiritual" or "electronic" opium even more dangerous. That is why "from modern cities with forests of skyscrapers, to closed-off and backward traditional farming villages, *wangba* have spread with the swiftness of a toxin; Internet games have become attached to the social body like poisonous tumours" (Zhang, 2005, translated in Golub & Lingley, 2008, p. 6). As a result, noted Professors Golub and Lingley (2008) of the University of Hawaiʻi at Mānoa, happy families have broken down and social morality collapsed to a certain degree.

The addiction analogy is interesting. Once broadcasted, it does make people feel creepy.

* I use cyberspace or virtual world to mean the digital world as opposed to the real or physical world.

But it is flawed in at least two ways. First, argued Turkle, the addiction reasoning attaches more power to the external (the drug and the Internet) than to the internal (the user, Chinese youths in the study). A more progressive understanding about youths and new media, suggested Turkle, should focus less on the addiction cliché and more on the forces that have kept students so engrossed in cyberspace. Those forces, like love and passion we often feel towards people, can help us, believed Turkle, better understand what students are attracted to, what they are missing, and what they need (1995, p. 30).

Second, the analogy subverts the best possible solution – to resolve the problem of addiction, we must first get rid of the addictive substance and it seems to be the only option. But, as Turkle contended more recently, we are not going to discard the Internet and mobile phones, and the solution the metaphor implies is not going to be the one the society in large will take, even though schools can ban students' visit to *wangba* and parents can regulate their children's use of ICT. Therefore, constructing students as victims of an evil substance is not a healthy step forward – it only makes even more adults hopeless or desperate (2011, p. 293).

Nonetheless, the anxiety associated with online risks is increasingly heightened when the young are depicted as savvy users of technology and more expert than adults in using ICT – they are capable of subverting parental control and perhaps evading adult invasion of their privacy in cyberspace, which in turn results in growing adult concern and anxiety (Livingstone & Bober, 2006, p. 107; Tripp, 2011, pp. 559 - 560). Not surprisingly, parents and educators often resort to extreme measures in order to regulate technology access and use, and often those means either fail (Livingstone & Bober, 2006, p. 107) or turn out to be so restrictive that students' consumption of ICT without control is hardly possible, even though computers and the Internet are at the same time viewed as being educationally beneficial.

1.4 Youth identity and development online

Despite the intensification of some adults' anxiety surrounding adolescent ICT access and use, going online and contacting friends via technology, for many teenagers, are simply "crucial developmental tasks" (Buckingham, 2008, p. 3). For teens, those activities enable them to socially participate and negotiate their "being" or "becoming" – the latter if we view them as passive recipients of adult influences (p. 4) – in a world beyond their confined schools and homes where they can "experiment away from the adult gaze" (Livingstone, 2009, p. 91), "find some thrills and challenges" (Turkle, 2011, p. 219), and develop "a strong sense of their own autonomy and authority as users of technology" – something usually denied to them in schools (Buckingham, 2005, p. 13).

Furthermore, those online activities often confer on the young significant elements for growing up. For instance, by creating a profile in cyberspace, students can learn how to read social cues, which are signs of reactions from others in the virtual community who actually read their profiles. boyd called this process "impression management" – students modify their profiles or adjust their behaviours upon receiving feedback from others in cyberspace (2008, pp. 128 - 129). Reading social cues and then writing/acting themselves into being thus become an important component of teenagers' lived experiences, and cyberspace turns out to be what Goffman (1990) called a "front stage" where students can manage their impressions on others in order to achieve certain goals (Buckingham, 2008, p. 6), and manipulate their identities by "changing photos, deleting unpleasant comments, altering listings of friends, asking people to change their representation of them, and even starting all over again" (Livingstone, 2009, p. 103). In cyberspace, they can also author/alter those non-verbal cues that are usually impossible to change in real life, for example, their age, ethnicity, gender, and geographical location (Burrell, 2008, p. 21), which is particularly true among younger teenagers (Lenhart & Madden, 2007; Livingstone, 2009, pp. 105 - 106). In that respect, youth identity online, in the words of teenagers, "is something we *do*, rather than simply something we *are*" (Buckingham, 2008, p. 8, original italics).

That said, the Internet has become what Erik Erikson (1985) called a *moratorium*, a "time out" and relatively free space where "friendships are made, displayed, and broken" (Livingstone, 2009, p. 102), and adolescents can experiment with their identities with relatively low risks and do whatever they need to do – "fall in and out of love with people and ideas" (Turkle, 2011, p. 152). Youth identity therefore refers to how teenagers subjectively view themselves "over time and across situations," and it evolves as a student's inner self changes, oftentimes through a process of self-inquiring driven by feedback from significant others – students look in their immediate and salient surroundings for social cues and make decisions on "what, how, and to whom they reveal personal information" (Livingstone, 2009, p. 112), what messages to incorporate and what principles to internalise so as to answer questions or self-doubts like "who am I" and "who will I be" (Stern, 2008, p. 97) – questions regarding "a core self, a personal sense of what gives life meaning" (Turkle, 1995, p. 203).

Consequently, to some high school students, particularly those who are unhappy, unpopular, unathletic, and unattractive (Turkle, 1995, p. 189), ICT are no longer "better than nothing" (substitutes) when they are physically present yet spiritually absent from schools. They become "something" (Turkle, 2011, p. 7), something important and preferable to what they experience in a sometimes boring, oftentimes frustrating, and most of the time overwhelming high school life. And to others, the virtual can be even "better than anything" (p. 12) when the real world does not satisfy, and when cyberspace becomes the only place where they can find a certain degree of self-esteem and certain things ennobling, and at times build something they can call their own – they can have "a fresh start" (Turkle, 1995, p. 190) and feel re-born. In that sense, cyberspace is not simply a safe and satisfying place, it becomes "a work place, or more accurately a reworking place" (p. 199) where they can build and re-build self-confidence, construct and re-construct who they are, who they pretend to be, who they want (or not) to be (p. 192).

That probably explains why virtual activities such as computer gaming can be so seductive that students often play for hours and hours at a stretch in order to satisfy the digital siren and/or, to satisfy, lose, or seek themselves by leaving their real selves and problems behind (Turkle, 1995, p. 188). When ICT become better than anything, what they have to offer has thus met where humans fail. Eventually, it turns out that cyberspace helps students either escape from their real lives or bring out the best in their real selves into the virtual reality. In any case, ICT become grist for the mill in a therapeutic way (Turkle, 2011, p. 223).

As reasoned above, adolescent virtual identity is thus more about "me," the self embedded in youth interaction with peers, "as known to and represented by others" (Livingstone, 2009, p. 105); it is less about "I," the self only accessible by and known to oneself (Mead & Morris, 1934). Just as some writers, for instance, thesis authors like me, often learn their thoughts by reading their words and comments from readers, adolescents in cyberspace can learn something about themselves by looking at what they say to others as well as what others to them (Turkle, 2011, p. 175) – constructing and reading social cues, an agentic act to establish and protect identity, as well as intimacy and privacy (Livingstone, 2009, p. 114).

As such, it is not unwise to conclude that youth identity is more of a construction or "a realm of discourse" that is unfixed, malleable and developing than of a mirror that faithfully reflects the "permanent structure of the mind" (cf. Turkle, 1995, p. 178). That said, argued Turkle, there can be many selves in cyberspace where teenagers can move from one to another, for ICT can provide youths with specific opportunities to "test out different versions of their current and possible identities" (Stern, 2008, p. 107) through actions such as writing and rewriting their online profiles. That being the case, Lifton (1999) was right in saying that the self is fluid, protean, and has many aspects that enable adolescents to embrace, modify, and flourish with a variety of ideas and ideologies.

However, their movement is not entirely free because of their involvement with families, schools, and communities. Their cycling in cyberspace is socially constrained (1995, p. 179). In other words, youth identity is *shaped* by their *social and technological* conditions where they situate (Livingstone, 2009, p. 117, my own italics), which helps us partly understand why Erikson argued that the self, once formed, is fairly stable and bounded (Turkle, 2011, p. 179). By echoing the same point, Stuart Hall (1996) stressed that:

> Because identities are constructed within, not outside, discourse, we need to understand them as produced in specific historical and institutional sites within specific discursive formations and practices, by specific enunciative strategies within the play of specific modalities of power. (p. 4)

Others may contend that students' online or "on-stage" impression does not necessarily correspond to their offline or "back-stage" identity, which is often more honest or authentic than is the one "on stage" where they tend to conform to defined roles in certain situations and simply play out "a kind of ritual" (Buckingham, 2008, p. 6). That is possible, but more often than not, students' online establishment mainly results from the fact that their close friends are already there (Tripp, 2011, p. 562; Valkenburg & Peter, 2009). As a result, their activities online are likely to be constrained by peer group expectation and pressure, and by the designs of specific websites and their own skills and types of literacy (Livingstone, 2009, p. 118).

This also implies that the Internet largely *fosters* rather than *undermines* existing social relations. It is common that today's teens communicate both online and offline, even those who do not have convenient and personal access to ICT often have accounts on social networking sites set up via means of shared access such as *wangba* in China. Once online, they normally communicate with friends rather than strangers, which suggests that strong ties offline are likely to get stronger online (Hampton & Wellman, 2003; Mesch & Talmud, 2007; Valkenburg & Peter, 2007) and virtual identities tend to be conditionally stable.

It is also argued that, although the Internet has made it easier for students to experiment with their identities, it becomes harder and harder to leave their past behind – as soon as they log on, they leave electronic footprints online, and the posts they leave on their friends' walls are likely to be there or somewhere in cyberspace all the time, just as some of the friends they have friended will be there for a very long time, or even a lifetime (Tripp, 2011, p. 243). In that sense, "the Internet is forever" (p. 169), and it is recording their every behaviour and collecting "visual" as well as "written proof" of their wrong doings, even if those acts simply reflect their spur-of-the-moment words and represent them at their worst (p. 257) – their missteps and awkward actions and reactions online will be frozen into computer memories (p. 259) and their migrated anxieties there are likely to proliferate in certain cases (p. 243).

Therefore, the notion of youth online identity being protean is challenged by the above-mentioned phenomenon regarding the persistence of data and people or what Turkle called "the anxiety of always" (2011, p. 260). Their connection to the Internet, even via their own computers and mobile phones, is perhaps not so private that their electronic footprints will disappear as they log off. That means their identity is protean only within a limitation, if not bounded and stabilised by on- and off-line constraints. Since students' establishment online is mainly for their offline friends, and they normally present in cyberspace those aspects of their lives that are reasonably consistent and likely to be received by their friends (boyd, 2008, p. 129), their virtual identity can often be more authentic than thought, although some aspects of their digital selves could be "polished" during that process of establishment (Stern, 2008, p. 108).

1.5 What should adults do?

It may be true that youths can passionately experiment with their selves in cyberspace. But not all are able to "work through" their real life problems in the virtual reality – they are not equally capable of taking advantage of the resources available online. Some students "are able to take in positive models, to bring other people and images of their better selves inside themselves" (Turkle, 1995, p. 204). Others, unfortunately, simply "act out" in cyberspace – they continue to identify themselves online with the negative sides of themselves in real life and view the formal as a simple extension of the latter. In other words, they continue to play who they are. But such an extension can have negative consequences – when the virtual simply reinforces the real, those students are likely to feel more depressed. Therefore, "life in cyberspace, as elsewhere, is not fair" (p. 204) – they have different effects on youth psychological development, in Turkle's words, they "only sometimes facilitate psychological growth" (p. 208). For those students who can enter cyberspace with a healthy enough condition, the virtual represents opportunities for growth; for those who cannot, it even poses risks like the opium.

Such being the case, emphasising the skills digital natives have is likely to intensify the confrontation between some adults and teens, which in turn may lead to the limitation of opportunities for therapeutic ends described above, and for productive learning and the development of new interests and technological expertise (Ito et al., 2010; Livingstone & Helsper, 2007). For the time being, we are only beginning to understand the impacts online opportunities have upon young people and what types of support they need in order to mobilise those opportunities (Tripp, 2011, p. 563). We are also at the early stage of understanding how to help young people "work through" cyberspace rather than simply "act out" – to make sure they do not just take their real world frustrations to the digital world and virtually express or "externalize"* (Turkle, 2011, p. 240) those real life problems repeatedly. In other words, we want them to utilise the opportunities that ICT have to proffer so that they can successfully confront those difficulties and avoid feeling depleted or disoriented after being disconnected (p. 214).

To better illustrate the point made above, let's look at computer gaming and online social networking for examples. We know that playing games online for exhilaration and amusement is one thing, and looking to it for a life is another – enchantment comes with consequences, and the ties formed through social network sites may not be the ties that bind, and sometimes, they might be the ties that preoccupy (Turkle, 2011, p. 280). In that case, what should we do in order to help young people reach the point at which they know not only how to use ICT in pedagogically, relationally, and emotionally conductive ways but also when not to use technology (p. 331)?

To find answers to the above question, neither the heroic narratives such as technology enthusiasts' digital native claims nor the evil discourses such as ICT as electronic and

* Venting and acting out without much resolution and growth.

spiritual opium would help – exaggerated statements only serve to increase readership (Turkle, 2011, p. 230) or provoke debate. To better answer the question, we probably need to break the frame before we can see something new. As noted earlier, the either-or narrative about ICT imposes upon adults and youths a quandary, just as Appiah (2008) argued:

> The options are given in the description of the situation. We can call this the *package problem*. In the real world, situations are not bundled together with options. In the real world, the act of framing – the act of describing a situation, and thus of determining that there's a decision to make – is itself a moral task. It's often *the* moral task. Learning how to recognize what is and isn't an option is part of our ethical development. (pp. 196 - 197, original italics)

That is to say, there is often a moral dimension in the framing or description of the relationship between ICT and youths, particularly in the case of Internet cafés in China. As such, "we have to love our technology enough to describe it accurately. And we have to love ourselves enough to confront technology's true effects on us" (Turkle, 2011, p. 242). But to know both ICT and ourselves enough is never that straightforward and it is always *us* who choose how things are framed according to what we *assume* they are or should be (p. 291, my own italics).

In the digital world, for example, we often assume that "more" has become today's social mores and "fast" a social fact – people always want more and want them to come fast, more airtime and instant delivery for instance. But, is what we think we want from technology what we really want to get from it? For the time being, we assume that, for example, to be connected anytime and anywhere is what we want from the Internet, regardless of whom we want to be connected with. But the truth of that connection is often that we want to be connected with those we really care (Turkle, 2011, p. 284) – with people to whom we can turn when in trouble, and with whom we are willing to share moments of rapture. As we grow up, we also assume that ICT are grown-up and in their maturity. But we are still at the beginning of things, and there is still room for corrections and a need to shape how they develop next – to make them serve human purposes (p. 294). That said, how should we regulate youth interaction with ICT then?

Interestingly, some academics attribute the dilemmas that many adults face in regulating their children's access to and use of ICT to the limitations of public policies regarding new media and communications. They argue that Western governments have de-regulated the industry and adopted a "lighter-touch" policy pertaining to the Internet (Montgomery, 2007). As such, the policies have devolved "the regulation of children's access and use onto parents" (Livingstone & Bober, 2006, pp. 96 - 97). Tripp also supported the policy-as-a-problem view by arguing that the parents they interviewed were put in a difficult position to restrict their children's access to and use of ICT (2011, p. 564). I find it hard to subscribe to such a view because China is largely viewed as a country where media and communications industry is highly regulated by the government (Liu, 2011; Zittrain & Edelman, 2003), yet adults in high schools adopt an even more restrictive approach to monitor students' use of the Internet and mobile phones than do many of their Western counterparts. And they often do that as if it is "a response to an external threat," rather than an "occasion for relationship work" (Livingstone & Bober, 2006).

Had Western governments played a bigger role in regulating the virtual world, would parents leave their children unsupervised? Probably not, they might just do exactly the same. However, the Chinese government's attitudes towards ICT, though ambivalent, is charged with political interpretations (G. Yang, 2009). On the one hand, they view technology as a symbol of modernisation and a means for development. On the other hand, the Internet provides a space which the government views as non-conductive to the Party's ideological framework. As such, they have waged effective campaigns, such as the "Great Firewall of China," to regulate cyberspace (Golub & Lingley, 2008, p. 4) in a hope to protect young people from "pernicious information," namely, pornography, violence, superstition and anti-government discourses (Liu, 2011, p. 18). Interestingly, such ambivalent attitudes are strikingly similar to those held by Western societies in history – people on the one hand celebrated the opportunities telephone presented; but on the other, they lamented the technology's capacity to disrupt intimate relationships and unsettle established social hierarchies (Buckingham, 2008, p. 11).

Yet it is hard to judge if it is the Chinese government that has dominated the virtual space. Many adults, like those in the West, seem to have adopted the same ambivalent attitudes that "veer between moral panics about the dangers of new media and an exaggerated romanticism about their liberating potential" (Buckingham, 2008, p. 5) – they fantasise ICT as a means for personal development and social mobility, but at the same time, they regard them as antithetical to academic performance that matters so much to millions that there is hardly any space for technology in "proper" learning. But still, many high school students in China can find ways to subvert school regulation and parental control in order to, say, spend some time in *wangba* – to escape temporarily from daily pressure and adult supervision (Liu, 2011, p. 8). Once they are connected in cyberspace, a new way of socialising with the world emerges.

As such, by imposing restrictions on students' access to ICT, we are actually, according to boyd, creating a participation divide in the information society between adults and teenagers (2008, p. 137), and between students in different schools with different policies regarding ICT access and use by students. After all, teens need to learn about the social world through trial and error, and through action rather than theory. The roles educators and parents have to play should be their guides, rather than policemen. Since students need access to both real and virtual worlds in order to mature in the 21st century, it might be better if educators learn how to help them navigate through the virtual as well as the real (2008, p. 138).

It thus follows that students should be allowed, if not encouraged, to engage with ICT rather than kept at bay, for sooner or later, they will have to face the real world and socialise with others. For the time being, high schools in China normally require their students to study in class from dawn to dusk during weekdays and students' lives are highly structured. Probably unlike their counterparts in America, where teenagers "are simultaneously idealized and demonized; adults fear them but they also seek to protect them" (boyd, 2008, p. 135), Chinese high school students are, by and large, better controlled and/or protected – most are not allowed to leave their campus throughout the week. They are isolated from the outside world by walls and CCTVs. However, as in America, such restrictions are deemed necessary to prevent troubles from their own mistakes or to protect them from the risks of society.

Since making mistakes is simply a part of teenagers' growing up, and in many cases, it is an important part, limiting their access to the Internet and banning mobile phone use on campus thus further segregate them from the outside or adult world, not to mention the aforementioned psychosocial and developmental benefits that teenagers can possibly take advantage of in the virtual world. It is true that students can participate through peer socialisation (boyd, 2008, p. 136), but that can be fundamentally different from socialising with other age groups and in non-school environments, for norms change from generation to generation and cultures vary from place to place. Given the crucial role the College Entrance Examination (*Gaokao*) plays in the lives of Chinese high school students, it is unlikely to see much change, at least in the near future, in various constraints schools often impose upon their students. However, adolescent engagement with ICT will change how they interact with others in and out of their schools. It is thus necessary to understand how, why, and how much they access and use ICT so that schools could utilise the knowledge to create a better environment where their students can live more happily, learn better, and develop more healthily.

Chapter 2

Technology in Society

2.1 Tools of empowerment or sources of inequality?

In Chapter 1, the thesis argued that the generalisations about young people and ICT have enjoyed much popularity, for they represent a reassuring story that the public want to hear and technology enthusiasts want to tell (Turkle, 2011, p. 18). However, it is worth noting that the heroic discourses do not tell the full story and little academic research actually support those generational claims (Buckingham, 2005, p. 12; Bennett, Maton, & Kervin, 2008; Helsper & Eynon, 2009, p. 3). In fact, a growing number of studies have revealed that significant differences exist among students in how, how much, and why they engage with ICT. Therefore, any uncritical approach to the relation between ICT and education is an “ahistorical” way to speculate what will happen and ignores the fate of some previous and present technologies in education, or the disjuncture between the “state-of-the-art” and the “state-of-the-actual” (Selwyn, 2011a, p. 38) — they delivered only a fraction of what they had promised since the 1960s and the use of ICT varied dramatically from school to school, subject to subject, and grade to grade (Selwyn, 2007, pp. 31 - 33).

Although students today, noted Rebecca Eynon, have a proportionally higher level of access to new technologies than their elder generations had when they were young (2010), and there are some truths in the aforementioned narratives about today’s youths (Helsper & Eynon, 2009; Ito et al., 2010), it is questionable whether those ICT-empowered “cyberkids” are the majority or typical of their generation (Buckingham, 2005, p. 12). While it is rather difficult to answer this question, studies after studies have reported that not all students are equally competent in reaping the benefits from using ICT and in avoiding potential ICT-related risks (Jung, Qiu, & Kim, 2001; Livingstone & Bober, 2006, p. 107; Zhao, Lu, Huang, & Wang, 2010). We may call some of the teenagers today "Digital Natives" in terms of the core operational skills they have to exhibit (van Deursen & van Dijk, 2011), but their detailed experiences in cyberspace vary considerably (Hargittai & Litt, 2011, p. 832), and the effectiveness in use of ICT is shaped to a great extent by their socio-demographic profiles (DiMaggio, Hargittai, Celeste, & Shafer, 2004; Hargittai & Hinnant, 2008; Livingstone & Helsper, 2007; Qiu, 2009; van Dijk, 2005; Warschauer, 2008).

While many believe that computers and the Internet are tools of empowerment and they can help remedy social problems such as inequality and inequity in education, others argue that ICT might have, if anything, amplified those problems (Selwyn, 1999, p. 78). The relationship between ICT and society is thus complicated. In order to better understand such a relationship, it is important to focus on specific technologies, which refer to computers, the Internet, and mobile phones in the study, and a particular type of society, which is schools in this case. In the examination of such a relationship, it is also vital to recognise, as Helsper and Eynon (2009, p. 16) warned, even the use of those catchy terms such as Digital Natives has negative impacts on the interaction between students and adults, for the labels themselves reflect the views and values of a demographic for whom ICT are largely new and transformative, not necessarily those of the young today. In other words, the terms are "exonyms" often used by outsiders (adults in the study) to refer to insiders rather than "endonyms" usually adopted by insiders (students in the study) to refer to themselves (Herring, 2008, p. 78).

Despite the above caveats, ICT proffer an appropriate lens through which we can investigate not only the technological and educational, but also the social, political, cultural, and economic mechanisms functioning in the schools. In the words of Neil Selwyn, digital technology is "an ideal focus" of ongoing sociological examination of schools and schooling (2011a, p. 9). Since most high schools in China adopt a restrictive approach to their students' access to and use of ICT, they provide an excellent intersection where a range of social issues in relation to power, control and (in)equality can be studied. In that regard, cyberspace thus "bring[s] philosophy down to earth" (Turkle, 2007, p. 8) – when I focus on ICT as "evocative objects," I meet not just sociologists and anthropologists, but psychologists, philosophers, economists, and educationalists as well.

2.2 Problems of essentialisation

Besides the differences within generations, one other problem associated with the digital native claims is that they assume there is *one* set of skills out there that somehow define today's youths as natives in digital tribes. That is to say, if a student can use a technology without any difficulty, we can label her a native. If this were true, then adults who have acquired the skills should also be called natives, which seems to contradict with Prensky's statement about digital immigrants that they are always behind and never likely to reach the fluency so naturally developed by the natives (2001). As such, the digital native claims are "at best misleading" and should "be abandoned in both popular and scientific writing" (Jones, 2010, p. 366). But the problem also lies in the fact that, as Professor Steven Higgins of Durham University (personal communication, 2011) questioned, there are different sets of skills young people today have to display. For instance, a boy is a very competent player of computer games, but seriously struggles with online content creation and rarely visits a specific social network site. Whereas a girl could be exactly the opposite – she dislikes computer games, but loves chatting online and writing blogs. Here arises the question: are they both digital natives?

Indeed, young people today engage with a variety of technologies and even one piece of technology, say the Internet, can demand very different sets of skills for a user to be considered skilled. Therefore, terms like Digital Native sound all-encompassing and assume "universal know-how, and comfort with, and usage of all facets of digital media" (Hargittai & Litt, 2011, p. 838), which in turn renders them vague and unable to capture reality. In that regard, Buckingham (2005) was right in pointing out that the digital native discourse belies the difficulties and frustrations young people often encounter in cyberspace (p. 26) and reveals "an attempt to construct an object of which it purports to speak" (2008, p. 15) – just as any other form of marketing rhetoric, the discourse is not a description of what today's youths really are, but a depiction or romanticisation of what they should be like.

Moreover, the discourse that depicts the young as autonomous and skilful overlooks the fact that today's youths "are being aggressively targeted as consumers: Their experiences of new media are framed and defined by broader social and economic forces that they do not control, or even necessarily understand" (Buckingham, 2005, p. 26). By quoting Hawisher and Selfe (1998, p. 3), Livingstone (2009) also noted the power and money at stake: "Vying for position . . . are not only educators but also publishers, commercial hardware and software producers, parents, governments, and the telecommunications players of the corporate world" (p. 87). This point was testified in my 2010 experience as a researcher in a high school in Beijing where I was questioned whether my research had any commercial intention. Recalling the school's response prior to my research and the ads targeting students throughout the City, I could conclude that the same students I wanted in the study had been commercially approached for profits – no wonder adults and students in big cities like Beijing and Shenzhen were on the alert for various forms of commercial penetration to their schools.

Higgins' point above also implies that there is no such a coherence or essence about digital natives out there; or according to the logic of Zhu Xi (1130 - 1200), a Neo-Confucian philosopher in China's Southern Song Dynasty (1126 - 1279), we are unable to identify the principle or essence (*Li*) underlying all digital natives through the investigation of those individuals in cyberspace (Theodore de Bary & Bloom, 1999, pp. 697 - 701). In other words, we are unable to find the *Digital Native* that is a kind of reality in various behaviours of today's youths, and that shapes the latter and is shaped by them (Feenberg, 2000, p. 447). That is also to say, to "reify"* or "thingify" digital natives is impossible, nor is it becoming to treat a digital native as a reality out there that has "a homogeneous, undifferentiated character" (Chandler, 1995). If we agree that "technology" refers to both material devices and "the practices and knowledge related to them and the social arrangements that form around those devices, practices and knowledge" (Lievrouw, 2006, p. 246), then the anti-essentialist approach can treat both ICT and various narratives about digital natives as texts, which are "interpretatively flexible throughout all stages of development (*being written*) and use (*being read*)" (Selwyn, 2003, p. 111, my own interpretation and italics).

Now suppose the essence, if any, of digital natives and the observable phenomena surrounding them is obvious and clear, how do the two relate to each other in the digital age then? It appears that there is first an identifiable thing or person that is the essence of digital natives; otherwise, it would be impossible for people to have various descriptions and arguments about today's youths, which, in Canadian Philosopher of Technology Andrew Feenberg's words, are a "human making" (2003c, p. 3). If true, the

* According to Berger and Luckmann (1967, p. 89), reification refers to the association of human phenomena with objects of the natural world, or the viewing of man-made artefacts as if there were something other than human products, such as the laws of nature. It implies that humans have forgotten their own authorship of what they made. In effect, the reified world is a dehumanised world (cited in Ling, 2012, p. 178).

logic is then contrary to the idea of ancient Greeks that man-made artefacts come first as ideas, which then influence their existence through human intervention. In any case, it suggests that the essence of digital natives and the phenomena we can observe are two independent realities. If the essence comes before the phenomena, and the latter exist purely according to plans and for purposes defined by the former, we should be able to control, at least to a certain degree, how students interact with their ICT so as to avoid the aforementioned risks.

But the reality is that students and adults alike often complain that the risks associated with adolescent use of ICT result from the "evil" technology, suggesting there are evil purposes embedded with ICT and that the phenomena are shaped by certain essence of technology. That being true, many designers of technology would most likely reject the idea – they would argue that intentions of technological designs are good and technological plans are not aiming to harm people. Therefore, it is probably the "detour" that has changed the designers' intentions – the technological black box has betrayed those good intentions (Latour & Venn, 2002). That is to say, the development and use of ICT do not necessarily follow a particular path, like "an arrow seeking its target" (Feenberg, 2003a, p. 79). Instead, the process is like a tree branching out in many directions, and the final "right" direction might not develop within the competence of technology designers, or the control of ICT users, or it may never be possibly inscribed in the nature, essence, or *Li* of ICT (Feenberg, 1992, p. 308).

To illustrate the above point further, let's take as examples printing technology and the emergence of the Internet. Postman pointed out that Guttenberg's printing technology was initially designed to disseminate bibles, but it ended up spreading secular books (cited in Kritt & Winegar, 2007, p. 5). In the case of the Internet, reportedly it was the users who had determined the direction of its development – they did not take the device as a given, but reoriented engineers and system administrators towards the popular ends of communication and entertainment; and in fact, Internet users around the world are continuing changing our concepts of the Internet in unexpected ways (Feenberg, 2003b, pp. 3 - 4).

The two cases above suggest that technology development and implementation do not always follow pre-determined courses. Instead, they often advance through complex interactions and negotiations within specific social and economic contexts (Selwyn, 2011a, p. 41; Williams, 1974), and the potential of technology is not limitless and their consequences are not inevitable. This is called the Social Construction of Technology (SCT), where ICT are "conceived of culturally and socially situated artefacts and systems, then [and] there is nothing inevitable about the way they evolve and are used" (Wajcman, 2008, p. 67). Such a theoretical stance therefore views technology as flexible both in design and in interpretation, and maintains that different social groups attach different meanings and interpretations to a technology in question (Bijker & Law, 1992; Pinch & Bijker, 1984). Those relevant groups, according to the theoretical view, consist of not only designers, but also policy makers, news producers, users, owners, operators, and so on* – groups often with diverging or even conflicting interests (Selwyn, 2011a, p. 45).

According to the SCT, users like students should be able to change the ends by changing the means (Latour & Venn, 2002, p. 252) in their interaction with ICT. But, in order to help students avoid detrimental ends associated with ICT, parents and educators in China often prevent them from using mobile phones on campus and visiting *wangba* outside schools. As a result, students' "subjugated knowledge" (Foucault's idea, cited in Feenberg, 2003b, p. 5) about ICT, gained through limited usage and practice, has little, if at all, chance to effect any significant change towards good ends. That is to say, students in the study are not able to act like a lay public in America who successfully changed the status of Chinese medicine in a new country (Feenberg, 2003b, pp. 5 - 6).

2.3 Human values in technology development

2.3.1 The retreat of *wangba*

Once adult regulation occurs with adolescent interaction with ICT, technologies become embedded with human values, which first shape the ways in which ICT are developed before people put technologies in their appropriate places in human societies (Turkle, 2011, p. 19). To illustrate this point, let's see how *wangba* are being used and viewed in China. Today, *wangba* are gradually retreating from well connected and well developed areas to places where they can survive (Qiu, 2009). This retreat partly results from the fact that home access to computers is less common in less developed regions, where *wangba* serve as public sites of shared access, just like those Jenna Burrell (2009, p. 187) described in Africa. But in China, the retreat also stems from its public image as "morally unsuitable public places" (Golub & Lingley, 2008, p. 4). In one academic paper for instance, they are described as below:

* See Burrell (2010, p. 235) for the differences in users, owners, possessors, operators, and purchasers of mobile phones in Africa.

> The environment at Web bars is troubling. Web bars are narrow, dark, stuffy, and the air in them is foul. Fire-fighting installations in some Web bars are crude and present serious safety hazards. Web bars provide their habitués with a dissolute cultural atmosphere in which they can behave without any inhibitions. A substantial number of the netizens at Web bars are students, but undesirable young people from society also can be found. Some Web bars sell various kinds of cigarettes and cigars, wines, soft drinks, and snacks. Youngsters do as they please here, get in the bad habits of smoking and drinking, and frequently create disturbances. All these things have highly deleterious effects on youngsters' physical and mental health. (S. Yang, 2006, p. 73)

Following the deaths of twelve visitors in a fire of 2002, a series of reports attacking *wangba*, such as the one quoted above, have created and constructed an Internet café for many (and then ill-informed them), particularly those who never visited one before, as an imagined public place that is often associated with murder, stealing, suicide, fighting, etc.,* just as those news producers did in the USA (Herring, 2008, p. 81) and how ICT were constructed as economic goods in the UK (Selwyn, 2007, p. 38).

The discourse against *wangba* in China, like those heroic narratives about digital natives, is powerful and its deterministic tone has depicted the Internet as something out of control and "an external force that impacts on ongoing family life, directly modifying children's behaviour" (Livingstone & Bober, 2006, p. 109) unless the state and adults intervene, despite the fact that science and technology, in China as well as in America, have been portrayed as something reassuring and as solutions to the world of problems – "as other things go wrong, science will go right" (Turkle, 2011, p. 11). As a result, *wangba* are imbued with meanings – to many, they are no longer a mystery, they are "figured out" – as in Burrell's words about Westerners, particularly American Whites, in the minds of some Africans (2009, p. 195) – morally and mentally, and much is presumed once the term is heard.

2.3.2 On an adult screen

Interestingly, what the discourse reflects in China is largely adult perspectives of the Internet and it is embedded with "adult values and adult fears" (Herring, 2008, p. 75), just as the skills of those digital natives have been exaggerated by some adults. The

* For more information about such reports, see Golub and Lingley (2008, p. 4)

Chinese youths, however, do not necessarily buy the discourse, which makes its way into the eyes and ears of the students either directly or through adults. They often have their own interpretations born of their own experiences, just as some of their Western counterparts do (cf. Herring, 2008, p. 76). In their view, the Internet may not be as dangerous as those news producers and adult commentators have described. Unsurprisingly, many choose to reject adult "moral panics" about ICT and simply "do whatever they are not supposed to" (p. 80), and to them, those adults who regard the Internet as spiritual opium are "overly conservative and close minded" (Golub & Lingley, 2008, p. 13). For instance, one user of the Internet wrote online in response to Zhang's association of Internet games with opium in the Qing Dynasty as follows:

> It's because there are too many people like you that my family came to misunderstand me . . . Now they only have to see the appearance of the word "Warcraft" and everything is off limits. As long as China has people like you in it, it will never develop; it seems that people like you have forgotten how the Qing Dynasty fell. (Liu, 2006, cited in Golub & Lingley, 2008, p. 13)

This computer game player clearly stood in sharp disagreement with the opium discourse and criticised the outcry and paranoia as misleading, for the Qing, according to the player, collapsed precisely because it did not embrace technology (Golub & Lingley, 2008, p. 13). Unfortunately, as Herring noted, youth perspectives lack the financial as well as institutional backing enjoyed by the mass media, and they have to operate within a system that is defined and dominated by adults and their discourses (2008, p. 76), which implies how youths behave and what they highlight about themselves either in real or virtual space are still largely influenced by a society that "relies heavily on acceptance and fitting in" and by a culture that substantially shapes what is "cool" about being a student in high school (Stern, 2008, p.107). As a result, adult negative narratives about the Internet have far-reaching impacts on youths in China, and young people are not always impervious to, sometimes they do endorse, adult discourses about ICT; in fact, they do take part in various forms of self-disciplining or self-policing, which thus renders problematic those narratives that overemphasise youth agency in cyberspace (Stern, 2008, p. 99).

As students monitor their own behaviours surrounding ICT, the very same technologies as a form of empowerment (e.g., Benkler, 2006), or "self-actualization" (Buckingham, 2008, p. 10), become also another way of exerting disciplinary power over the young (e.g., Foucault, 1990); and what appears to be an opportunity for self-building or "self-reflexivity" (Giddens, 1991) sometimes turns out to be a process of what Foucault called "self-monitoring" or "self-surveillance" – students become their own policemen and need to make sure that their behaviours in cyberspace conform to acceptable norms and values of their communities; and cyberspace becomes in a sense something like Jeremy Bentham's panopticon, a wheel-like prison where inmates are made to believe that they are always being watched by a prison guard on top of the hub (Turkle, 2011, p. 262) – they automatically conform to the norms imposed by the observer. In Turkle's words, they "look at themselves through the eyes of the prison guard" (1995, p. 248), just as students in schools often look at themselves through the eyes of their teachers. As such, controlling in modern societies does not always have to stem from the presence of brute force. As students learn how to monitor themselves, "discourse substitutes and does a more effective job" (Turkle, 1995, p. 247), for force, argued Foucault, can hardly reach evenly to all individuals.

The panopticon metaphor applies quite well to students' use of *wangba* in China, for many students visiting *wangba* often do that either in line or in conflict with parental expectations or school norms (Liu, 2011, p. 9). For example, spending too much time in *wangba*[*] often makes a "good" student (or feel) "bad." Those weak-willed addicts are generally viewed as lacking of moral education from both parents and teachers (Liu, 2011, p. 14), and the "good" students who occasionally do have some free time to visit the place may not be able to enjoy their time there without a sense of degradation. However, those who visit *wangba* just to relax are "better" than the ones who indulge themselves in playing games for days and nights and forget about their studies and the expectations of their parents and teachers, but somehow "worse" than those who can suppress their desires now and do the "proper thing" (Golub & Lingley, 2008, p. 13). The "proper thing" for "good students" in Chinese high schools is to focus on the preparation of the *Gaokao*, an extremely successful mechanism designed to recruit talents for higher education while deeply stratifying the Chinese population and leaving great implications for life opportunities of millions of Chinese youths (Liu, 2011, p. 16).

2.3.3 The social construction of youth interaction with ICT

As reasoned in Section 2.3.2, technological development and appropriation are not deterministically fixed by its internal laws; they depend on a variety of factors and actors such as socioeconomic conditions, experts, users, officials, and so on (Feenberg, 2003b,

[*] Or *pao wangba* in Chinese, literally meaning frittering away time by immersing oneself in an Internet café (Golub & Lingley, 2008, p. 12)

p. 4). In Feenberg's words, it is not the technological laws alone that shape what technology is. It is "over-determined by both technical and social factors" (1992, p. 307), for technology is not outside of our society, it is an indispensable part of it (MacKenzie & Wajcman, 1999). Students' use of *wangba* in the above mentioned section also suggests that those teenagers are "pressured" users of ICT, and they engage or refuse to engage with their studies as well as new technologies in "pragmatic and strategic ways" – their interaction with ICT must be viewed against the "consequential validity" of the "high stakes" *Gaokao*, and the roles, if at all, ICT play in the students' lives must be peripheral (Selwyn, 2011a, p. 109). However, not all students are compliant with school regulations and policies, and "technological developments have meant that both the capacity to carry out surveillance and the potential for resistance have grown" (Hope, 2005, p. 360), which suggests ICT also offer alternative means for struggle and resistance (Selwyn, 2011a, p. 112), and students' use of ICT thus equates to the tactics often employed through daily routines by those who are powerless and under control, just as de Carteau put: the powerful are "cumbersome, unimaginative and over-organised," while the powerless are "creative, nimble and flexible" (1984, p. 29).

Since technology is a social object, it is subject to human interpretations. To a certain degree, we can argue that technology is "what we make with words" (Chandler, 1995) – what constitutes appropriate use varies from society to society. It is therefore not surprising to see, in the Chinese case of Section 2.3.2, students adjust their relationship with ICT according to certain accepted norms and practices. When their behaviours in relation to ICT are socially "acceptable," they are regarded as "rational, responsible and mature" users (Liu, 2011, p. 17). Otherwise, they are subject to moral or physical regulations. That is also to say, "what technology is for and what it can do" are interpretatively flexible (Grint & Woolgar, 1997, p. 70), just like the Great Wall in China, its meanings are so fluid that they vary across time and perspectives. For instance, in the early 20th century, it represented one of the greatest engineering accomplishments in Chinese history to the nationalist Sun Yat-Sen, Father of China. Mao Zedong regarded it as a symbol of national defence in modern China. Lu Xun, the great author of the 1920s and 1930s, described it as "a wonder and a curse," representing "everything bad about Chinese culture" (Hessler, 2010, p. 141). To the Japanese invaders during the Second World War, photographs of Japanese soldiers beside the Wall reinforced their claim of Chinese territory. To foreign writers such as Jorge Luis Borges and Franz Kafka, the Wall represented Chinese xenophobia, for in their view, the Chinese treat the Wall as the evidence of their cultural greatness. To the Chinese government today, the Great Wall can even be utilised to promote multi-ethnic unity, for it is "more like a river rather than a barrier" (p. 142).

As such, a more progressive analysis of young people and ICT must highlight students' roles in their negotiation of various rules regarding ICT access and use within their home and school contexts (Selwyn, 2011a, p. 110), and take into consideration those social, cultural, and political factors that shape the sub-contexts within which technologies are adopted and used (Selwyn, 1999, p. 79), for technology is as much integrated into social systems as any other human undertakings (Bromley, 1997, p. 53) and ICT are part of and influenced by school contexts (Selwyn, 1999, p. 79). In other words, ICT are not "a set of neutral, benign, and homogenous artefacts" (Selwyn, 2007, p. 36) – they are socially constructed in the sense that different stakeholders such as designers, users, policy makers, and so on create, negotiate, and attach differing and occasionally conflicting forms, meanings, and uses to the technology (Oudshoorn & Pinch, 2003, p. 24).

Therefore, critical analyses of the discourses and policies surrounding technology can help provide a more insightful understanding about ICT and youths than is possible through the study of individual or institutional process alone, for such an approach reveals the power structures that often shape the nature of ICT even before they reach school gates (Selwyn, 2007, p. 36). Put in another way, what defines technology must lie in both hermeneutically interpretable meanings and technically explainable functions (Feenberg, 1992, p. 307). Since what technology is for the groups (e.g., adults in the study) that define its fate determines what it becomes as it is used or abandoned, it is necessary to study the broader contexts within which relevant groups (e.g., both adults and students in the study) reside (Feenberg, 1992, p. 309) and look beyond classrooms and school gates for variables that have played subtle yet significant roles in (mis)constructing what ICT are and what they do *for* and *to* students (Selwyn, 2007, p. 32, my own italics).

2.4 Challenging technological determinism

Treating ICT as texts and studying technology in its social contexts clearly challenge technological determinism, which imbues ICT with inherent qualities that follow "inevitable" courses and "impact" on students and educators alike for worse or better in all contexts (Selwyn, 2011a, p. 41). It also asserts that "technology dominates society and transforms its values" (Feenberg, 2003a, p. 74) or "technology determines history" (Williams, 1994, p. 218) – technologies are the primary causes of social change and they are the foundation of society, as they were and will be (Chandler, 1995). In short, technological determinism views new technologies as external forces that are capable of changing society at many levels – they affect how institutions operate and individuals act and interact. For instance, Karl Marx noted that "the windmill gives you society with the feudal lord; the steam-mill, society with the industrial capitalist" (Chandler, 1995, n.p.). Today, technological determinists tend to assert that, for instance, video games *cause* violence; the Internet *improves* learning (Selwyn, 2011a, p. 41, original italics), *shrinks* the world, and *undermines* national boundaries (p. 42, my own italitcs); or *wangba* ruin the lives of Chinese youths.

ICT constructed under the deterministic framework thus have psychosocial effects, irrespective of how and where they are used. Not surprisingly, learning is sometimes equated with access to information and, notions of "information society"* and "knowledge economy" are utilised to justify growing presence of ICT in schools (Buckingham, 2008, p. 12). It seems that human factors and social arrangements to technological determinists are only secondary. Technologies therefore function autonomously and are "influencing society yet beyond the influence of society" (Buckingham, 2007, p. 74). Technological change, as determinist notion implies, is never a part of broader social and historical developments (Buckingham, 2008, p. 10) and it can be explained without much reference to human society. The social dimension of it, according to technological determinism, is thus represented only through the purposes it serves, but the purposes are always in the minds of its beholders. To technological determinists, technology is pretty much like science and mathematics, which are by nature independent of the social world (Feenberg, 1992, p. 304) and emerge from a value-free process of research and development "rather than from the interplay of complex social, economic, and political forces" (Buckingham, 2008, p. 11).

Unfortunately, technological determinism is flawed in at least the following ways. First, it stresses causality and looks for cause and effect relations. But in the study of youth digital experiences, it is often difficult, if not impossible, to differentiate the two. For

* According to Manuel Castells, the information society is a new mode of development where "the source of productivity lies in the technology of knowledge generation, information processing, and symbolic communication" (1996, p. 16). It is thus a society where ICT are playing increasingly significant roles in more and more aspects of economy and individual life and the level and quality of access to them often determine if and how much one is marginalised or included (Warschauer, 2003c, p. 12).

example, students from well-to-do backgrounds have better access to ICT and perform better in certain subjects. Can one make the conclusion that better access to technology *leads* to better academic results? It might be possible that students' better academic performances make their parents happy and encourage them to purchase ICT for the students as rewards, which in turn empower or enlighten the students in myriad ways. In that case, which is the cause or effect? It is certainly not a "billiard ball model of change" (Chandler, 1995).

However, it is worth noting that this overt notion of cause-and-effect or "hard" or "strong" determinism has now been disavowed by many who study technology and society, and an alternative approach called "soft" or "diluted" determinism has been utilised to analyse the "influence" or "bearing" of technology (Selwyn, 2011a, pp. 41 - 42). For instance, instead of saying ICT improve learning and teaching, soft technological determinists would contend ICT *help* improve learning – they acknowledge the influence of non-technological factors in education, but typically view those contextual elements as constraining barriers and recommend the removal or minimisation of their effects so that the benefits of technology could be better achieved (p. 42, original italic). However, those harbouring such views are still technological determinists, and to them, devices and machines still look like things "out there" that have the capability to invade life (Nye, 2006, p. ix; see also Turkle, 2011), just as Shirky (2008) reasoned:

> Our control over tools is much more like steering a kayak. We are being pushed rapidly down a route largely determined by the technological environment. We have a small degree of control over the spread of these tools, but that control does not extend to being able to reverse, or even radically alter, the direction we're moving in. (p. 307)

Second, a technologically deterministic view involves sociological reductionism, which "reduces the normative and qualitative richness" of the social world (Feenberg, 2003a, p. 74). Also, reductionism often separates things into different parts – one part is assumed to affect another in a linear fashion and interpretations are usually made "from the parts to the whole" (Chandler, 1995). But relations in cyberspace are usually much more complex – they can be non-directional or multi-directional (Feenberg, 1992, p. 304) and the whole can be bigger than the sum of parts, particularly when the process is rich in meanings and purposes. Therefore, holism is perhaps a better approach than reductionism, for it helps one tap into complex pictures. As one shall see later, ICT are not merely tools in the study, and they reflect sociocultural values. To study technology well thus calls for a holistic approach that investigates not only broader socioeconomic contexts within which ICT situate, but also bottom-level meanings that users and non-users alike often pour into access and use.

However, human objects often engender significant sociocultural ramifications. For instance, Anthropologist Julie Archambault found that many young men and women in Mozambique fought with their partners "because of the phone," for a phone can be "uplifting" and empowering, but at the same time, it often triggers intimate conflicts. In that respect, a phone is no longer just a device for communication, but something that can feed suspicion and spark fighting through incriminating texts and voice calls – a phone becomes a "necessary evil," for it allows one to know things that she may not want to know (2011, p. 453). Reductionism is useful and necessary to build theories in the natural sciences, but it oversimplifies social phenomena when we isolate technology from its social context and view it as a single primary determinant. After all, ICT as well as the information they convey are relational (Burrell, 2008) rather than intrinsically beneficial (Castells, 2000).

Third, technological determinism places technology at the centre of its analysis, as if everything can be explained in terms of technology. This techno-centric approach therefore runs the risk of reducing humans into Homo Faber – simple tool-makers and tool-users (Chandler, 1995). But even in antiquity, our ancestors attached significant meanings to the tools they chose to use. For instance, kings in China's Shang Dynasty (1600 - 1050 B.C.) communicated with their ancestors through sacrificial rituals and divinations. Precious objects such as jade and cowry were buried in Neolithic tombs and oracle bones were used to make predictions and record what actually happened after divinations – by hearing the crack of a heated turtle shell, diviners were able to make interpretations of the messages supposedly sent by the dead. Through divination, kings were able to make decisions on what to sacrifice and in what quantity, or whether there would be a disaster or should they go to war or not. Through the process, the turtle shell was no longer an ordinary piece of bone; it was believed to be able to make the connection between the living and the dead, to justify a war and legitimise the rule of a king, for only a king, often the head of a lineage, was able to communicate with those spiritual forces and above all, Heaven (Ebrey, 2010, p. 21).

Likewise, ICT in schools can also be rich in meanings. They are probably not simply a means to achieve students' subjective ends; instead, they can, or at least are believed to be able to, undermine school values and at times leave students prey to risks such as addiction and pornography (Buckingham, 2008, p. 11). By banning access to *wangba* and the use of mobile phones on campus, educators in China are implying that ICT are autonomous in that they develop according to their own laws (Feenberg, 2003c, p. 6) and students of even high school age cannot control them. While adults can control them by simply removing them from students' daily lives, they essentially accentuate or at least acknowledge technology's autonomous power over students. As such, banning ICT on campus is tantamount to imposing a negative deterministic view of technology – once engaged with ICT, students would be at risk and "proper" learning and teaching disrupted. This contrasts with the positive deterministic view of technology where ICT are regarded as a driving force in the history of education – they affect teachers as well as students and shape schools to meet the requirements of efficiency, progress, and modernity; they offer immense resources for enlightenment (Benkler, 2006) and possess the potential to liberate students as well as teachers from narrowly defined ways of learning and teaching (Buckingham, 2008, p. 11).

This positive view was and still is emphasised in certain cases (Selwyn, 2011a), and people believe that, just as cars have extended our feet, ICT have the capacity to extend our eyes and brains. Consequently, positive technological determinists argue that we must embrace and adapt to technology, for instance, the industry-led educational policy of the 1980s in Britain witnessed a large-scale "insertion" rather than "integration" (Barto, 1996) of micro-computers into schools (Selwyn, 1999, p. 80). However, in many Chinese high schools, ICT are normally associated with the negative deterministic view – the Internet and mobile phones shall not enter high school classrooms.

2.5 ICT as texts and instruments

While technological determinism is problematic in many ways, so is its opposing theory of viewing technology as texts shaped by existing social relations and influenced by social norms and values. For the convenience of argument, let's call the opposing theory social constructionism. To people holding such a view, technology has no inherent qualities, cannot determine anything, and is open to human interpretation (Selwyn, 2011a, p. 43). This anti-essentialist approach thus sees technology as "simply a matter of what people choose to make of it" (Buckingham, 2008, p. 12) and the product of human interpretative work – "some more persuasive and influential than others" (Selwyn, 2011a, p. 43). But ICT are not "*completely* open to *any* reading by *any person* at *any* time"

(Selwyn, 2011a, p. 44, original italics), notwithstanding our desire to control the tools we use and downplay the power of ICT – to many, it is just anathema to argue that our tools have their own ends and are now in their control of us (Carr, 2010, 46).

It may be an overstatement to say that ICT are autonomous, but is it true that technology has no properties of its own? While most people today, noted Nicholas Carr, view technology as neutral instruments "entirely subservient to the conscious wishes of their users" (2010, p. 46) and, students and schools *do* make their own decisions on whether or not to use ICT at any given time, it is not convincing to argue that we as a generation have chosen (as opposed to what we might have chosen otherwise) to use what Carr dubbed "intellectual technologies" (p. 44) such as computers and the Internet. It is even more difficult to say that we have chosen the side effects or risks of ICT as described earlier, which were often unintended or even impossible to control. In that regard, argued Carr, the view that technology *is* autonomous begins to make sense, or at least, its progress has its own logic, which does not always converge with human intentions – "Sometimes our tools do what we tell them to. Other times, we adapt ourselves to our tools' requirements" (p. 47).

As reasoned above, technology may have some autonomous laws that operate independently, just as our economy did over a century ago — its laws were initially regarded as uncontrollable. But today, we can develop democratic institutions to change its course, at least to a certain degree. That said, can we develop appropriate institutions in education as well so as to exert effective control over ICT? If the answer is yes, many would probably agree, then ICT are controllable. But any kind of human control involves a choice of one value over another. Through the process of human control, ICT will cease to be neutral instruments, for they frame a way of life in society and a way of learning in school (Feenberg, 2000, p. 446).

But how does that control frame a way of life or learning? To answer this question, the following case might help unravel the logic. For instance, people often argue that "guns don't kill people, people kill people" (Feenberg, 2003c, p. 10), but a society with people armed with guns is essentially different from a disarmed one. Therefore, choosing which society to live in involves, at a moral level, a choice of value that is embedded in the preferred framework of life.

Back to the case of ICT in schools, some instrumentalists may argue: "The Internet is just a tool. You should not let the tool control you. Rather, you must control the tool" (Liu, 2011, p. 4). But when one decides on how to control the tool, in the same vein, she is imposing a cultural or moral meaning upon the tool. Therefore, encouraging or banning adolescent interaction with ICT frames a way of life and learning, which varies from school to school and region to region. In that respect, I concur with Feenberg that technology is an environment within which a preferred way of learning is elaborated, a way of learning with specific modes of pedagogy, assessment, norms, virtues, so on and so forth (1992, p. 309). As such, he was not wrong in arguing that "technology is a social phenomenon through and through, no more and no less significant than any other social phenomenon" (2003a, p. 74).

That said, what is then the right, if any, relation between society and technology? For the time being, a "dialectical approach" (Williams, 1974) or a "theoretical middle way" (Hutchby, 2001) seems to be the way out, for it views technology as both socially shaping and socially shaped in both "enabling and constraining ways" (Selwyn, 2011a, p. 44). In other words, the consequences of technology are partly influenced by its users, but it also possesses inherent constraints and affordances* that were built into it by designers, and those qualities in turn define how a device can be used, which is at the same time shaped or interpreted, often to a large degree, by the interests of those who produce and promote the technology (Buckingham, 2008, p. 12). Is this dialectical approach appropriate in the study of young people and new media in China? How can we "introduce elements of the social into explanations of the technical" (Rappert, 2003, p. 568) and avoid granting either the social or the technological an all-important standing? How can one delve into the "micro-practices of everyday life" without losing sight of the bigger picture – "the encompassing cultural and societal structures" (Berker, 2006)?

2.6 The value of a critical approach

It is worth noting that taking a critical approach to the above mentioned theoretical frameworks regarding technology in society is not to deny the enlightening and empowering aspects of technology and the differences today's youths have to display, neither does it support technological pessimism or promote anti-technology perspectives (see also Selwyn, 2011a, p. 51). Instead, it calls us to think twice about what technology

* They refer to "functional and relational aspects which frame, while not determining, the possibilities for agentic action in relation to an object" (Hutchby, 2001, p. 444).

"disrupts or diminishes" and to drop those unbending views such as the optimism that ICT can solve most social problems (Turkle, 2011, p. 283). Furthermore, taking a critical approach does not mean there is only one "correct" way to examine the relation between ICT and schooling (p. 49), nor does it mean one theory is right or others wrong – it is more about whether a social theory regarding technology in society is appropriate to study, at different levels, both technological and social aspects of the phenomenon in different Chinese high schools, and if it offers a timely corrective to the long-held view that ICT such as *wangba* are closed black boxes with consequences beyond control unless they are crudely removed from youth daily lives (p. 52).

In education, questioning what ICT can achieve does not mean we should let go of their hope – it is undeniable that the Internet has profoundly improved efficiency in the spreading of information and sharing of valuable resources, and it has enabled new ways of collaboration across time and space as we please, and above all, students do find it increasingly important and research does show that "some uses, under some conditions, are associated with improved test scores measuring standard educational outcomes" (Livingstone, 2009, p. 89), not to mention the fact that there are ongoing reconfigurations of pre-existing activities in schools and more and more youths are finding new opportunities of learning associated with ICT. The fundamental issue, as Livingstone pointed out, lies in the successful embedding of ICT and the opportunities they have to offer "within the formal structures of the school and the curriculum, for the benefit of all children" (2009, p. 90).

A critical approach is vital because conventional theories regarding technology in schooling have their limitations, for instance, the technologically deterministic view as reflected in the heroic narratives about digital natives overlook the cultural factors that might have created barriers – often in the form of regulations and restrictions – that even technologically sophisticated users can hardly rise above (Hope, 2005), not to mention the consequences those barriers have for students' educational use of ICT. For example, the supposedly tech-savvy students are likely to be disengaged or disaffected from engaging with technology in schools (Garrison & Bromley, 2004), or they approach ICT in highly conservative ways for learning (Voogt, Almekinders, van den Akker, & Moonen, 2005; Wood, Mueller, Willoughby, Specht, & Deyoung, 2005), which might be responsible for the doldrums ICT have often displayed in education for the past few decades, despite technology's outward appearance of being a high-profile element in contemporary education (Selwyn, 2007, p. 34) and its association with modernity and progress.

Echoing the same point, Livingstone argued that daily practices and normative judgements in education are actually shaping (and limiting) what ICT can achieve, for what's familiar is reproduced via ICT much more easily than is something new and novel. Unsurprisingly, the view that ICT herald new ways of learning and teaching has witnessed, as yet, little evidence mainly because of the influential yet conservative ways in which schools still operate. For instance, ICT are often utilised to deliver pre-determined curriculum rather than foster student-centred and creative forms of education (2009, pp. 88 - 89). Moreover, the celebratory narratives assume that, noted Livingstone, parents attitudinally share the same educational and technological vision for their children, and they possess the material resources to realise it (2009, p. 64).

Finally, most claims about digital natives are based on data collected from the West. Research into interactions between young people and new technologies elsewhere are therefore increasingly important, particularly when ICT are permeating in developing countries such as China (Castells, Fernandez-Ardevol, Qiu, & Sey, 2007), Jamaica (Horst & Miller, 2006; Miller, 2006), Ghana (Burrell, 2008), Mozambique (Archambault, 2011), and India (Warschauer, 2003c) at breathtaking rates. While the generalisations about digital natives in developed countries overlook the effects of sociodemographic factors on access and use, it would be worthwhile to investigate the relationships between those factors and ICT appropriation and use in developing countries such as China, where great social transformations are taking place with deep undercurrents of inequity that are plaguing many sectors of Chinese society today (Cartier, Castells, & Qiu, 2005; Hessler, 2010; Murphy, 2008; Whyte, 2010b).

Chapter 3

Mind the Gap

3.1 Contemplating the conceptualisation

The term "Digital Divide" was initially coined to describe the gap in access to computers and the Internet along factors such as race, gender, age, income, and education. The term drew attention from a wider public (Gorski, 2005; Mossberger, Tolbert, & Stansbury, 2003; Servon, 2002; van Dijk, 2006) after America's National Telecommunications and Information Administration (NTIA) released its report Falling Through the Net, where it was utilised to denote "the divide between those with access to new technologies and those without" (NTIA, 1999, p. xiii). However, using the metaphor to describe disparities in the information society is not problem-free and how it is defined and then interpreted has social ramifications.

3.1.1 A continuum rather than a dichotomy

First of all, the term presents a binary logic which divides society into two simple groups of people – the haves and have-nots. This logic, though "expedient for describing sociotechnological differences" (Gunkel, 2003, p. 507), implies an absolute inequality. But in reality there are areas of gray and digital inequality itself is dynamic and multifaceted (Grant, 2007; Livingstone & Helsper, 2007; Selwyn & Facer, 2007; van Dijk & Hacker, 2003). In other words, between technology haves and have-nots also exist other groups, for instance, a group I would like to call have-togethers — those who for various reasons share access to ICT.

In many parts of the world, sharing access to technology is probably a norm today. For example, Burrell found it so common in Uganda that digital technologies were made widely available to multiple users either free or at a small fee. Those devices included telephones in telecenters, the Internet in Internet cafés, and computers in schools (2010, p. 230). In remote and resource-constrained areas, even mobile phones can be commonly shared among family or community members. That is to say, there are rich and diverse ways in which people gain access to and use ICT, as people did with bicycles, televisions, and radios in the past (perhaps still so today). All in all, people are imaginative and innovative in welcoming the new from their margin. The binary logic thus subverts the very agency of the technologically marginalised.

Though implicitly, the logic also accentuates the characteristics of the digital-haves and pathologises the have-nots. In other words, the binary logic views ICT as an end rather than a specific means to achieve a specific end. As a result, those who are on the wrong side of the dichotomy are often registered as disadvantaged (Burrell, 2010, p. 232). For instance, among the categorically disadvantaged are those who for various reasons refuse to use ICT. But they are often blindly associated with socio-economic, cultural, or cognitive deficits (Selwyn, 2003, pp. 101 - 102). The term thus implies having is essentially good, more is better, having and having more is inherently desirable for all (for a similar view, see Selwyn, 1999, p. 82). While being true to a certain degree, the logic overlooks the fact that people take different attitudes towards ICT, and underestimates the capacities individuals have to rational choice and free will.

It is also true that ICT are not randomly adopted, and there are groups of people who are disenfranchised because of economic conditions. But, in this study for example, there are many young people banned from using ICT mainly because their parents and teachers view the technologies in question as being detrimental to the teenagers' healthy development, not because they/their families are unable to afford them. So treating non- or less-use as a social problem to be solved, rather than a social selection process, is based on a poor understanding of the phenomenon, for choosing not to participate is a way of life for many students in the study – they are "conscientious objectors" who choose not to take part in the information society in order to dispel adults' moral and safety concerns (boyd, 2008, p. 121). That is to say, they are practising a level of agency — they want to assert some control over their own lives, just as those users of ICT do (Selwyn, 2003, p. 111). As such, not having ICT can be more of a "digital decision" than of a "digital division" (Selwyn, 2011a, p. 115).

It is worth noting that those who choose not to participate, or do not let their children to use ICT, include also computer phobias, who always fear that computers and the Internet pose real threats to either themselves or their children. Their negative perceptions of ICT thus keep technology at bay (Selwyn, 2003, pp. 103 - 104), just as some parents, grandparents, and teachers do in the study. Nevertheless, it is not clear if the fear of or aversion to technology is temporary. To technological enthusiasts, the fear may result from the lack of experience – it is just a matter of anxiety, as ICT become more prevalent, it will disappear. However, what we do know about technophobia is that it is related to individual characteristics (Selwyn, 2003, p. 104). Put in another way, (not) choosing to use ICT can be a result of personal preference or taste (see Gosling, 2008, for an insightful account of the relationship between personality and the ways people use ICT).

Others who refuse to use ICT are for ideological reasons – they are the "*information want nots*" (Selwyn, 2003, p. 104, original italics). Those people, including some of the students in the study, have the capability to participate in the information society if they so choose; but to protect traditional or "proper" ways of learning, they say no to ICT. In other words, ICT are objects to which users often attach meanings and values (Horst & Miller, 2006). Therefore, to simply categorise people into either haves or have-nots according to their external attributes of possession masks a great deal of information about why and how people use technology (Snyder, Angus, & Sutherland-Smith, 2002).

Therefore, it is important to appreciate the variety in patterns of access and use, for individuals, pointed out Amartya Sen (1992), have different needs and possess different capabilities, either genetically inherited or socially endowed, in satisfying their needs. Equality can mean absolutely equal share of essential resources such as food and water; it can also mean shares matched to individual needs or worth/value, however defined; or a resource made available for individuals to take advantage of according to their own values and preferences. Regarding digital inequality, non-access can be the result of limited financial resources, but it can also involve the consequences of free will, or regulation/restriction/coercion from one group (e.g., adults) upon another (e.g., students), or some combination of the possibilities (Burrell, 2010, p. 232). Therefore, it is vital to examine the social process under which digital inequalities occur.

3.1.2 More than technology

Second, the digital component of the term underscores "affordability rather than ability to use technology" (Mossberger et al., 2003, p. 4). It sounds as if there were a straightforward treatment out there, which, once applied to the disadvantaged, has a magic healing power (Selwyn, 2003, p. 107). It thus implies that access to technology alone can solve gaps in education. While it is undeniable that access is a primary condition for students to benefit from ICT, and it is indeed a problem for many in developing countries like China, the gap in access alone does not make the phenomenon a root problem. As ICT become increasingly affordable, the ways in which people *use* them are attracting more attention.

For instance, Mark Warschauer recently reported that access to ICT had improved substantially in America and certain groups such as African-American and Hispanic youths in America today actually spend more time with new media than do Whites, yet there are differences in how and how much they benefit from using technology (2011, p. 29). Another recent study by Vigdor and Ladd (2010) reported that academic benefits associated with technology were strongly mediated by students' SES and race in America – similar findings were reported at the end of last century (Attewell & Battle, 1999). That is to say, the spread of computers and the Internet did not narrow existing social and educational inequalities. Instead, it appears that they have generated another "Sesame Street Effect" where technology of promise actually increased the educational gap between the affluent and the poor, and "even among those with access to the technology" (Attewell & Battle, 1999, p. 1). Therefore, the problems associated with the so-called Digital Divide are not merely technological — they are rooted in social, educational, and economic factors that are responsible for almost all types of inequality in society.

Other studies have also reported that the had-nots are spending more time on ICT. According to Lenhart and colleagues (2010), Black and Hispanic youths in America made more cell phone calls per month and were more likely to gain access to the Internet via their phones. Rideout and associates (2010) found that Black and Hispanic teens spent more time online than White Americans did, although their overall level of access to ICT was lower than that of White youths. The team further concluded that print media were the only media that White Americans spent more time on per day than Blacks and Hispanics did. In Wenglinsky's study, the socially disadvantaged generally gained less from technology use than did the socially as well as technically privileged (2005).

Researchers outside America have also documented such a trend, for instance, Jochen Peter and Patti Valkenburg reported children from lower social backgrounds were more likely to use ICT for entertainment than were those with more educated parents (2006).

This new trend in youth engagement with ICT thus reveals that youths of lower SES are more likely to "exploit" or indulge themselves in what they have once they are connected to technology, or more vulnerable to the risks associated with ICT such as addiction. That is to say, accessing the Internet is relatively easier; the intellectual demands of using it are much higher (Livingstone, 2009, p. 73). Therefore, greater exposure to technology sometimes has negative consequences, and more is not necessarily better. And students' engagement with ICT often has a negative bearing on their academic performances, particularly for the socially disadvantaged groups such as African-Americans and the ones with low SES, just as Vigdor and Ladd (2010) noted: "unproductive computer use is crowding out schoolwork of all kinds" (p. 28).

The findings in America also resonate with what Livingstone said in the UK – if priority is given to access rather than use, if the conditions for high quality use such as teacher training, curriculum design, and collaborative practices are missing in schools, if students do not know how to effectively search and critically evaluate online content, and if ICT exist to substitute for quality teaching, then academic benefits associated with ICT use, if at all, would be very limited (2009, p. 80).

If we compare the research findings from both America and the UK, we can easily find what Livingstone called a curvilinear relationship: those who use ICT from time to time perform better than those who rarely use technology and those who use it a lot (2009, p. 79). To explain the positive correlation between low SES and high academic performance mediated through ICT, Livingstone (2009, p. 81) reasoned, low-SES students have benefited from Internet use probably because their friends cannot afford extensive access, thus they have more time to read and concentrate rather than chat and play in cyberspace as many of their better-off counterparts do.

The conclusions made in the above-mentioned studies are thus grounded on the differences in use. In other words, the physical divide as reported in Mossberger and colleagues (2003) almost ten years ago in America is narrowing, but other forms of divide are gathering momentum. Therefore, ICT are not always as empowering as they appear to be if viewed in isolation from social factors, and their effects on academic performances are mixed (Livingstone, 2009, p. 77; Warschauer, 2011, p.28). Since what matters most is often relative rather than absolute inequality, lower-SES students may remain relatively disadvantaged even they gain more access to ICT. To put it in another way, mere access to ICT may end up exacerbating rather than reducing pre-existing social and educational gaps, even though ICT often promise to ameliorate those gaps (Livingstone, 2009, p. 81).

As such, the term sounds as if the problem is merely a technological issue (Gunkel, 2003) – as long as access is provided, all other problems will be solved. But the reality is that technology appropriation is often related to both technological and social changes, and users of technology are not always passive recipients of what is available. Instead, they act upon, namely, evaluate, adopt, adapt, and integrate technology into their daily lives – a process Daniel Miller called "localization" (2012, p. 150) – so that a chosen artefact becomes "specific to the cultural concerns" (p. 150) of a region, serves individual purposes, and helps its users achieve their potentials. This is the process of technology appropriation, which often alters what technology is and how it is used (Sey, 2011, p. 378). As Orlikowski argued, users of technology are "purposive, knowledgeable, adaptive and inventive agents who engage with technology in a multiplicity of ways to accomplish various and dynamic ends" (1992, p. 423).

The Digital Divide metaphor thus echoes the tone of technological determinism, which claims that the direction of technological change is pre-determined by an internal "technical logic" and this change has sure impacts upon individual lives and economic conditions of societies, implying that social or educational change automatically follows technological change (Williams & Edge, 1996, p. 868). In other words, technological determinists often suppose, rather than demonstrate, that once equipped with ICT, users will start enjoying the benefits they have to offer, despite the fact that some ethnographical studies (Horst & Miller, 2006; Slater & Kwami, 2005) have proved otherwise and that the link between ICT and development "rests more on wishful thinking than empirical findings" (Archambault, 2011, p. 446). Regarding this point, Castells also reminded us that technology alone is not enough, people's ability to use and adapt ICT (human and social factors) are equally, if not more, important "in generating and accessing wealth, power, and knowledge in our time" (2000, p. 98), and their skills and experiences with ICT are often shaped by the conditions in households and communities, such as the types of computers and Internet access they enjoy, as well as the educational backgrounds of others surrounding them.

3.1.3 How do different divides relate to one another?

Finally, the Digital Divide metaphor tells us nothing about the relationship between different types of divide. For instance, about ten years ago, the access and skills divides in America reinforced each other in Mossberger and colleagues' study — people without access had fewer opportunities to practise skills necessary for entry to cyberspace, and those who lacked the skills did not bother going online – it was a vicious circle that time (2003, p. 121).

Neither does the metaphor provide any information about how the types of divide in cyberspace relate to existing types of inequality in education and society. We know that the access divide has substantially narrowed, the had-nots are now more vulnerable to the risks of technology than are the haves such as American Whites. Therefore, digital inequality in schooling "is more often entwined with than opposed to the well-established internal processes of stratification within schools," just as Warschauer and associates noted:

> We found no evidence to suggest that technology is serving to overcome or minimize educational inequalities within or across the schools we examined. Rather, the evidence suggests the opposite: that the introduction of information and communication technologies in the schools serves to amplify existing forms of inequality. Differences in human support systems for technology use, homework assignment patterns, and emphases on preparation for testing all mitigated the extent to which technology could be used effectively for academic preparation in low-SES schools. (2004, p. 584)

In order to draw our attention to social factors that have contributed to the differences in the digital age, Turkle too noted that students have different minds and mindsets, and they appropriate ICT or make ICT their own in different ways, so do they in using and interpreting ICT — their personality, history, and culture together shape how they see and use technology (1995, p. 31). Unsurprisingly, lack of sufficient skills in use, despite more provision of technology, can at times reinforce rather than remediate social inequalities (Mossberger et al., 2003, p. 6) – those with skills and privileges in the digital age are more likely to utilise ICT for even greater achievements than are the ones who are less skilful and socially privileged (Warschauer, 2011, p. 29).

The term thus provides a poor roadmap for resolving social problems such as gaps in education, and material access to technology is not a sufficient condition for social inclusion (Warschauer, 2003c, pp. 7 - 8), just as piano alone is not enough for producing music (Kay, 1991). When we see ICT as musical instruments or the extension of our mental activities, we may find it easier to realise how insufficient it is to achieve something via access to technology alone, for the phenomenon under concern is a dynamic and fluid process – while the divide in access is narrowing, others (e.g., generational divide) may be emerging and widening (e.g., usage, skills).

3.1.4 A School vs. Society divide

Corresponding to the generational divide discussed in Section 1.2, the Digital Divide sometimes manifests itself in a broader society vs. school divide – the differences between students' experiences outside schools and their daily routines of school life (Buckingham, 2005, p. 13), or a "digital disconnect" between students' social lives and their school experiences in Neil Selwyn's words (2007, p. 39). However, the term Digital Divide is unable to capture such a phenomenon. One the one hand, it is often argued that school structures are unsuitable for technological penetration – teachers are too old to fully engage with their tech-savvy students, curricula are too rigid and entrenched to effectively integrate ICT into meaningful learning and teaching, school leaders or administrators do not have enough funding or vision "to go with the technological flow" (Dale, Robertson, & Shortis, 2004). Therefore, schools are virtually "dead-sites" (2007, p. 39) for any meaningful use of ICT.

On the other hand, students' outside worlds in China, as in many other countries, have undergone enormous social and cultural transformations over the past 30 years or so. And ICT become increasingly important in the ways they relate to information (ultimately knowledge), communicate with one another, and probably exert certain control over personalised, flexible, and creative modes of learning. For instance, they have more freedom and autonomy in deciding where, what, and how to learn than ever before (see a discussion regarding mobile technology and learning in Selwyn, 2007, p. 40).

Yet Chinese secondary schools, like some of their Western counterparts, have remained pretty much the same and ICT in schools often fail to make the bond with students' real concerns and interests – little has changed in how teaching and learning are conducted, in the ways students are assessed, and in the power relations between teachers and students (Buckingham, 2005, p. 26). And more often than not, students' use of ICT is subject to rigid regulations, like what Arafeh and Levin (2003) described about the situation in America: "For the most part, students' educational use of the Internet occurs outside of the school day, outside of the school building, outside the direction of their teachers" (p. iii), and "new" technologies simply repeat the mediocrity of "old" ones in education (Selwyn, 2007, p. 41). However, the "disconnect" between society and school is becoming more salient than before when the commercialisation of ICT is affecting many aspects of adolescent life today. And indeed, as Buckingham pointed out, students are now growing in a consumer culture where the young are often treated as "active and autonomous", although much school learning remains "passive and teacher-directed" (2005, p. 14).

3.1.5 Closing the divide through the market?

To a society, ICT can be "public goods" which provide "spillover benefits" or "positive externalities" – positive effects that ripple beyond those who are directly involved in the transactions of the goods (Mossberger et al., 2003, p. 5). Like public libraries, ICT are often associated with economic growth, democratic spirits, and transparent governance. In education, they are usually viewed as vital to a knowledge economy (see Selwyn, 2007). However, if left alone to market forces, such goods may under-provide those externalities. Therefore, it is crucial that policy makers see other aspects of the Digital Divide as the gap in access to devices narrows (Mossberger et al., 2003, p. 5).

Those who believe in market forces to bridge the divide tend to support the diffusion theory of innovation (Rogers, 2003), which states that new technology starts from innovators to early adopters in a society. The wealthy and educated are more likely to adopt it earlier than the rest of the society. But as time advances, it becomes more advanced and its cost lower, an "early majority" thus appear. Following that come the "late majority", and by that point, those who still have not adopted the technology are called "laggards." But eventually, the technology will saturate the society. This model is the famous "s-curve" of diffusion theory, which asserts that new technology will sooner or later trickle down to the whole population and that the earlier one adopts the technology, the more relative advantages one can derive from its use. Therefore, the have-nots are simply laggards -– their adoption of technology is just a matter of time (Norris, 2001; van Dijk, 2005).

Clearly, the diffusion theory values the speed at which users adopt a new technology rather than how they make the technology their own (Sey, 2011, pp. 378 - 379). It also assumes that the early adopters will stay where they are and the market is a neutral mechanism that responds to what individuals need (2005, p. 12). Unfortunately, such assumptions are not always correct and the gap between the technology rich and poor *does* have significant consequences. For instance, the poor's disenfranchisement in the information society not only limits opportunities for themselves, but also reduces the size of the market for a new technology (Selwyn, 2003, p. 105). Moreover, young people who are privileged in terms of access to ICT are more likely to participate in wider technology-based activities and get more out of their engagements with technology than are those who are technologically disadvantaged (Buckingham, 2005, p. 12; Davies & Eynon, 2013). As a result, the diffusion of technology often mirrors or even exacerbates existing social inequalities over time (Witte & Mannon, 2010, p. 3).

3.1.6 Elements crucial for a progressive understanding

Taken together, the definition of the digital divide must take into consideration elements beyond physical access and the sociological context within which ICT penetrate. As Warschauer (2003a) noted, "the opposite of the divide is *multiply*" (p. 47, original italic), implying the benefits of access and social inclusion can only be maximised when physical access comes with human and social support, for gaining access to the information society is a social practice (Warschauer, 2004; Warschauer et al., 2004). As such, to reap the benefits of using ICT is not just a matter of education but also of power, for ICT alone generate no automatic benefits. Other academics have echoed the point when they analyse the features of the digital divide and examine human efforts to address it (Avgerou, 2003; Madon, Reinhard, Roode, & Walsham, 2009; Selwyn & Facer, 2007; Thompson, 2008; Warschauer, 2003b). The overarching theme emerging from those analyses is that ICT on its own is not sufficient to address social and educational problems such as poverty and inequality, for the technological gap is but one link in a causal chain that has reproduced social and educational disadvantages.

While the social context where ICT access and use situate is important, it does not mean that individuals are less vital in the investigation of young people and new media. That is to say, we need also to understand the meanings students attach to their gadgets — in Selwyn's words, why ICT are relevant to their lives and learning experiences from their own points of view (2003, p. 109); or as Turkle (2011) put, what do the objects "evoke in their users" (p. 20). ICT are relevant to students probably because they are fun and enjoyable, because they are sources of information and knowledge, or because through technology they can better communicate and socialise with their parents, friends, and/or persons of significance. Since the values and meanings people pour into their ICT are shaped by the ways they organise their lives, it is also necessary to study how students appropriate and incorporate technology into their daily lives -– how do they negotiate the right place of ICT in their daily routines of life and study (Selwyn, 2003, p. 110).

But to achieve an even more progressive understanding, one perhaps needs to shift the paradigm of the traditional digital divide concept. By employing a multicultural approach in education, Gorski (2005) argued that this shift requires one to replace the equality orientation with an equity orientation by considering the larger and more contextualised picture of education and society (p. 6). In other words, one needs to examine the digital inequalities under the broader inequities in education and society. For instance, the gender digital divide is a symptom of sexism. To better understand it, one must place it under that broader context of sexism. Therefore, we cannot fully address the gender digital divide by simply throwing ICT to an inequitable system where girls and women are systematically discriminated against. Likewise, adding more computers and faster Internet access to schools cannot easily "transform teachers' attitudes and expectations of different students or the pedagogical gaps" (Gorski, 2005, p. 37).

The digital divide, like the gaps in teachers' pedagogy and expectations of students, is deeply rooted in its social, cultural, political, and historical contexts. Therefore, any effective way to address it must aim for solutions at these higher levels. Otherwise, ICT, widely regarded as great social and educational equalisers (Benkler, 2006; G. Yang, 2009; Zheng, 2008), "will at best uphold current inequalities and at worst deepen them" (Gorski, 2005, p. 37). Gorski's perspectives are helpful, but they are too pessimistic to see the enabling and empowering features of ICT. Unlike technological determinism, they see technology as a social product "patterned by the conditions of its creation and use" (Williams & Edge, 1996, p. 866). Like technological determinism, this "social determinism" simply views technology as the subject of a single rationality or logic, such as the political imperative of the ruling class. Therefore, a more accommodating approach should avoid these two extremes, for the digital divide refers to not just a technological problem, but a constellation of social, economic, political, and cultural issues. In other words, any attempt to give a rigid and univocal definition would risk oversimplifying the flexible, plural, and multifaceted nature of the phenomenon. Since the technical is entwined with the social, next I am going to provide a contextual knowledge about how patterns of inequality in China formed over the course of contemporary Chinese history.

3.2 Social inequality of contemporary China

3.2.1 The two social transformations

To better examine the social structures within which digital inequalities situate in China today, it is necessary to understand the major social transformations after the foundation of the People's Republic, the transformations that shaped, to a large extent, what China is like today. According to Martin Whyte (2010b, p. 2), China has undergone two primary social revolutions since 1949. The first was socialist in nature and was launched by Mao and his colleagues during the 1950s. The second started in 1978 and embraced capitalist market into the socialist state. However, both demanded the Chinese people to renounce or abandon former ways of living and welcome a new yet radically different social order.

Regarding the consequences of the two major transformations, conventional discourse goes like this: the first aimed to eradicate the gigantic social gaps of the "feudal" society, and it was made possible largely "through class struggle and the creation of socialist institutions in the mid-1950s" (Whyte, 2010b, p. 2), regardless of the impacts those changes would have on the country's economic growth; the second was featured with its emphasis on economic development over everything else, and it was achieved mainly through the promotion of foreign direct investment, introduction of market competition, and encouragement of export, regardless of the effects those measures would have on social inequality.

As for the first social revolution, people normally associate it with total equality, for various campaigns, particularly those launched during the decade of the Cultural Revolution (1966 - 1976), eliminated differentials in material rewards such as dressing styles and housing quality, and hundreds of thousands of educated urban youths were mobilised to the countryside to take up farming after 1968 so that social inequalities between urban and rural China could be reversed (Whyte, 2010b, p. 3). However, the period also witnessed many intellectuals and experts attacked, intimidated, or even driven to suicide, while those viewed loyal to political patrons made decisions on the lives of their fellow citizens. The pursuit of equality in the period thus undermined economic development. In the words of Whyte, by the 1970s, China was "too equal and thus fundamentally inequitable" in the sense that skills, efforts, and contribution to society were no longer acknowledged (2010b, p. 3).

Because of the disastrous consequences of Maoist egalitarianism, China's leaders in the post-Mao era had good reasons to focus on economic development and down-value social equality. As a result, the second revolution saw the country's economy grow strongly and rapidly for over thirty years. But at the same time, social gaps manifested not only quantitatively in statistics, but also qualitatively in aspects such as access to education and medical care. By the first decade of the 21st century, China has become once again very unequal (Whyte, 2010b, p. 4), which is reflected in the divide in question – differences in adolescent access to and use of ICT.

3.2.2 The persistence of *Hukou*

Section 3.2.1 described conventional views regarding the two transformations in China, but those views are misleading in several ways. While being true to a certain extent, they are based on the following two assumptions. First, they assume that socialism equates to egalitarianism and state planning or intervention always results in equality. Second, they give people the impression that peasants in Maoist China enjoyed similar status to that of urban residents. But in fact, China's rural-urban divide resulted to a significant degree from the institutions created in Mao's China.

For instance, the Household Registration System (*Hukou*) before 1949 existed merely to record where people lived (Whyte, 2010b, p. 7), but in Mao's China, it was utilised at various points to control the movement of Chinese people, particularly after the collapse of the Great Leap Forward (1958 - 1960), which first recruited as many as 20 million rural migrants to satisfy the estimated labour shortage in urban factories, then deported roughly the same number to the countryside after the campaign failed in the 1960s. However, the gates of Chinese cities kept shut to rural labourers until the reform era and the socialism created in Mao's era was every bit biased against peasants and agriculture and towards urbanites and industrial development. For long, China's countryside was "a source of low-cost agricultural products to feed the urban population" (Whyte, 2010b, p. 9) and urbanites were guaranteed jobs, subsidised housing, education, and other benefits.

With those institutional discriminations, peasants were unfortunately left to rely upon their own labour and whatever their local communities had to provide (see also Ming, 2009, p. 27), and they had to turn over a large proportion of their agricultural produce to the state at artificially low and bureaucratically set procurement prices each and every year. However, the prices for goods manufactured in cities, such as chemical fertiliser, were relatively high. In the end, the price scissors, together with low state investment in agriculture and the limitation of labour movement, resulted in widespread poverty the Chinese peasants had to endure throughout the socialist period (Whyte, 2010b, p. 10). Even worse, Chinese rural residents, starting from the 1950s, were not simply bound to soil and the lower end of economic development; they were also regarded as a lower caste.

This prejudice largely stems from the *Hukou* system, a mechanism introduced in the 1950s by the state in order to limit voluntary rural-to-urban migration initiated by individuals. Under the system, even today, a child inherits her mother's household status and is registered as either agricultural (rural) or non-agricultural (urban) once she is born. Since the status was tied to a range of benefits or restrictions, individuals could only move downward or horizontally, not upward (from rural to urban) unless permission was granted (e.g., admission to higher education in cities, or service in the army). Urban status was however not always permanent, and often people were required to move from bigger cities to smaller ones, or to the countryside, not necessarily to their places of origin though. Because of such a mechanism and other man-made institutions such as the rationing system in Mao's China, it was extremely difficult for a peasant to move to a city and survive there. For long, the *Hukou* in China, noted Dorothy Solinger, Professor of Chinese Studies at UC-Irvine, is the "most fundamental political institution that defines the relationship of Chinese citizens to the state and its resources" (1999, p. 3).

Nevertheless, the *Hukou* has been relaxed. But still it is a key determinant of one's entitlement to public services and local citizenship (Ming, 2009, P. 28), and it proves to be an effective way to keep Chinese cities relatively lean, for the countryside in many provinces are largely reserved for the old, young, unemployed, and "rusticated" urbanites.* The *Hukou* is also responsible for the vast urban-rural gap "which limits the opportunities, mobility, and welfare of rural dwellers" (Ming, 2009, P. 28) and shapes the level and nature of students' engagement with ICT. Today, although it is much easier than before for a rural resident to relocate and work in a city, for most jobs there are

* For accounts of rural youths "abandoning" (leaving for long) their home villages, see Hessler (2010) and Whyte (2010b, p. 11).

no longer assigned and essentials of life bureaucratically controlled through rationing according to local *Hukou*, it does not mean that one's rural *Hukou* automatically migrates with her, implying that she is excluded from state provision of public services in her host city (Cheng, 2010, p. 24), for instance, the education of her child must be left in her home province.

3.2.3 Marginalisation in cyberspace

It is undeniable that China's reform policy has made the lives of millions of ordinary Chinese people better and easier than before, and the state has indeed abandoned many institutions and policies designed in the socialist era, for instance, the de-collectivisation of agriculture and return to family farming under the Household Responsibility System. It is indeed very common to see rural residents migrate and settle in large cities such as the Special Economic Zone of Shenzhen in the study. It is also true that making a living in cities like Shenzhen today for migrants is no longer impossible – for many, it is just difficult. They can get ahead as long as they are hard-working, talented, and well-educated (Whyte, 2010a, para. Conclusion: Beyond the myth of the social volcano), and as long as they are willing to take up those low-paying, low-skilled, and often temporary and unstable jobs urbanites usually disdain, namely, the three-D jobs, which are "dirty, difficult, and dangerous" (Whyte, 2010b, p. 14). It is difficult partly because the socialist *Hukou* system is still functioning today and only marginal changes have taken place ever since. As such, China's economic development is sometimes viewed as an "incomplete urbanization" (K. W. Chan & Buckingham, 2008, p. 583), where migrants working in cities do not enjoy full citizenship in those cities.

Yet, rural residents keep leaving their home villages in order to earn a decent living[*] or to escape rural poverty[†], although signs begin to show in recent years that some villagers prefer to stay in their home towns as the state is trying to narrow the rural-urban divide and shift priorities towards rural development (Whyte, 2010b, p. 20). As a result, migrant workers, or the so-called "floating population," often constitute a significant proportion of a host city's *de facto* population (Ming, 2009, p. 17), particularly in those newly arising cities such as Shenzhen.

As such, Whyte was not wrong in making his conclusion that: "China entered the new

[*] Pull factors such as higher income and more opportunities in cities.

[†] Push factors or unfavourable conditions such as surplus labour in rural China, see Cheng (2010, p. 3).

millennium still sharply divided into two separate castes, rural and urban, with sharply different rights and opportunities in life" (2010b, p. 13). In education for instance, while the *Hukou* system still functions, market reform at the same time affects the financing of public schools (Whyte, 2010b, p. 14). Since local governments during much of the reform era have to raise revenues to provide basic public services, and not all local governments are equally able to generate enough funds, significant urban-rural and regional gaps in public expenditure for education exist (Cheng, 2010, pp. 24 – 25), hence the saying (Ming, 2009, p. 35): "The more you collect the more you spend, the less you collect the less you spend, rely on yourself to balance accounts" (*duoshou duozhi, shaoshou shaozhi, ziqiu pingheng*) — the central government has devolved its financial responsibility to local governments while benefiting the most from internal migration (see also Cheng, 2010, p. 24).

China's economic prosperity in the past 30 years or so has not yet translated into "equal opportunity for all Chinese citizens" (Whyte, 2010b, p. 15), and the categorical *Hukou*-based discrimination by people and institutions against rural migrants in Chinese cities has persisted throughout the reform period (Hessler, 2010, see also). For instance, migrants in cities are often regarded as "uncultured, backward, and, in general, less civilized than urbanites" (Whyte, 2010b, p. 16), and also blamed from time to time for increasing crime rates in cities. Due to such barriers migrants have to confront in their host cities, Whyte argued that rural-to-urban migrants in Chinese cities cannot be classified as a separate caste in reform era China, and there are still two primary castes – rural or urban residents, for the barriers villagers face in order to migrate are much less significant than the ones facing migrants who want to be urban residents or to be treated as urbanites -– the former is mainly a financial and logistic issue, whereas the latter is legal and rooted in urban cultures (2010b, p. 16). As such, it is appropriate to treat the students in one school of the study (Hengshan) as rural teenagers, even though the majority of the students' parents are migrant workers in big cities far away from the school.

3.2.4 Rurality and ethnicity in Tibet

Having analysed how rurality contributes to inequality in China, it is now time to examine the roles ethnicity plays in the digital divide. Also starting in the 1950s, the Chinese state identified 56 ethnic groups* or nationalities (*minzu*) according to their

* Except for the mainstream Han, 55 other ethnic groups constitute about 9% of Chinese population, see Cheng (2010, p. 18).

unique cultural and linguistic marks that had been persistent over time (Cheng, 2010, p. 16), and designed a series of policies aiming to help those minority regions to achieve economic and cultural development. Those social arrangements are called preferential or ethnic policies, which confer a long list of benefits that only officially recognised minority groups are entitled to (Cheng, 2010, pp. 51 - 52; Sautman, 1999), and the policies often manifest in education, housing, and family planning (Hu & Salazar, 2010, p. 292).

In Tibet, the policies nevertheless created an urban-rural cleavage, for urban ways of living there were subsidised by the state and salaries in state sectors were deliberately set high, often on a par with those in China's most prosperous cities (Hu & Salazar, 2010, p. 295), while living standards in rural Tibet remained "among the lowest and slowest-growing in the country" (p. 296). This income inequality, together with the low population density as well as Tibet's adverse weather and geographic conditions, have made urban-rural divide in Tibet "the steepest among all regions in China" (p. 296).

Since the state relaxed its *Hukou* system and invested substantially in the country's western borderlands such as Tibet, the past two decades or so witnessed the flooding in of rural Han migrants to the Tibet Autonomous Region (TAR). Today, those Han Chinese mainly work in the third sector, construction, or run their own small businesses due to the lack of manufacturing in the region. However, like rural migrants in other cities of China, those migrants retain their rural *Hukou*, and in Tibetan cities, they are also subject to systematic institutional discriminations against them in terms of social status, education for their children, and health care (Hu & Salazar, 2010, p. 298). For instance, a recent study by Hu and Salazar reported that urban Tibetans do not necessarily view rural Han migrants in Tibet as "unfair competitors" (2010, p. 288), just as one Tibetan official described in the same study some Han migrant workers' job in Tibet:

> There were no pedicabs in Lhasa before Han migrants started them. Having a man pedalling, sweating and panting like crazy in front of a cart . . . only animals would do that. Only those Han men would do that. Tibetan young men refused to do it . . . We Tibetans don't shine shoes on the street. Holding other people's stinky feet with your hands and putting them right in front of your face? How gross is that?! I would never do that even if you gave me ten thousand Yuan. (2010, p. 299)

To rural Han migrants, those dirty jobs are simply a low-skilled way of making a living.

But to Tibetan elites, according to Hu and Salazar (2010, p. 300), those jobs have a cultural connotation -– traditionally in Tibet, "dirty" jobs were done only by "dirty" people such as butchers and carpenters -– those of the lowest caste in Tibet's traditional society. In the end, the authors concluded that even in Tibet, "ethnicity cannot trump *Hukou*" (2010, p. 304), and they pointed out that rural Tibetans are likely to face double discrimination because of their ethnic identity and rural *hukou* (p. 305). While anthropologist Melvyn Goldstein's recent study (2010) conducted in the TAR did show signs of priority shifting from urban to rural Tibet (as it is happening in other provinces of China), we know yet very little[*] about how both rurality and ethnicity affect Tibetan students' interaction with ICT in Tibet. Based on data collected from a school in the TAR, this study thus promises to fill the gap.

3.2.5 The stratifying *Gaokao*: in real life stories

The vast majority (except a few in Shenzhen) of the students studied in the project are striving for one purpose, which is to pass the *Gaokao*. An overall score one achieves in the *Gaokao*, which is held each year throughout the country, has significant consequences for life chances, and for many, it has life-transforming effects. Since the competition for university places is fierce, one mark can sometimes make a huge difference. For instance, *Fuli* had a score five marks higher than the requirement for key universities, but about 20 marks lower than expected. In the end, he was accepted by a university outside Shenzhen for a subject which was not his first choice. Had he performed as usual in the *Gaokao*, the student commented, he could have been accepted by his first choice in Economics and International Commerce. However, *Fuli* himself does not view the *Gaokao* as critically important as it was. Although he is not happy with the score he achieved, he sees no considerable difference between the university that accepted him and many others, neither does he see any association between the official category of a university and the capability of a student attending that university. "It is not like before," said the student, "the association is no longer that significant."

However, a score can have very different consequences for students of diverse sociological profiles. For students in Nanshan, it is easier for them to get into Shenzhen University, and a large number of candidates in the school do end up there, although the University is viewed by many in the school as an option only or the only option. This does not

[*] One recent study (Cheng, 2010) revealed that migrant students were disadvantaged in education, but those with migrant and minority profiles were even more marginalised. However, the study was conducted in Tibet's neighbouring province of Yunnan.

mean that students accepted by the University are not "smart;" it simply reflects how the University is perceived by the students in the School. To those students without a *Hukou* in the city, the entrance requirement is much higher, so is it for those who study in many other provinces of China and consider the University for a degree.

Students in the same school also view the *Gaokao* in different ways, which consequently affect the strategies and attitudes they take in high school. While acknowledging the important role a score has to play in defining the options a student has in the *Gaokao*, *Yanhai* does not view academic success as crucial for her. She justifies her indifference to the *Gaokao* by pointing to the fact that many entrepreneurs in Shenzhen are extremely wealthy and they do not have impressive academic profiles. The only purpose for so many people studying so hard, the girl argued, is to earn as much money as possible, and what they learn today has nothing to do with that end, for students like her in high schools like hers are not studying to extend knowledge, rather, they are all reciting and memorising for the *Gaokao*. Nevertheless, the student regards the *Gaokao* as a vital stage in life, for the pressure she undergoes can help her better adapt to a harsh and competitive life once she steps into society. She further reveals that her relatives see no value of her effort made for academic success, for sooner or later, she is going to marry someone. But she also realises that it is not easy to marry well if she does not have the quality necessary and that she cannot rely upon a certificate of marriage forever.

In stark contrast with *Yanhai*, *Pin* views *Gaokao* as a critical first step towards a decent career. As a high school student, he sometimes reads newspapers about career choices. He is aware that the pressure faced by university graduates in China today is overwhelming, and he has selected biochemistry, actuarial science, and architecture as his dream careers. But in order to launch a job in any of the subjects he lists, he must first of all have a relevant degree, and to obtain such a degree, he needs to pass the *Gaokao* with a decent score. That is why he is hiring private tutors, as many high school students in Shenzhen do, to improve his performances in Mathematics, Chemistry, and Physics. The teachers his family hires for him are from different schools and they are all well-known in their specific subjects. According to the student, the tutorial his family pays for is one-to-one, and it is available in Shenzhen at almost all levels of education. In comparison with *Yanhai*, *Pin* is rather pessimistic about society. He views the gap in wealth as striking and reality cruel in Shenzhen. If he does not act now, he fears that his future would be uncertain. However, *Yanhai* does not view the *Gaokao* as the only way towards success — wealth in her understanding. Her viewpoint does not just mirror her family's values, but translates into her attitudes towards the *Gaokao* as well.

The difference between the two students may result from their difference in sex, but other female students like *Yajun* are not like *Yanhai*. As a top student in her year, *Yajun* does not view the *Gaokao* as useless as *Yanhai* does, although she has changed her previous view that the *Gaokao* is the only indicator of one's academic performance. To *Yajun*, some knowledge she learned from high school is very useful, for instance, her geographical knowledge of the Country proved helpful once she attended her university in Chengdu. She also viewed the highly structured way of learning in high school as a means to self-improvement, let alone the skills transferable in her future career. Although she said she should have focused more on personal development and human wisdom in high school, she regarded the *Gaokao* as a ticket to higher education in China. Upon further reflection, *Yajun* did not view higher education that important either, for her understanding was that it all depends on oneself as a college student. Therefore, nothing exerts more influence on oneself than does oneself, reasoned the student, what matters most is the way one chooses one's future.

However, *Yajun* noted that the *Gaokao* is a huge face project to her parents, for her performance in the exam is an indicator of how successful her parents are in raising and educating their daughter. In order to reduce the burden of their high expectation placed upon *Yajun*, the couple appeared to reassure their daughter that her performance in the *Gaokao* does not matter that much, and they occasionally comforted her by emphasising that Shenzhen University is not a bad option; even if that were not possible, she could still attend a local vocational institute where all candidates can join, joked the girl, as long as they can write their names correctly, and graduates from that institute can easily find jobs. In appearance, the parents seemed to care little about their daughter's performance in the *Gaokao*, but to *Yajun*, they were actually very concerned. They wanted her to perform well and attend a key university, and *Yajun* did satisfy them in the end. But the student doubts the *Gaokao* is still that important to her parents except for its face value.

The *Gaokao* is certainly more than face value for students in many other provinces like Hunan where rural population is bigger and educational resources scarcer than in Shenzhen. *Yajun* has a classmate from Shanxi province of the Country's west. Like many students in Hunan, Shanxi students often rent private accommodation close to their high school campus in their final year. They do not have weekends as those in

Shenzhen do; instead, they have one weekend off every month. Students get up at around 6 AM, and study until very late in the night. *Yajun* feels she was much luckier than her friend was, for she had two days off every week, and she did not have to compel herself to the extent that her health had to be put at risk. Her school did not have stringent rules to regulate students' hair styles either. And yet, she can attend the same university with a much lower score than that required of her Shanxi classmate. To *Yajun*, humanity was lost in her classmate's race to the *Gaokao*. She thus questions if it is worthwhile to sacrifice that much for a place in a university like hers.

It is worth noting that *Yajun* performed well in the *Gaokao* and eventually secured a place in a key university, her viewpoint might have been different had she not been accepted by that university. For those who failed in the *Gaokao*, the onslaught of feeling worthless can cause a series of consequences. For instance, *Xiumeng* does not know what to do next. On the one hand, her parents want her to repeat her final year, but she does not want to, even though she refuses to accept the reality. She is not satisfied with her performance in the *Gaokao* for she failed in her best subject. As a result, she ended up without any option she could accept. In comparison with *Xiumeng*, *Boyi* is much luckier, although Shenzhen University is not her first choice. As a fine art candidate, *Boyi* revealed that she did not perform well in the assessment of her drawing. She only needed a few more marks to get into her university of preference, Guangzhou Academy of Fine Arts. However, her father is a lecturer at Shenzhen University and because of that, she can freely choose her subject. Therefore, she is happy to accept the offer. She believes she can learn much more under her father's close guidance and supervision.

Chapter 4

On Mixed Methods Research

一张白纸，不能沟通

One blank piece of paper cannot communicate

– a survey response from Hunan

4.1 For a better definition

Different authors emphasised different elements in their definition of Mixed Methods Research (MMR thereafter) as a separate methodological orientation. An earlier definition in Greene, Caracelli, and Graham (1989, p. 256) required the mixing of methods consisting of at least one quantitative and one qualitative method, but it overlooked the importance of philosophical and theoretical components in research methodology. To incorporate the missing elements, Johnson, Onwuegbuzie, and Turner (2007) offered a new definition more recently which "combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding . . ." (p. 123). This definition goes beyond what the earlier one lacked by introducing quantitative and qualitative viewpoints and the rationale for MMR, but it does not give due consideration to the heated paradigm debate about the mixture, neither does the one provided in Creswell and Plano Clark (2007):

> Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis and the mixture of qualitative and quantitative approaches in many phases of the

> research process. As a method, it focuses on collecting, analysing, and mixing both quantitative and qualitative data in a single or series of studies. Its central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either approach alone. (p. 5)

Despite some strides made in the above definition, e.g., the philosophical underpinning of MMR, it does not place considerable stress on the trend that conducting MMR is becoming "*the third methodological movement*" (Teddlie & Tashakkori, 2010, p. ix, original italics), or a standalone approach which is different from either quantitative or qualitative research and often has its own terminology. For instance, it talks about "trustworthiness," "authenticity" (Lincoln & Guba, 1985), and "legitimation" instead of "validity" (Onwuegbuzie & Johnson, 2006); "inference transferability" instead of "inference" or "transferability" alone (Teddlie & Tashakkori, 2009, p. 311); and sometimes "qualiquantology" (Stenner & Rogers, 2004) instead of "mixed methods," for the word "methods" cannot appropriately represent what's actually going on in the mixture – it's more than the mixing of methods. The vocabulary is likely to grow as MMR become more rigorous and systematic in various disciplines.

More importantly, the definition does not address *how* the two approaches together can provide a better understanding. It assumes that two are certainly better than one and any such mixing would magically bring about desired results. Furthermore, as Stephen Gorard rightly contended, the definition confirms the validity of the so-called quantitative and qualitative approaches, which to him should be blown away altogether, for common knowledge about Q-Word approaches such as sampling,[*] the number of cases,[†] and the relationship between researcher and researched[‡] does not always accurately describe what happens in practice (2010, pp. 245 - 246). By quoting Paul and Marfo (2001), Gorard advocated: "Research should be judged by the quality and soundness of its conception, implementation and description, not by the genre within which it is conducted" (p. 543).

Even if we could ignore the above shortcomings, there remains a fundamental question: Does MMR really provide a better understanding? As Greene asked: "Shouldn't we be

[*] But true and complete random sampling is rare!

[†] The misconception that small number is associated with qualitative studies and large number with quantitative designs.

[‡] Believing that qualitative research is subjective and quantitative research is objective without realising personal judgements lie at the heart of all research.

modest in promoting MMR and careful about claiming some promised potential, wonderful things about mixing methods that we don't really know ourselves at this point" (cited in Leech, 2010, p. 260)? At the moment, we are indeed not sure as to whether it is the "content" of research that has been enhanced or it is the "methods" that have been enhanced through the use of mixed methods (Creswell & Plano Clark, 2011, p. 283).

Nonetheless, Creswell and Plano Clark have more recently addressed some of the aforementioned flaws by listing the following defining characteristics of MMR. Firstly, driven by research questions, MMR involve the persuasive and rigorous collection and analysis of both quantitative and qualitative data. Secondly, the mixture can occur concurrently, sequentially, or one can be embedded within the other. Thirdly, there is an issue of priority in terms of weight a study places on either strand, which is defined as a component that encompasses some basic process of conducting either qualitative or quantitative research – raising a specific research question, gathering data so as to address the question, analysing the data collected and then interpreting it. Finally, MMR are influenced by philosophical worldviews in design and placed under theoretical frameworks (2011, p. 63).

Still, the definition is not water-tight. Although the authors were explicit in stating that the sum of mixing quantitative and qualitative strands would be greater than *either* approach alone because of its complementary effect (2011, p. 59), they did not consider the possibility that the combined effect of having the two seemingly opposing approaches interacting with each other might be greater than the *sum* (B. Hall & Howard, 2008, my own italic).

While being a difficult job, clearly defining MMR is vital, for it helps researchers obtain rigour in their studies and renders their research findings more trustworthy than otherwise. However, giving a definition is by no means suggesting that followers of any definition should treat it as a cookbook recipe, let alone the fact that there is currently no "canonisation" of a mixed methods design (Kelle, 2006, cited in Creswell & Plano Clark, 2011, p. 280). Rather, the definition should function as a guiding framework against which researchers can better weigh alternative design options and justify their decisions under specific circumstances (p. 60).

But what is a research design? According to Punch (2009), it refers to an overall plan for a study and it consists of four key components, namely, "the strategy, the conceptual framework, the question of who or what will be studied, and the tools to be used for collecting and analysing empirical materials" (pp. 211 - 212). Since the four ingredients surround most empirical research, research designs thus connect empirical data to research questions and specify what tools and procedures to utilise in order to address specific research questions. In this study, I treat MMR as one design option to investigate youth interaction with new media.

4.1.1 The binary logic and Q-Words

In Section 3.1.1, I argued that the Digital Divide metaphor suffers from a binary logic, the definition of MMR is not immune to the problem either. According to Johnson and Gray (2010), much of Western ways of knowing is based on philosophical dichotomies, which tend to view the world in pairs, for instance, materialism versus idealism, with the former referring to the doctrine that matter underlies everything and the latter viewing ideas and the mental as the foundation of all things. This logic also manifests in research as deductive (reasoning from the general to the particular) versus inductive (reasoning from the particular to the general); empiricism (knowledge must come from experience) versus rationalism (knowledge is obtainable from reasoning); absolutism (there are unchanging laws governing the world) versus relativism (true knowledge varies across person, time, and place). The schism is visible too between "Continental" and "Anglo-American" philosophers.* Also in natural and literary sciences, Snow (1964) noted that the distinction is so big that they often hold distorted images of each other – non-scientists generally regard scientists as shallowly optimistic; whereas scientists view literary intellectuals as lacking foresight. "There seems then to be no place where the cultures meet" (p. 17), but to Snow, the clashing point can be exactly when the two cultures can join each other in achieving common goals. To Johnson and Gray, this is the tenet of MMR (2010, p. 86), for the world needs both wisdom and science.

The list of bipolar pairs can go on and on. In research methods, the binary logic is probably the beginning of the so-called paradigm war, a war even starts at the conceptual level of research. For instance, Gert Biesta argued that the very concepts of quantitative and qualitative research are problematic, for "research *in itself* is neither qualitative nor quantitative;" it is "*data*" that can be treated as qualitative or quantitative (2010, p. 98, original italics). But often in intellectual debates about research, the two stand for much more than data. The concepts thus refer to packages of elements in research, such as

* The former stresses wisdom, whereas the latter scientific knowledge, see Johnson and Gray (2010, p. 86).

philosophical assumptions, designs, methodologies, and methods. As a result, when one embraces or rejects one element of either package, she is labelled as either a quantitative or qualitative researcher in a wholesale manner. Therefore, to use "quantitative" or "qualitative" that way is inappropriate, for, as Biesta contended, what is at stake is not data alone. So adopting those labels without a second thought is in practice essentialising approaches to research while disregarding their constructed nature and discounting their unique social and historical contexts (Greene & Hall, 2010, p. 125); and using those notions in discussion can "create quasi-problems and oppositions" and, lumping together those heterogeneous elements leads to fractions and polarisations and offers little hope for interaction and exchange. For example, researchers who favour texts and those who prefer numbers might assume that they have little to share, even if they have very similar ambitions, are driven by the same assumptions, and are both concerned with knowledge creation (Biesta, 2010, pp. 98 - 99).

Some researchers even advocated abandoning the Q-Words altogether, for the two words to them add nothing and they doubt if there is, for instance, such a thing as a quantitative or qualitative interview (see Gorard, 2010, p. 243). Not surprisingly, paradigms to them are "a symptom of scientific immaturity" or "a cultural cliché with so many meanings it is now almost meaningless" (p. 244). Also in their view, paradigms are not only confusing to novice research students, they can even imprison or corrupt the students, for "artificial categories of data collection and analysis are not paradigms" (p. 248). To Gorard, both quantitative and qualitative methods "involve subjective judgements about less than perfect evidence, both involve consideration of quantity and of quality, of type and frequency" (2010, p. 248). Therefore, nothing is gained from the schism and, engaging with the unworkable philosophy is, in Gorard's view, a waste of time, time taken away from focusing on "the craft, the fun, the importance, and the humility of research" (p. 249).

The critique above has some merit, but I find it hard to fully agree with Professor Gorard that philosophical engagement is unnecessary. Pondering upon what we take for granted in research can help us a lot, for instance, the issues associated with Pragmatism as the philosophical partner for MMR and the differences between pragmatic and dialectic inquiries are worth closer examinations and I shall discuss them in full detail later. That is to say, the paradigm debate is not confusing me to a hopeless point; instead, it has helped me truly appreciate the roles philosophical assumptions have to play in research. While I agree with Gorard that some research methods texts are misleading and that there is no consensus yet at the abstract level, I cannot at this stage justify the redundancy of their roles. In my view, such inconsistency is perhaps calling for meaningful scholarly work and discussion about it. It is indeed challenging and never straightforward, but we need to engage with it, just like many things in our life, we do them not because they are easy. Therefore, instead of abandoning paradigms altogether, we should "frame the differences and challenges as opportunities for further learning and further conversation and further discourse" (Greene, cited in Leech, 2010, p. 262).

Moreover, Gorard's emphasis on practice and results is in itself a utilitarian approach to research, and his statement that "mixed methods (the ability to use any appropriate methods) is the only sensible and ethical way to conduct research" thus challenges Morse's concept of MMR, which is neither the muddling of methods nor simply multiple methods research (2003). Therefore, viewing MMR as the only sensible way to do research risks Bryman's concern that mixed researchers might seal themselves off from the wider research community and "end up talking to each other rather than beyond" (cited in Leech, 2010, p. 263). Furthermore, I concur with Greene that MMR are not likely to take over all social inquiries. Instead, "we are joining a long respected family, and we are the newcomer and we should be respectful of our elders" (Greene, cited in Leech, 2010, p. 260).

4.1.2 Solving ontological dualism

To escape the traditional binary logic, alternatives have been advocated. For example, Charles Sanders Peirce (1839 - 1914) proffered synechism, which recommends us to view those seemingly dichotomous phenomena as continuous. That way we can get away from "false choices" (Johnson & Gray, 2010, p. 70). What's more, thinking synechistically helps us reconcile opposing worldviews in specific research designs so as to better address specific research questions.

Another way to avoid the binary logic is related to John Dewey's theory of knowing, which is not based on the traditional dualist mind-world schism that is obsessed with the impossible question – how "a knower who is purely individual or 'subjective,' and whose being is wholly psychical and immaterial . . . and a world to be known which is purely universal or 'objective,' and whose being is wholly mechanical and physical" (cited in Biesta, 2010, p. 106) can ever be connected. Instead, Dewey argued human experiences provide a means to penetrate into the heart of nature, which in turn reacts upon people and their actions. The interaction or transaction between human and nature thus suggests man bears the consequences of his doing and learns from the consequences so as to intelligently plan or direct (control) his actions in future. Through this process, man commands more control over his environment and becomes more attuned to it. In other words, he learns from those tentative, experimental, experiential, and coordinated transactions with nature.

To learn, for Dewey, is therefore not to acquire some fixed information about some fixed reality out there. It is a complex and flexible process through which nature becomes meaningful to man and man acquires a set of predispositions for intelligent action (Biesta, 2010, p. 107). This implies that knowledge comes from action and reflection; it requires inference, "a reaction to something distant in time or place" (p. 109). Since inference is related to an unknown future and involves a certain level of risk, knowledge can thus be temporal to be falsified or even a mistake. This logic therefore negates the traditional dualist view that knowledge is something passive and out there waiting for us to discover or depict. For Dewey, knowledge concerns a relationship between action and consequence. It offers possibility rather than certainty. Therefore, outcomes of any scientific inquiry can hardly be truth, but "warranted assertions." Assertions about the consequences of human actions can only be warranted in specific times and situations. But they can be useful in or transferred to other circumstances.

Critics of Dewey might argue that his transactional approach is actually very subjective. Dewey (1859 - 1952) acknowledged this in response, but he contended that this is not a problem insofar as we construct the world for our own individual purposes, just as China's Neo-Confucian philosopher Zhu Xi (1130 - 1200) argued in the Southern Song Dynasty (1126 - 1279) that everybody could be a sage through self-cultivation (mind) and investigation of things in the universe (world). It becomes a problem only when there is a need to interact with others. At that point, it is still possible to connect our subjective worlds, which, for Zhu Xi, are already in our minds (otherwise, how could we possibly know something?) and lead to the fundamental principle or *Li*, something coherent in everything in the cosmos (P. Bol, personal communication, Fall, 2011). In other words, by investigating things in the world and grasping their *Li*, we are actually cultivating ourselves and becoming aware of the *Li* in us, for we and the world are essentially part of each other (see also Theodore de Bary & Bloom, 1999, pp. 697 - 719).

But then, Dewey argued, we can construct an inter-subjective world out of individual subjective worlds. To Zhu Xi, learning is also a way from ourselves to the outside world, for by cultivating the *Li* in us, the good side of human nature, we are actually going all the way from ourselves to bringing peace to the world (P. Bol, personal communication, Fall, 2011). At that point, the stalemate between objectivism and subjectivism is solved (Biesta, 2010, p. 112), and the world for Dewey and Zhu Xi is no longer a deterministic world. It is a "moving whole of interacting parts," by which it means the universe is evolutionary and humans are creative beings. Knowledge, therefore, is always a human endeavour, although to Zhu Xi, it is more about moral cultivation and less about original contribution to knowledge as this PhD thesis is supposed to be. In Dewey's and Zhu Xi's worlds, the dichotomous either/or dualism between subjectivism and objectivism thus weakens its power. For mixed researchers like me, this can be a liberating and enlightening starting point (see also Biesta, 2010, p. 113).

MMR, as Johnson and Gray (2010) argued too, is the result of such empowering thoughts. As a result, researchers are not necessarily caught between deduction and induction; instead, they talk about abduction, which is a creative and iterative way of thinking (p. 71). To Ridenour and Newman, the iterative process is an "interactive continuum" in that quantitative and qualitative methods are no longer regarded as dichotomous and researchers adopt a holistic approach to their studies where theories can be both built and tested and methods mixed (2008, p. 27). In addition, mixed researchers can now think of multiple realities. They concur with more qualitative researchers that human thoughts, values, feelings, and emotions are real. Like sociologists and anthropologists, they subscribe to the belief that languages, institutions, and cultures are out there and they together bound human thoughts and act as lenses through which our understandings of the world are formed. They also agree with more quantitative researchers that there are objective realities that *do* impact on individual as well as societal lives.

In other words, mixed researchers acknowledge subjective reality, which is often individual, personal and experiential; objective reality, which tends to be material things and causal processes. But more than that, they accept inter-subjective reality such as social structures, institutions, and languages (Johnson & Gray, 2010, p. 72). As a result, they inter-connect the subjective, objective, and inter-subjective parts of the world by learning from differences and creating new syntheses. By so doing, they also inter-connect the macro, meso, and micro. Essentially, acknowledging that there are not only different levels, but also types of reality becomes an ontological principle for MMR (Johnson & Gray, 2010, p. 84). Next I look at the roles paradigms have to play in MMR and what problems we have if Pragmatism is partnered with MMR.

4.2 Justifying MMR: in theory

Since each method is usually best at answering one type of questions and all methods have inherent limitations, results generated from one method alone are likely to be biased. In other words, we are more likely to broaden the scope of a research problem if two or more methods with offsetting biases are employed. Also, if the results from different methods converge, then the validity of research findings is enhanced (Greene et al., 1989, p. 256). Apart from this convergence argument for MMR, Creswell argued that the complex nature of social problems such as students' level and nature of engagement with ICT calls for the use of MMR, and that an expanded understanding or more comprehensive account can be achieved if the strengths of both quantitative and qualitative methods are utilised (2009, p. 203). Regarding research into cyberspace, Pippa Norris also echoed this point: "No single methodology can hope to capture the rich complexities of life on the Internet" (2001, p. 36).

Furthermore, MMR are well suited to examine "overlapping but also different facets of a phenomenon" (Greene et al., 1989, p. 258). For example, in this study, a paper-and-pencil survey is utilised to measure the factual aspects of students' interaction with ICT, whereas interviews are employed to explore the meanings as well as the implications of their engagement with technology. That is to say, the two approaches measure similar, as well as different, aspects of the digital divide phenomenon, and results from one method will hopefully elaborate, illuminate, or corroborate the ones from the other. Even if results from different methods mismatch, as Jick (1983) argued decades ago, "divergence can often turn out to be an opportunity for enriching the explanation" (p. 143).

All the justifications above are made for what Bryman called a "technical version" (2008, p. 606) of MMR. This version places greater emphasis on the strengths normally associated with quantitative and qualitative methods, and views them as autonomous and capable of being mixed. Researchers subscribing to this version might acknowledge the distinctive philosophical assumptions underlying each tradition, but they do not necessarily regard the connection fixed and ineluctable.

4.2.1 "Paradigms lost and pragmatism regained"?

We must therefore be cautious that the *ad hoc* mixing of methods might threaten the validity of our claims to knowledge, for traditional methodological assumptions are likely to be violated in the mixing (Morse, 2003). In other words, when methods are mixed, adhering to both quantitative and qualitative paradigms at the same time in a single study could be difficult, if not impossible. Tashakkori and Teddlie (2003) called this problem "paradigm incompatibility," which asserts that the conflicts between the two traditions are too fundamental to be combined. Thomas Kuhn (cited in Johnson & Gray, 2010, p. 85) viewed the incompatibility as "paradigm incommensurability." He contended that scientists are literally living in very different worlds and it is difficult for them to easily communicate and deeply understand each other. This "epistemological version" (Bryman, 2008, p. 606) of MMR views research methods as grounded in incompatible philosophical assumptions and renders the mixture invalid, if not infeasible.

But some academics believe the two can be mixed in a way that does not violate the philosophical assumptions of either tradition. In fact, they have either moved on without bothering having a paradigm at all, just as Gorard advocated, "mixed methods, in the sense of having a variety of tools in the toolbox and using them as appropriate, is the only sensible way to approach research . . . without the need to create a new paradigm" (2010, p. 247); or found a philosophical foundation of their own, and for many, it is Pragmatism, which is the attempt to gain knowledge or understanding through the pursuit of desired ends, rather than the abstract pursuit of knowledge through "inquiry" (Morgan, 2007, p. 69). They argue that those who are obsessed with paradigms seem to prefer "normal science," which summarises what's worth pursuing and how to achieve it. Thereby, they deny "scientific revolution" and ignore the fact that some people might call into question those assumptions about what can be known and how to go about such knowing (Morgan, 2007, p. 54).

For pragmatists, what really matters is thus not the debate about the differences between quantitative and qualitative approaches, it is the nature of research itself that is really at stake, for methods are, as Morgan argued, simply mechanical or technical issues, research topics such as the digital divide are not inherently important and research methods are not automatically appropriate. It's researchers who make the choices and these choices are inevitably influenced by aspects of their personal histories, social and cultural backgrounds (2007, p. 69).

In this study, I do not want to get stifled by the paradigm debate and entangled with those philosophical quagmires. Rather, I am trying to disorient myself first by engaging with those discussions, and then re-orient myself by examining or even constructing those theoretical assumptions and philosophical underpinnings. I know eventually, I need to cross not only methodological lines but also disciplinary borders to address my own research questions about youth interaction with new media. For convenience of later discussions, please allow me to capitalise the pragmatism described above. Next, let's see what problems we have to address in order to make Pragmatism *the* theoretical partner for MMR.

4.2.2 Problematic Pragmatism

By adopting elements from multiple theoretical lenses, pragmatists may both test theories and build multiple perspectives, for they employ whatever that might work to address their research questions. It is practicality and consequence that they focus on. In Bryman's words, it's "horses for courses," meaning one chooses the right horse for the right course, or tailors her methodological approach to her specific research problem (cited in Leech, 2010, pp. 259 – 260). As a result, they are usually not confined to a single stance and can be both formal and informal in writing. They may collect both quantitative and qualitative data to deductively test and refine theory and inductively develop and build insights.

Unsurprisingly, Pragmatism has been accepted as "one 'best' worldview for mixed methods" (Creswell & Plano Clark, 2011, p. 43) because of its capability to draw upon multiple ideas that work (being ontologically pluralistic), its flexibility in combining different methods (believing there are multiple routes to knowledge), and its tolerance with both objective and subjective knowledge (reality can be complex). By counting on Pragmatism, Tashakkori and Teddlie (2003) contended, researchers are no longer forced to choose either post-positivism or constructivism (making the either-or logic redundant), no longer caught by the metaphysical debate about truth and reality, for they agree with John Dewey that knowledge is the result of human-environment interaction, which can solve the problems associated with the subjective-objective dualism (Johnson & Gray, 2010, p. 88). And finally, they reject monism, reductionism, or dogmatism; focus more on research questions than on methods and procedures; and endorse universal human values such as equality and freedom.

As a result, Pragmatism has gained currency in MMR, for it is flexible enough to allow theories to play different roles in social research, just as Amin and Thrift (2005) described:

> Few now believe that one theory can cover the world (or save the world, for that matter). No particular theoretical approach, even in combination with others, can be used to gain a total grip on what's going on. Theory-making is a hybrid assemblage of testable propositions and probable explanations derived from sensings of the world, the world's persistent ways of talking back, and the effort of abstraction. (p. 222)

However, choosing Pragmatism as the philosophical partner has at least the following problems. First, it gives rise to the issue of reconciling contradictory and contested ideas and arguments which, as paradigm purists argue, make MMR untenable (Greene & Caracelli, 1997) as the result of mixing incommensurable philosophical assumptions. In other words, it underestimates the influences of different philosophical assumptions, influences that can be significant when different approaches are combined, for ontological, epistemological, and axiological assumptions are real properties of social research, although researchers can be implicit about them (Maxwell & Mittapalli, 2010, p. 147).

Second, it demands much more from researchers who often have a preference in one approach to another, because of the training they have received in a particular discipline, where members tend to share beliefs about what questions are worth asking, and what procedures are most appropriate in addressing those questions (Denscombe, 2008; Morgan, 2007, p. 53).

Third, the point of focusing on what works could in theory violate certain aspects of research ethics. For example, a pragmatist might argue that recording conversations without informants' consent* can be justified, for the data gathered that way solve their research problems and help develop insights that are very difficult or impossible to obtain through normal and ethical procedures. That said, focusing on what works is like getting rich by whatever means. Is that kind of everyday pragmatism the same as the philosophical Pragmatism we are referring to? If yes, Pragmatism is thus not problem-free. If no, how should we distinguish the two in a study?

* See Appendix C for the Informed Consent Form used for this study.

Fourth, although I agree that research methods should serve research questions, it does not always mean that the questions asked fully articulate research purposes (Biesta, 2010, p. 96). The two are different, with the latter providing a framing for the former, not the other way around (p. 103).

Finally, MMR assume that qualitative and quantitative traditions embody distinctly different yet straightforward differences, differences that can be easily categorised even if they are compatible. Not surprisingly, mixed researchers often present those characteristics associated with quantitative and qualitative strategies in dichotomous ways. Moreover, they assume that all members of either tradition share those underlying philosophical assumptions. That is certainly not true, for instance, anthropologists often challenge the view that communities are united by shared beliefs, values, and practices. They argue that such an assumption ignores substantial intra-cultural diversity and misrepresents the process by which social solidarity is achieved and maintained (Maxwell & Mittapalli, 2010, p. 148).

That said, just as MMR should not be regarded as "a mindless mantra" (Freshwater, 2007, p. 135) or "a magical methodological solution for the complexities of social inquiry" (Greene & Hall, 2010, p. 131), Pragmatism ought not to be taken blindly as *the* paradigm without an appropriate level of understanding about what it really means, for there are different versions of pragmatism, for instance, everyday pragmatism versus philosophical Pragmatism such as John Dewey's pragmatic inter-subjectivity between objectivism and subjectivism.

4.2.3 A pragmatic mixed researcher vs. a dialectic social inquirer

Due to the drawbacks mentioned above about Pragmatism, it would be safer for me to avoid adopting a pragmatist label. However, I stick to the principle of employing multiple worldviews and methods in this research. By keeping a distance from Pragmatism, I am not saying that it has nothing to offer for MMR. I just question if it should act as *the* philosophical foundation and be introduced in a wholesale fashion.

However, if a label is necessary, I would consider myself more of a "situationalist" (Creswell & Plano Clark, 2011, p. 26) than of a pragmatist, for I manage to adapt worldviews and methods to this particular research situation in China. But this kind of situationalism, some might argue, is still pragmatism. In that case, I am at most a "dialectical pragmatist" (Johnson & Gray, 2010, p. 88), by which I mean I take multiple viewpoints very seriously and do as much as I can to learn from the differences that encompass not only knowledge but also values, and then synthesise them in my own study. This dialectical component is taken from Greene and Hall's "dialectic stance," upon which I shall elaborate next.

Like Pragmatism, a dialectic stance can adopt more than just one paradigm, methodology, and method in a research project. But it values respectful dialogue between diverse perspectives about a social phenomenon so as to generate insights, understandings, and discernments "through the juxtaposition of different lenses, perspectives, and stances" (Greene & Hall, 2010, p. 124). Unlike Pragmatism with its antennae attuning to "practicality," dialectical stance's antennae are attuned to "multiplicity" (p. 138). It advocates meaningful and mindful engagement with differences in that the end products, such as deep insights and comprehensive understandings about young people and new media, are of both theoretical and practical importance.

Therefore, dialectic inquirers are more attentive to surprises and paradoxes across datasets than are pragmatists, and they do not necessarily seek convergence or consonance of research results from different methods. Instead, they equally value divergence or dissonance, for when results disagree, they require further analysis and perhaps the collection of more data, which in turn might provide opportunities for fresh insights (Greene & Hall, 2010, p. 125). In that respect, they can be said to seek divergence as a means to meaningful understanding. Pragmatists, however, seek "actionable value" of data and privilege those datasets with practical applications in addressing their research questions on hand. That is to say, their warrant of "actionable knowledge" is based on continuous application (p. 138).

Despite the differences, pragmatists and dialectic inquirers are equally mindful, reflective, and intelligent inquirers. Their inquiries are closely related to contexts and life experiences and have a hope to improve life conditions. After all, pragmatic and dialectic mixed researchers are consequentialists, albeit in different ways. For instance, the former aims to provide "workable solutions to ongoing and pressing problems," through "actionable knowledge, knowledge laced with guidance about what to do," and for direct improvements and tangible changes in the real world. Whereas the latter endeavours to surface differences, legitimise them, and then engage with them. It provides "an easing of the tensions, the violence, and the hatred that divide different peoples, one from another" (Greene & Hall, 2010, p. 140).

However, we should recognise that behind the dialectic stance lie the following assumptions. First, it believes in the commensurability of multiple paradigms, which Greene viewed as multiple ways of seeing, hearing, and making sense of the social world, and multiple perspectives on what's important. Second, the complexity of human phenomena can be better understood not only by the use of multiple methods, but also by the consultation of multiple perspectives. Third, it points out the limitations of Creswell and Plano Clark's practice in limiting social inquiries into four paradigms (see Creswell & Plano Clark, 2011, pp. 40 - 42), which in my view overlook significant contributions from other traditions that may not well fit in any of the categories (Greene & Hall, 2010, p. 125). For example, realism can be an integration of realist ontology (there is a world out there that is independent of our perceptions) with a constructivist epistemology that our understanding of the world can be constructed from our own standpoints and it is not possible to obtain a "God's eye point of view" (Maxwell & Mittapalli, 2010, p. 146). Having talked about the philosophical assumptions behind research methods, I now turn to the question of how they influence my own research design.

4.2.4 Multiple phases and shifting paradigms

Researchers preferring certain approaches may call for a minimisation of theories' roles in their studies. For instance, grounded theorists tend to explore their research problems without having overarching theories involved in their research designs (see Charmaz, 2006; Strauss & Corbin, 1998). In phenomenography, researchers are also supposed to "bracket out" preconceived ideas when they conduct interviews and analyse empirical data, for they argue that interviewees' experiences and understandings are not out there to be "read off" (Marton, 1994). To me, getting rid of pre-determined theories or totally bracketing out preconceived ideas is hardly possible, for empirical studies are always more or less guided by prior theories. Nevertheless, I concur with Uljens (1996) that being influenced by prior theories does not mean that research designs and data interpretations have to be determined by them; quite on the contrary:

> [A] researcher must always be acquainted with knowledge (theory) in the field that he or she is investigating in order to do a good interpretative job. Previous knowledge as such is by no means a hindrance to being open-minded both in gathering data (e.g., by interviewing) and in analysing data. (p. 122)

Unlike many other studies which employ throughout their designs a single or dominant philosophical underpinning, this study spans over more than one phase and adopts more than one method – different philosophical assumptions underpin different phases of the study (see Creswell & Plano Clark, 2011, pp. 82 - 83). Since the first phase of the study is quantitative, the philosophical assumption that influences the design of that stage is towards a post-positivist orientation, which implies that I aim for breadth and representativeness of students and their interaction with ICT the study manages to cover, and the data collected through a survey should be able to generalise patterns of access and use and the views and attitudes they hold about technology to other members that the study cannot possibly cover. Inevitably, this phase is influenced by guiding theories regarding ICT and delimited to a few variables that can be practically measured and utilised to test hypotheses regarding differences in students' engagement with ICT. The post-positivist stance not only influences the purpose of the first phase, but also determines how the students are selected, what type of data it collects, and consequently, how students' responses are dealt with in analysis.

To be more specific, in each school, I first asked four classes of 50 or so students in their second year of high school to fill in a survey (see Appendix D for more about the survey). The four classes consist of students from both science and arts tracks, and each track has one key and one ordinary class. Year 2 students were chosen because final years are extremely busy with their preparation for the *Gaokao*, and indeed my preliminary fieldwork in 2010 suggested that they had the lowest level of engagement with mobile phones. First year students were excluded in the main study partly because, generally speaking, their high school experiences are not yet as rich as second years', which means they might not have as much to say about their experiences with ICT as year 2 students do, and their attitudes towards school policies regarding mobile phone and Internet use might be different. In fact, students in the study did report that they treated school policies much more seriously when they first entered high school. Therefore, year 2 students are likely to yield the richest data about youth engagement with ICT, which is what this research aims to capture eventually.

Another reason for selecting only year 2 students in the main study is related to data analyses. Since there are three schools to compare in the main study, it is better to have at least some characteristics of the groups alike. That is to say, all students in the main study are in the same grade, they are all working towards the same goal (to excel in the *Gaokao*), and their school structures are more or less the same in terms of arts and science tracks as well as key and ordinary classes. For the quantitative strand of the study, these factors are treated as explanatory variables, they are therefore better to be physically controlled at the design stage than statistically controlled in analyses (Punch, 2009, p. 216), given the constraints of time and resources I have to face in the project.

Furthermore, data gathered in the first phase has an instrumental purpose. It helps me select interviewees and refine interview questions for the ensuing qualitative phase, where multiple perspectives, thick descriptions, and deeper understandings are valued as the result of shifting in philosophical assumptions from post-positivism to more of constructivism. The aim in the qualitative phase is therefore to develop theories regarding ICT appropriation in China and discover insights from responses that can help explain or elaborate on significant, outlier, and non-surprising results from the first phase (Morse, 1991). As such, the study is more like an "emergent mixed methods" design (see Creswell & Plano Clark, 2011, p. 55), for certain interview questions asked of the students in the qualitative phase *emerge* from my initial interpretation of the quantitative results in the first phase.

As one can see, the two phases in the study are not separate or independent; they are connected when I utilise survey results such as students' levels of access to ICT and their self-reported academic performances to guide the purposive sampling of students for the qualitative phase (Creswell & Plano Clark, 2011; Morgan, 1998). Basically, the selection of students for in-depth interviewing is based on the maximum variety principle. In other words, I make sure that students from all major backgrounds typically found in each school are selected. I adopt four levels of criteria in making the selection. First, how many mobile phone handsets students have ever owned by the point of study and how much on average they spend on mobile phone bills at that point. Second, how often they visit *wangba* during term time. Third, what their parents do for living and their levels of education. Note there are two items at this level, this is because students are provided with the option to select "I prefer not to say" for either of the items, which means, if a student selects this option for one item, I can look at the other for a clue. Four, students' self-reported academic ranking in class.

As detailed above, theoretical lenses do influence the research design. They not only change in the study, but are tied to different phases of the same project as well. Since the research is a sequential rather than a concurrent mixed methods design, I feel it is more appropriate to employ multiple lenses than a single all-encompassing one such as Pragmatism, which in my view would fit better if a researcher aims to employ multiple stances and collect all types of data to address research questions in a one-off or single phase, namely, convergent designs which aim "to obtain different but complementary data on the same topic" (Morse, 1991, p. 122) in one go. Nevertheless, I agree with pragmatists' view that research questions are of crucial importance in MMR. Next, I will explain what place research questions should occupy in MMR.

4.3 Questioning questions in MMR

As in most social inquiries, research questions play a central role in the design of MMR (Creswell & Plano Clark, 2011, p. 60). Despite the difficulty I have in wholeheartedly embracing Pragmatism as my worldview for the research, I accept research questions should be central to conducting MMR. However, it is necessary to first of all clarify some key concepts such as research problem, research question, and research purpose. These terms are often used interchangeably.

According to Plano Clark and Badiee (2010), the three concepts are three key elements that actually define the focus of any research. However, they are not parallel to one another. They rank from the general and broad to the specific and narrow – a research problem or "content area" (p. 276) is broader than research purposes, which refer to researchers' primary objectives and define what specific questions to be addressed. That is to say, research questions are the extension of or derived from research purposes (Ridenour & Newman, 2008); they are specific and workable. In research designs, research questions appear in different forms, they can be very explicit as interrogative statements with question marks, or less explicit as declarative statements which reveal researcher's aims. More often in quantitative designs, they are raised as hypotheses to predict certain outcomes.

It is often argued that research questions should dictate what methods to employ in a study, but I prefer they act as the hub of a research process (Plano Clark & Badiee, 2010, p. 278). For researchers holding the former view, methods are always "servants," never "masters," of questions (Greene, cited in Plano Clark & Badiee, 2010, p. 278). This dictatorship view regards the choice of research methods as analogous to the selection of tools from toolboxes to address predetermined purposes, suggesting that the adoption of MMR is justified when and only when research questions call for it. In that case, the questions must be, as Bryman (2006) argued, both exploratory and confirmatory. This model goes well with Pragmatism, for the methods employed should "work" to answer stated research questions (Biesta, 2010; Greene & Hall, 2010). Moreover, the model helps cool down the paradigm war by emphasising the link between questions and methods, rather than the one between paradigm and methods.

However, the dictatorship view represents a linear mindset in designing a research. It risks ignoring the contextual influences upon research designs, for instance, personal values and preferences do have their roles to play. The linear model may also pose real challenges in, say, grounded theory and exploratory studies where researchers are not very sure of what significant elements to study in their specific fields at the very beginning. After all, social research can be a very dynamic process in which questions might emerge, be refined or even abandoned (Plano Clark & Badiee, 2010, pp. 279 - 280), therefore, allowing it to dictate the methods that follow is not always feasible.

Unlike the dictatorship model, Maxwell and Loomis (2003) conceived of an interactive hub model that relates research questions to not only methods, but also purposes, theories, and validity issues. In this alternative model, the central role of research questions is not challenged, which suggests research questions still inform or are informed by other components – they interact with one another. However, the hub model is no longer a simple linear process and it can have both questions of variance (e.g., how much, true, or correlated) and of process (e.g., why and how), and they together inform and/or are responsive to other components (Plano Clark & Badiee, 2010, p. 280). As a result, research questions can be generated at three stages at least. They can arise from literature review, in conjunction with the implementation of methods, and in response to specific research findings and interpretations (p. 281).

Since initial results in my own study do require me to ask new questions in later stages of the sequential design, I view the interactive hub model a better partner for dialectic MMR and the dictatorship model for pragmatic MMR. Nevertheless, I am not arguing that the interactive hub model should replace the dictatorship one or other models that are not discussed in the thesis. I believe that each model has its own contribution to specific research circumstances. Having discussed what place research questions should occupy in MMR, I shall now specify what exact questions the study aims to address.

Chapter 5

Mixed by Design

5.1 Objectives to accomplish

In Section 4.3, I argued there is a hierarchy in research problem, purpose, and question. In this study, the research problem is about adolescent appropriation of and engagement with ICT in three different high schools of China. Under this broad area of research lie three objectives the study aims to accomplish: the first is to examine how different students really are in terms of access and use within and between the schools; the second is to chronicle the social, emotional, and intellectual dimensions of youth interaction with ICT; and the third is to investigate the ramifications of the differences under concern. To achieve the goals, it is necessary to address the following answerable questions.

Question One: How do variables such as students' school class (Arts vs. Science plus Key vs. Ordinary), ethnicity (Tibetan vs. Han), socioeconomic status (parental education), and locale (urban vs. rural/pastoral) relate to their level (e.g., personal, home, and school access to ICT) and nature (e.g., what do they do with technology) of interactions with as well as attitudes towards ICT? **Question Two**: What do ICT mean to students of different sociodemographic profiles and how do they engage with them, given different constraints they face? **Question Three**: How do students' engagement with ICT, academic matters, and life experiences such as privacy, online trust, and relations with significant others correlate with one another?

Both quantitative and qualitative questions in the study are based on relevant literature and preliminary findings, and they can be summarised into the following themes. First, availability addresses research questions of either strand. It asks students what ICT they have access to at home and in school, whether and for what purposes they visit *wangba*, how they perceive the level and quality of access, how technology access and use affect their studies and life experiences, or the other way around, how their home and school experiences shape the ways they approach ICT, where they seek support when faced with problems concerning ICT. Second, utility seeks to find out what they usually do with their ICT, what opportunities and/or risks (issues concerning privacy, security, and computer games) the students have experienced and how important the ICT they have are to their studies and daily lives. Third, autonomy aims to understand what restrictions students face in their relations with ICT and how they respond to those regulations imposed upon them.

As one can see from the questions raised above, the study sets out to tell stories about not only "early adopters," but also "laggards" of "emerging technologies." In other words, the research is not simply "interested in telling new stories about new technologies" (Selwyn, 2011b, p. 211) of those who are already "privileged in other areas of their lives" (Buckingham, 2008, p. 18); it also aims to produce insightful "accounts of the 'everyday life' of educational media and technology" – accounts of both the ordinary and extra-ordinary aspects of students' engagement with ICT (Selwyn, 2011b, p. 212). Indeed, this is how most students experience learning and technology in and outside their schools. After all, as Bauman put, focusing on the familiar and most ordinary aspects of the everyday can also be "a way to reveal and expose the extraordinariness we would otherwise overlook" if we know how to first make familiar things strange (2010, pp. 3 - 4). In the sections that follow, I will explain why a sequential MMR is adopted to answer those particular research questions.

5.2 Justifying MMR: in practice

Due to the nature of the research questions raised above, neither quantitative nor qualitative methods alone can make a satisfying picture of students' digital lives across such geographically, culturally, and socioeconomically diverse groups of students, for, as Creswell and Plano Clark (2011) noted, qualitative and quantitative research portray different pictures and each have their own strengths and limitations. If a small number of students are investigated qualitatively, the ability to generalise their perspectives to other students is weak and it is difficult to eliminate biases in data interpretation, despite its capability to illuminate or illustrate certain mechanisms or reasons behind some resultant survey findings. But if I only examine students in a great number by means of a survey, the ability to generate in-depth understanding of individuals is diminished, despite its capability to uncover trends and relationships, and to keep a relatively safe distance between I as a researcher and the students as the researched.* "Hence, the limitations of one method can be offset by the strengths of the other method, and the combination of quantitative and qualitative data provide a more complete understanding of the research problem than either approach by itself" (Creswell & Plano Clark, 2011, p. 8; also mentioned in Jick, 1979). That's to say, mixed methods not only record behaviours, but also treat students as people with purposes, feelings, and thoughts. Therefore, a mixed methods design in the study offers multiple ways of viewing the phenomenon under concern in China, it is not only practical and intuitive, but also fits well with the study's purposes.

If the reasons given above are not compelling enough for the employment of MMR, let's suppose that a well administered survey were able to capture the richness and complexity of students' engagement with ICT, but some silent survey responses could have been misinterpreted had I chosen not to talk to participants in person. For instance, in the survey, I asked students to select the highest level of academic qualification their parents have. The job in analysis was pretty straightforward when I looked at the responses from students in the first two mainstream Han schools. It is normal to expect that there is only one highest level of qualification for either parent. Students from single-parent families could simply ignore one column and select one for just a parent.

But in Tibet, the results demanded extra attention. When I first saw some students select two qualifications in one column, I thought that might be the result of their difficulty in understanding this particular question, and it reminded me of the questions students asked when I was in their classroom while they were filling in the survey. They asked me how to rate statements from one to five. Luckily, I was able to give the instruction needed and their teachers helped them too when the instrument was administered. I was first surprised by such a question, because no students in the first two Han schools asked such a question. Then I felt guilty, I thought the survey was not designed well enough, even though I had revised it more than ten times and tested it among Han students prior to the trip to Tibet (see Appendix D for a more detailed explanation). So when I came across such "abnormal" responses again, it was natural for me to think that it's due to their misunderstanding.

* Data engendered this way is often believed to be objective and value-free.

But I was wrong; I did not take into consideration the fact that in rural or pastoral Tibet, when a woman is married to a man, it is still not uncommon that she is automatically married to the groom's brothers at the same time. I was aware of such a phenomenon in Tibet when I read Sun's A Year in Tibet published in 2009. But I was not quick enough to correctly interpret that piece of quantitative data. Initially I even thought I was lucky because the majority of the students did not misunderstand the question, but when the same "mistake" kept arising, I suddenly realised that I was ignorant when I recalled on what I had read! That moment, I felt I needed to talk to students like never before. In Creswell and Plano Clark's view, I needed qualitative data to explain surprising quantitative results and add insights to them! Just as one Han student in Hunan wrote on the reverse of the survey he completed: "One blank piece of paper cannot communicate (*yizhang baizhi buneng goutong*)." Indeed, how could a survey alone fully convey students' perspectives, thoughts, and feelings about their highly disputed relations with ICT in China? Next I will elaborate on what other unique features this study has.

5.3 Featuring the design

Having justified the selection of MMR to address the research problem, it is time to describe a few points that feature the study. Like the ethnographic research in Taylor (2001, p. 93), this study has the following features. While the study largely focuses on groups of students, interviewees are not treated *en masse* (e.g., Tibetan students do X and mainstream Han students do Y). Rather, they are portrayed as individuals with different motives, backgrounds, and personal stories. In addition, the study adopts a holistic approach, which means parts are studied and described in relation to the whole, students are first examined in their micro contexts such as families and schools, but those contexts are then related to the macro environments, such as the larger sociocultural, economic, and political surroundings of the schools. In the study, the links between micro and macro contexts are established through exploring the lived experiences of those students with their own ICT and by examining the broader shaping forces of schooling and technology access and use beyond school gates (Selwyn, 2011a, p. 40).

To be more specific, the study's micro context refers to student-student, student-teacher, and student-parent dynamics in and out of school settings. The macro context is the wider economic, political, and cultural conditions in the different regions of China.

By taking into consideration different levels of investigation, the study aims for an understanding of "the intimate connectedness" between "wider contexts and conceptualisation" and the "merely particular" (Webster, 2005, p. 453). This approach thus addresses the warning raised by Robin Mansell: "The current emphasis on small-scale, descriptive, qualitative studies and the constructivist perspective may obscure larger-scale social, political and economic development, technological changes, and structures of power that do in fact constrain or direct (if not determine) how ICTs are designed and used" (Lievrouw, 2004, p. 13). As mobile phones and the Internet permeate further and wider in China, it is increasingly important to study them as normal or banal, and to strike a balance between macro- and micro-level examinations so that both students' experiences and institutional influences are taken into account. That way, a more robust account of ICT's roles and their societal and educational implications is more likely to occur than otherwise (Lievrouw, 2004, p. 14).

Furthermore, thick description of larger contexts is necessary in the research project. This makes it easier to understand and compare unique school circumstances under which students' behaviours surrounding ICT are formed. As Watson-Gegeo (1988, p. 581) argued, once school-specific settings are clear, readers of the research can compare the factors described in the study with settings they are more familiar with so that they might recognise their own settings in new ways or find the settings described in this study illuminating (see the Intensive Interviewing chapter of Gray, Williamson, Karp, & Dalphin, 2007). Finally, data collection in the study is directed or at least influenced by theoretical frameworks, indicating that some aspects of student lives and certain research questions attract more attention than others, particularly at the beginning of the study. Nevertheless, this approach does not limit the scope of the project, as each school is investigated on its own terms.

Since it is extremely difficult, if not impossible, to extract my own theoretical biases, beliefs, and values from how I gather the data, analyse them, and present them in the findings, I am trying to write the thesis in a way that not just represents what I see, hear, and think of the students studied (van Maanen, 1988, p. 48), but from time to time it sprinkles the thesis with students' voices that represent their rather than my point of view and illuminate their experiences "on their own terms and in their own words" (Stern, 2008, p. 99). That is to say, I oftentimes need to quote directly from interview transcripts and avoid paraphrasing students' words and then claiming them as actual words spoken (Bryman, 2008, p. 454). However, I must agree that the "interpretive omnipotence" or "final word" (Taylor, 2001, p. 94) on how the findings regarding youth engagement with ICT in China are interpreted and represented lies largely in my hands. That is because authentic quotations do not guarantee that researchers are never duped by informants, just as van Maanen (1988) argued:

> No longer is the social world . . . to be taken for granted as out there full of neutral, objective, observable facts. Nor are native points of view to be considered plums hanging from trees, needing only to be plucked by fieldworkers and passed on to consumers. Rather, social facts, including native points of view, are human fabrications; themselves open to social inquiry as to their origins. (p. 93)

As such, how can I avoid romanticising or exoticising the settings I am investigating, particularly in the case of Tibet? One solution van Maanen offered is to move "back and forth between an insider's passionate perspective and an outsider's dispassionate one" (1988, p. 77). The aim in striking such a balance is to achieve "naturalness," which allows researchers to err, but efforts should be taken to make valid interpretations. In the study, I occasionally committed gaffes, for instance, I asked a student in a group interview whether her grandfather had visited *wangba* and used the Internet, they all laughed loudly, but I did not misread the information to the point of invalidating students' account about Internet use in Hunan province, where *wangba* are largely associated with juvenile delinquency and youth disengagement with school work, parents and grand-parents* often ban the students' visit to Internet cafés, even though they themselves have very limited knowledge about the Internet and may have never visited one before – grandparents can hate *wangba* to such a extent that, in a student's own words, they would not allow their grandchildren "to even have a look at it."

While aiming for that "naturalness," I also seek saturation in most aspects of students' engagement with ICT by cross-checking viewpoints from a number of informants in each school. By so doing, the trustworthiness of accounts students give is thus increased. Since "cross-checking" involves two or more students to reach saturation, at the bottom level of individuals, I do "member-checking" (Taylor, 2001, p. 112) by contacting interviewees more than once or staying in touch with them online when I need their confirmation or clarification on certain issues they raised in initial interviewing. This proved very useful when I transcribed those interviews. In addition, the methods

* Many students' parents in Hunan are migrant workers in other provinces and the students often live under the supervision of grandparents.

also help reduce the effects of my presence as a researcher and the leading questions I might have asked during interviewing (p. 113), for my presence might result in unnatural responses from the students interviewed, and leading questions run the risk of me attributing unnatural insights about ICT use to the students, insights they might not have had without those questions.

As described in Section 4.2.4, this study is a sequential MMR in that the quantitative survey results are used to select interviewees and provide a context for qualitative analysis. Moreover, prior to the main study, a preliminary fieldwork was conducted in China in 2010. In the preliminary fieldwork, both quantitative and qualitative data were collected from over 400 students, with about 100 from each of the four schools scattered across the country from Beijing in the North, to Hunan in the Central South, Shenzhen in the South, and Tibet in Western China. Results from the preliminary study informed which and how many schools were studied, what items appeared in the survey, and how samples were drawn in the main study, which are the topics of the sections that follow.

5.4 Sampling

As Morse argued, the greatest threat to validity in MMR can be sampling (2010, p. 347), a process through which researchers select a subset of units or cases from a population of interest so as to address specific research questions. Between sample and population stands a sampling frame (in probability sampling) or sampling boundary (purposive sampling), which refers to the individuals, groups, cases, or activities that are likely to provide the data source, either quantitative or qualitative, for a study (Collins, 2010, p. 356).

Since the study has inductive and deductive components, sampling strategies for qualitative and quantitative strands are different. That is to say, sampling used in the quantitative strand could be unsuitable, therefore invalid, if inappropriately copied to the qualitative strand, for the indicators of confidence usually used in the two strands are different – quantitative data highlight statistical significance, whereas qualitative results emphasise trustworthiness and saturation. So the decisions made on sampling strategies have an effect on "the quality of the researchers' meta-inferences and the degree to which the findings can generalise or transfer to other individuals, groups, and contexts" (Collins, 2010, p. 354). Meta-inference refers to those "inferences from qualitative and quantitative findings being integrated into either a coherent whole or two distinct sets of coherent wholes" (Tashakkori & Teddlie, cited in Onwuegbuzie & Combs, 2010, p. 398).

As in the selection of paradigms and methods, sampling decisions reflect researchers' values and beliefs about "what constitutes credible data and what are the best mechanisms to collect data" (Collins, 2010, p. 355). In Greene's view, the choices are shaped by researchers' mental models, namely, "the complex, multifaceted lens through which a social inquirer perceives and makes sense of the social world" (Greene, cited in Collins, 2010, p. 355).

Morse also asserted that methodological assumptions of each paradigm must be adhered to in MMR (2003, p. 194), which implies that a probability sample should be selected to run the survey, and a separate purposively selected sample chosen for in-depth interviewing about students' engagement with ICT. Probability sampling in the study aims to increase external validity of the study and leads to greater breadth of information concerning students' interaction with technology. This sampling strategy requires me to establish a sampling frame (year 2 students) and predetermine sample size (four classes of 50 or so students from each school) prior to the fieldwork.

5.4.1 Stratified random sampling

Students in the three schools were recruited through presentations about the study made to all chosen classes in year 2 of each school in a hope that participants were as fully informed of the research as possible. In the presentation, students were verbally assured of confidentiality and knew who would have access to the data they willingly chose to provide. Prior to their completion of the paper-and-pencil survey, they were asked to read a brief description of the study and sign, in both Chinese characters and *Pinyin*, to proceed. It was also made clear to all students that they could choose not to participate and were free to withdraw from the study at any time they pleased. It is worth noting that the pen-and-pencil survey, like the one utilised in Hargittai and Litt (2011) about twitter adoption in America, is vital in the study because it helps avoid bias against those who are less likely to use or less familiar with ICT, let alone the fact that the study's primary focus is on differentiated access and use.

In recruiting those participants, I did my best to make sure that every student of selected classes had an equal opportunity to participate in the study so that a representative sample of all year 2 students in the schools were selected. This stratified sampling strategy employed two stratifying criteria, namely, Arts vs. Science and Key vs. Ordinary classes, and the strata could be easily identified in the three schools. In the end, I had in each school two classes from Arts and two from Science, and for each track, two classes (one Key and the other Ordinary) were randomly selected by the schools on my behalf. When selecting classes, I first told year 2 leaders my criteria, then I relied upon them to help identify the classes. As in arguably any research, there involved human judgement in the selection of classes for each stratum, but the survey responses from the schools did show the strata I wanted. Therefore, I have a high level of confidence to call this a "stratified random sampling" (Bryman, 2008, p. 173). That is to say, I have confidence in generalising findings from the classes selected to at least all year 2 students in each school. Another issue in sampling is its size, which I am going to detail next.

5.4.1.1 Probability sample size

Regarding the size of probability sample in each school, it is worth noting that there is no definitive answer to such a question. As Bryman (2008, p. 179) reasoned, it depends upon a number of factors and it is often a compromise between the constraints of researchers' time and resources, the need for precision, and the following considerations. First, there is a difference between relative and absolute sample sizes, and contrary to what many might have expected, it is the absolute sample size that matters most. This means that a nationally representative sample of 1000 in the UK has an equal level of validity in a nationally representative sample of 1000 in China, although the latter has a much bigger population. It also implies that the precision of statistical inference increases as sample size increases.

Nevertheless, "a large sample cannot *guarantee* precision, so that it is probably better to say that increasing the size of a sample increases the *likely* precision of a sample. This means that, as sample size increases, sampling error decreases" Bryman (2008, p. 179, original italics). By sampling error, I mean the variation between sample statistics and population parameters. Therefore, an important factor one needs to consider when making decisions about sample size is how big a sample error one is prepared to tolerate. The smaller the error, the bigger the sample size. However, Fowler (1993) argued that in practice most survey researchers employ more than just one criteria when making decisions about sample size, and that researchers are often not able to specify in advance "a desired level of precision" (p. 34).

Second, although it is in theory correct to say that the larger a sample size, the greater its precision, there are other considerations such as time and cost in any social research. Also, there is a certain point, often in the region of 1000, after which, the increase in precision becomes less noticeable when sample size increases. In other words, drawing larger samples after a certain number becomes less cost effective (Bryman, 2008, p. 180). Third, although in my study the non-response rate is very low,* it is not easy to estimate in advance how big exactly non-response rate would be like in a study. Therefore, there is often a need to sample more. But how much more is difficult to estimate, so to foretell an exact sample size is not straightforward. However, the principle is that the size should be big enough to achieve statistical power and to detect statistically significant relationships and the sample should be representative, which refers to the "degree that the sample accurately represents the population" (Teddlie & Tashakkori, 2009, p. 344). This sampling is clearly related to the quantitative strand of the study. Next let's look at sampling for the qualitative strand.

5.4.2 Purposive sampling

5.4.2.1 Selecting schools

The criterion I employ for the qualitative strand is saturation, which means "the point when you have heard the range of ideas and aren't getting new information" (Krueger & Casey, 2009, p. 26), or "a researcher collects and analyses cases to the point that sampling additional cases does not provide any new information (i.e., informational redundancy) that can be incorporated into the thematic categories" (Collins, 2010, p. 360).

However, in practice, reaching the point of saturation can be more complex than said, because it depends on data quality in terms of how complex the data itself is, sample heterogeneity (the more heterogeneous, the bigger the sample), sampling strategy (maximum variation normally requires more cases than others), and researchers' resources (Collins, 2010, pp. 360 - 361). That is to say, to determine the size of purposive sample through theoretical saturation is not straightforward either. Therefore, as in probability sampling, it is very difficult to know in advance exactly how many interviews are enough, although Guest, Bunce, and Johnson (2006) concluded that once about 12

* As said before, I was present in the classes when students filled in the survey and I noticed that it was very rare students did not participate, even though I told them at the beginning that they could choose not to participate.

interview transcripts were thematically analysed, around 92% of the codes employed in their analyses were produced. They thus claimed that 12 is the number of interviews "needed to get a reliable sense of thematic exhaustion and variability within [their] data set" (p. 65). Nevertheless, their informants were largely homogeneous (about 60 interviews with African women at risk of contracting HIV) and their research focus was relatively narrow (women talking about sex). What will the situation be like if a study, like this one, involves more heterogeneous samples and has broader research foci?

There are diverse opinions about sample size in qualitative studies too. For instances, Warren (2002, p. 99) interestingly argued that it is necessary to conduct between 20 and 30 interviews for a qualitative study to be published; Gerson and Horowitz (2002) noted that "fewer than 60 interviews cannot support convincing conclusions and more than 150 produce too much material to analyse effectively and expeditiously" (p. 223). These statements regarding qualitative sample size are not likely to be shared by all, but there seems to be a rule of thumb, and that is "the broader the scope of a qualitative study and the more comparisons between groups in the sample that are required, the more interviews will need to be carried out" (Bryman, 2008, p. 462; Morse, 2004). Next I will explain how I selected the schools and interviewees in the study.

The three schools, as well as those participants selected for the interviewing, are purposive samples in the study, which means they are particular settings and persons that are "deliberately selected for the important information they can provide that cannot be gotten as well from other choices" (Maxwell, 1997, p. 87). This strategy responds to the purposes of the qualitative strand so that new insights or fresh aspects can add to or generate new theories regarding ICT appropriation in China. Unlike probability sampling, purposive samples aim to increase the transferability of the study, which means each school represents a broader group of schools as closely as possible and the selection of the three schools allows for comparability between the three types of schools on key dimensions of students' relations with ICT (Teddlie & Yu, 2007, p. 80). In other words, the movement of me as a fieldworker is attending to something coherent that is not spatially bounded, something that may not be discernible in studies that situate the largely cultural phenomenon pertaining to youth and ICT in spatially fixed places. That is also to say, I did, as what Marcus (1998, p. 79) advocated, "follow the object" (e.g., mobile phone and the Internet) and "follow the metaphor" (e.g., digital divide, digital native) in the study in order to link up "disparate entities," entities that may also happen on the move (Burrell, 2009, p. 183). In that case, I was following the discourses (e.g., reports and discussions about *wangba*). Therefore, the purposive sampling technique in the study aims to generate typical cases and to produce contrasting cases across three different types of schools.

5.4.2.2 Choosing informants

As for interviewees, at least 15 students were selected from survey respondents in each school, with five representing high, average, and low levels of engagement with ICT respectively. Both typical and atypical cases were investigated. These carefully selected informants, though small in number, were able to provide greater depth of information pertinent to the level and nature of students' engagement with technology, for social processes register in individual lives to varying degrees. This is particularly true in contemporary China where great transformations are taking place and inequality is pervasive. The sampling boundary for purposive samples in the study consists of those students who were willing to be interviewed and left their contact details in the survey. This strategy is therefore informal (non-random) and based on both expert judgement of me as a researcher (Teddlie & Yu, 2007, p. 83) and survey responses.

However, there were by far more students who expressed willingness to be interviewed than I needed in the study. I had to decide which students I should select for the following-up in-depth interviewing. My principle was to include students with different levels of access to ICT, family backgrounds (measured by parental education), self-reported academic performances, track (Arts vs. Science), and attainment status (Key vs. Ordinary). This strategy is what Collins called "stratified purposeful sampling." It is stratified because sampling boundary is divided into subgroups where members are relatively homogeneous with respect to the above-mentioned characteristics. However, it also embraces the principle of "maximum variation" (Collins, 2010, p. 358), by which I mean a variety of groups were selected so that I could maximise the range of perspectives about ICT in the study or enhance what Sandelowski (2000) called "informational representativeness."

However, I enjoyed different levels of support from the schools while conducting those interviews with the students, particularly those without convenient access to QQ or a mobile phone. As Bryman (2008, p. 458) pointed out, organisational support or restriction has a critical role to play in sampling. In my study, one school helped me organise the interviewing process, they offered me a quiet office and asked those individuals I chose to visit me in the office during their evening self-study sessions. That way I was able to talk to those who had no access to ICT. The second school did not grant me that level of support, but I was able to stay in the school for a relatively long period of time, which means I was eventually able to talk to as many students as I wanted. In the third school, I was unable to do equally well in both regards, however, I managed to reach the minimum standards I stated earlier in sampling, which means I talked to the ideal number of students and included students meeting various criteria mentioned earlier. To remedy what I lacked during my visit to the third school, I later communicated much more with students from the school online than with those from the other two.

5.4.3 Relations and implications of the two strategies

The combination of sampling techniques as detailed above inevitably poses the problem of "representative/saturation trade-off" (Teddlie & Yu, 2007, pp. 86 - 87), suggesting that the more I focus on the representativeness of quantitative sampling, the less I can reach the saturation of qualitative sampling, or vice versa. Although both probability and purposive sampling strategies are employed in the study, I reject the dichotomous mentality that research findings are either specific to one context or universally generalisable. As Morgan contended, research results can hardly be "so unique that they have no implications whatsoever for other actors in other settings" (2007, p. 70), nor can they apply to all historical and cultural settings. This binary logic also denies the relationship probability and purposive samples can enjoy in MMR. In this study for instance, the purposive samples of students in the second phase are a subset of survey participants in the first phase. The qualitative sampling is therefore "nested" within the quantitative one (Collins, 2010, p. 364). In my view, what matters most is thus the extent to which research findings generated in one specific school can be made the most appropriate use of in others. This is called "transferability" of research findings in Lincoln and Guba (1985, p. 297), "making connections" in Woods (1996), "comparability" in Watson-Gegeo (1988), "analytic generalisation" in Yin (2009), "naturalistic generalisation" in Stake (2005), or "contribution to theory building" in Cummins (2000).

Despite the variety in terminology, the gist is to compare or connect schools "at a more abstract level" (Watson-Gegeo, 1988, p. 581). It therefore makes sense to argue that once the situation in one school is understood in its entirety and complexity based on rich data, "readers can extrapolate and make connections with settings closer to home"

(Taylor, 2001, p. 117). If the connections can be easily made, or in other words, insights gained from one school can well inform the understanding of another, then, as Woods (1996) argued, the external validity of a study is enhanced. However, this case-to-case transfer is different from what Onwuegbuzie, Slate, Leech, and Collins (2009, my own italic below) called "external (statistical) generalisations," which involve making predictions or inferences on data from a representative sample to the *population* from which the sample is drawn. This is also called "universalistic generalizability" (Onwuegbuzie & Combs, 2010, p. 417).

At the bottom level of individual informants, "naturalistic generalisation," parallel to the case-to-case transfer of schools at a higher level, operates and is based on the perceptions of research readers who reflect on their own experiences and selectively accept research conclusions before drawing their own according to the extent to which research findings apply to their own circumstances (Collins, 2010, p. 360). Here research consumers take over the role of researchers to make predictions or generalisations from their own or vicarious experiences, either entirely or in part (Onwuegbuzie & Combs, 2010, p. 417). However, this differs from "internal (statistical) generalisations" (Onwuegbuzie et al., 2009, my own italic below), which make generalisations or inferences on data from typical or elite informants to the *sample* from which the informants are selected. This is also called "particularistic generalizability" in Onwuegbuzie and Combs (2010, p. 417).

In my view, the non-statistical generalisations mentioned above also resonate with the argument in Yin (2009) that results from case studies (either schools or students) "are generalisable to theoretical propositions and not to populations or universes" and the goal is to "expand and generalise theories (analytic generalisation) and not to enumerate frequencies (statistical generalisation)" (p. 15). According to Curtis, Gesler, Smith, and Washburn (2000), this type of generalisation is "applied to wider theory on the basis of how selected cases 'fit' with general constructs" (p. 1002). In a similar fashion, Cummins (2000) highlighted:

> In complex educational and other human organisational contexts, data or 'facts' become relevant for policy purposes only in the context of a coherent theory. It is the *theory* rather than the individual research findings that permits the generation of predictions about program outcomes under different contexts. Research findings themselves cannot be directly applied across contexts. (pp. 204 – 205, original italics)

This approach thus focuses on what we can do with research findings, rather than simply on whether it is possible to statistically generalise the findings from one school to other schools. As such, I should examine the factors that might affect the transferability of the theories I am going to test and build in the thesis, and ask how much they can be used in other circumstances and what warrant there is to make such transferability possible. As such, representativeness and saturation are equally emphasised in the study because equal weight is allocated to either strand. Next let's look at the correlational survey and interviewing that feature the two strands in the study.

5.5 Correlational survey

The word "survey" is rich in meanings, according to Punch (2009), it sometimes refers to any research, quantitative or qualitative, that gathers data from a sample. In everyday language, it means any descriptive study where variables may not necessarily exist and its aim is to describe simple proportions or percentages. In that case, we call it "descriptive survey" or "normative survey." The survey in this study is more correlational, which refers to the relationship between independent[*] and dependent[†] variables (pp. 222 - 223).

But what does it mean to say two variables are related to each other? Here, I am not necessarily saying one causes the other. To say they are related to each other can also mean they vary together or co-vary. This is one step forward from the traditional cause-effect relationship. Instead of saying one causes the other, we can now ask what causes one variable to vary and how we can account for (or some of) the variance or difference in that variable (Punch, 2009, p. 224). This way we can operationalise our research by focusing on which independent variables have brought about changes in the dependent variables we are interested in. For instance, when I account for the differences in access to *wangba* and mobile phones, I look for variations in parental education in years, which is a quite reliable indicator of students' socioeconomic status in China (as tested in the preliminary study), and is significantly related to the level and nature of students' interaction with ICT.

This strategy thus helps researchers avoid the causal language which has been criticised a lot in social sciences. In my study, I will not claim that differences in family socioe-

[*] For cause, sometimes called "treatment' or "experimental" variable.
[†] For effect, also called "outcome" variable in experimental designs.

conomic status have caused those variations in students' interaction with technology. Instead, I say they are highly correlated, and they are other factors, for instance, school policies and community attitudes towards ICT, that can at the same time account for those differences. And through multiple linear regression, I can also find out how important each independent variable is in accounting for the differences in access and use, given that I can specify and measure both independent and dependent variables (Punch, 2009, p. 227).

The correlational survey in the study plays a crucial role in data collection because it is good at providing numeric description of "trends, attitudes, or opinions of a population" (Creswell, 2009, p. 145). Since the sampling of survey participants is based on probability principles, its findings can be more confidently generalised to a wider population in each region. Survey is also praised for the economy of its design and rapid turnaround in data collection (p. 146). In this study for instance, I was able to collect hundreds of survey responses within a pretty short period of time, whereas interviewing the targeted number of students in each school took much longer.

The self-completion survey thus aims to find out "relationships-between-variables" in the study. Unlike experimental designs, which often look "downwards" (from independent variables to dependent variables) or "forwards" (from causes to effects for people who are used to the causal language) and ask what is the effect of the cause, the correlational survey in my study looks "upwards" (from dependent variables to independent variable) or "backwards" (from effects to causes) and asks what is the cause of the effect. In other words, the survey examines events in the social world after they have occurred and takes the world as a given. It involves no manipulation and studies the world as it is. It is sometimes called "ex post facto research – research that occurs after the fact" (Punch, 2009, p. 214). Having described the survey's role in the study, I shall explain how I analysed the survey data.

5.5.1 Missing values in parental education

Missing data is often one primary concern in survey studies, to which the study is not immune. The variable that has most missing values in the study is parental education in years, a key variable that is so important that the issue must be dealt with.

Before introducing the measures taken to tackle the missingness, it is necessary to explain how the variable was measured and then coded. Parental education was initially measured by each parent's highest qualification, which ranges from "No formal education" to "Post-graduate studies." Since it usually takes six years to complete primary education, three years to finish either middle or high school, four years to obtain a college degree, and another two to get a Master's degree in China, the differences in length between two neighbouring qualifications are not consistent. It is therefore inappropriate to average the values assigned to the range of qualifications that students report about their parents' education. One way to meaningfully measure the variable is to transform each qualification into the number of years it normally takes to complete. That means a value of 0 should stand for no formal education, 6 for primary education, 9 for middle school, and 12 for high school. To get a college degree, it normally takes 16 years. Missingness occurs when one selects "I prefer not to say" or simply skips the question. As it is normal that most students come from two-parent families, there are most likely two values for each student – one for father, and the other for mother. For convenience, variable `pe` (parental education in years) was created as the mean of mother's and father's education in years reported by each student. In total, there are 110 missing values (out of 698 responses, or 16%) for this item across the three schools.

If I do nothing about the missingness and continue to run various analyses on the variable, I would basically assume that it is ignorable and none of the other variables, observed or not in the study, played a role in the missing mechanism. That could be a big assumption if those values are not "missing completely at random" (Hernan & Robins, 2013, p. 18), which means the missing values have nothing to do with other covariates in the study and are ignorable. By default, most statistical software packages just ignore the missingness and run various tests on complete cases.

Bearing in mind the caveat, I need to understand how the missing values actually occurred and examine if they are indeed ignorable. One way to test that is to see the difference-in-means. This is done by first dividing the data into two groups defined by the missing variable of parental education. It is then necessary to find out whether other relevant covariates differ significantly between the two groups. The differences become comparable after I standardise those differences-in-means for the covariates concerned. If the two groups differ significantly in a covariate,* then that variable must have played a role in the missing mechanism. That is to say, if I ignore the missing data and run different analyses on complete cases, the results would be biased against those who for

* Normally two standard deviations away from the vertical no-difference line of zero.

various reasons did not respond to the item in question. In R, I can visually detect if the missing values for parental education are "missing at random" (Hernan & Robins, 2013, p. 18), which means the missing values were somehow affected by the covariates that show significant differences-in-means between the two groups.

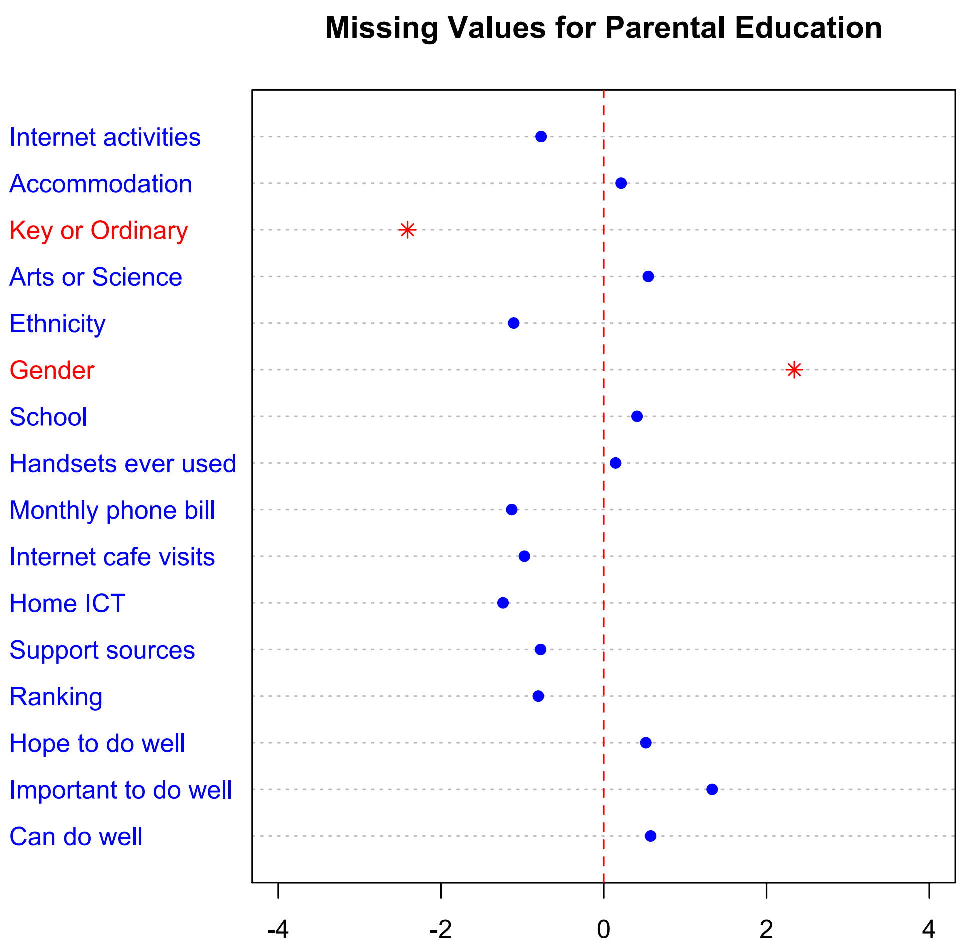


Figure 5.1: *Balance plot – red variables significantly differ (two standard deviations away from zero) in parental education (in years) between missing and complete groups; whereas blue ones do not.*

As shown in Figure 5.1, covariates `stream` (Key or Ordinary class) and `gender` (Male or Female) have imbalance between the missing and complete groups. In the balance plot, the blue covariates are not significantly correlated to the missingness in parental education, suggesting I can run various analyses based on them and ignore the missing data problem. Later I will use some of the blue covariates to predict the missing values in parental education.

5.5.2 Mean and regression imputation

There are multiple ways to impute missing data, among which are mean and regression imputations. For reasons mentioned earlier about bias, I should exclude the red covariates shown in Figure 5.1. As the study utilises several imputation methods, it leaves me with several sets of data about parental education, namely, the data I actually observe in the sample, and other imputed ones, which are the same in observed values but differ in imputed ones. Although imputed data sets are more complete than are the actual sample data, I shall not forget that they are not 100% *real*. As such, all forthcoming analyses pertaining to the variable will be based primarily on the sample data. However, the imputed ones will be utilised to boost confidence in certain results – if they converge on multiple datasets, then the evidence I have is more robust than otherwise; if they diverge, I need to find out why and be more careful about the claims I make. Next, I shall explain how I implemented the imputations.

Mean imputation in analysis first calculates the mean of parental education in the complete group, which is 9.19 years of education for all parents across the three schools. The method then fills in all missing values in parental education with the above mean. To visualise the imputation procedure, I list below the first 20 values for parental education before and after mean-imputation:

```
Pre-imputation by mean
[1]  0.0   NA  0.0  6.0  7.5  4.5 14.0  6.0  6.0  7.5  6.0
[12]  3.0   NA  6.0  3.0   NA  3.0   NA  3.0  0.0
Post-imputation by mean
[1]  0.00  9.19  0.00  6.00  7.50  4.50 14.00  6.00  6.00
[10]  7.50  6.00  3.00  9.19  6.00  3.00  9.19  3.00  9.19
[19]  3.00  0.00
```

Regression imputation also starts with complete data for parental education. But prior to the imputation, this method needs to find out which regression model best accounts for the variation in the outcome variable. When selecting predictors, the study utilises what Julian Faraway called “backward elimination” and “forward selection” (2004, p. 122). The former first runs a regression of the outcome variable on all candidate predictors. It then drops the one that is not significant in the summary statistics of each regression iteration. The process is repeated several times until all predictors become significant at the conventional significance level of $\alpha = .05$.

The latter simply reverses the former, but after each regression, it selects the predictor that has a p-value smaller than $\alpha = .05$. The process continues until no additional variable provides extra explanation for the variation in the outcome. Since the two methods have the limitation of inflating the significance of those variables that are selected, I also take into consideration the Sum of Squared Residuals (SSR) and the Adjusted R^2 values from each regression. When striking the balance between bias and variance at this stage, I prioritise the precision in estimation, rather than the maximisation of R^2 values. In other words, what I want is a model that has the lowest SSR but the highest Adjusted R^2, for the former minimises the errors in estimation, while the latter maximises a model's explanatory power by penalising irrelevant predictors.

In the end, I chose the following linear regression line called Model 5.1 to predict the missing values in parental education in years:

$$pe \sim school + icth + support \tag{5.1}$$

According to the summary statistics of Model 5.1 in R, the Adjusted R^2 value is 0.58, suggesting around 58% of the variation in parental education can be accounted for by the model. Overall, the linear model fits the data quite well with a high F-statistic at 203.4 and a very small p-value at 2.2×10^{-16}, implying that the predictors selected are statistically significantly correlated with parental education in years. The coefficients on all selected predictors of Model 5.1 and their associated test statistics are presented in Table 5.1.

	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	4.21	0.33	12.86	0.00
Home access to ICT	0.78	0.16	4.87	0.00
School Hengshan	3.04	0.27	11.07	0.00
School Nanshan	7.04	0.42	16.84	0.00
Support	0.24	0.12	2.01	0.04

Table 5.1: *The regression model to predict missingness in parental education*

Put in words, parental education is highly associated with home access to ICT, which school students attend, and the level of support available to the students when they encounter difficulties in using ICT. For Basum students in Tibet, if they have no home access to ICT and seek no support from either home or school when they have difficulties in using ICT, their parents have on average 4.21 years of education. But for similar students in Hengshan of Hunan, and Nanshan of Shenzhen, the means are 3.04 and 7.04 years higher than that in Basum respectively. For all students in the study, the expected difference in parental education between students with one item difference in home access to ICT is 0.78 years, given they seek a similar level of support when using ICT.

```
Pre-imputation by regression
[1]  0.0   NA  0.0  6.0  7.5  4.5 14.0  6.0  6.0  7.5  6.0
[12]  3.0   NA  6.0  3.0   NA  3.0   NA  3.0  0.0
Post-imputation by regression
[1]  0.00  5.70  0.00  6.00  7.50  4.50 14.00  6.00  6.00
[10]  7.50  6.00  3.00  5.23  6.00  3.00  5.47  3.00  5.23
[19]  3.00  0.00
```

Again, the first 20 values for parental education before and after the regression-imputation are listed here, followed by three density plots (Figure 5.2) of the three datasets. As illustrated in the plots, parental education with regression-imputed missing values resembles the sample data more than does the mean-imputed one.

5.5.3 Diagnostics of the regression model

So far so good, but linear models have a few assumptions. First, it assumes the samples were independently collected from the schools. This assumption was satisfied, for the data were collected from three different schools and the selection of one did not affect how likely the other two were selected. Second, the model assumes the error terms have constant variance, in other words, it expects the data from each school to spread evenly across the overall regression line in the vertical direction. Third, it assumes a normal distribution of error terms. Finally, it assumes that there is a best linear approximation model to fit the data. For the last three assumptions, I have to employ various diagnostic methods to see or test if they have been met. Let me first check for constant variance of error terms in Model 5.1.

As shown in Figure 5.3, the error terms do not seem to be constant in the vertical direction, particularly in Nanshan. There are also more outliers in Basum than there

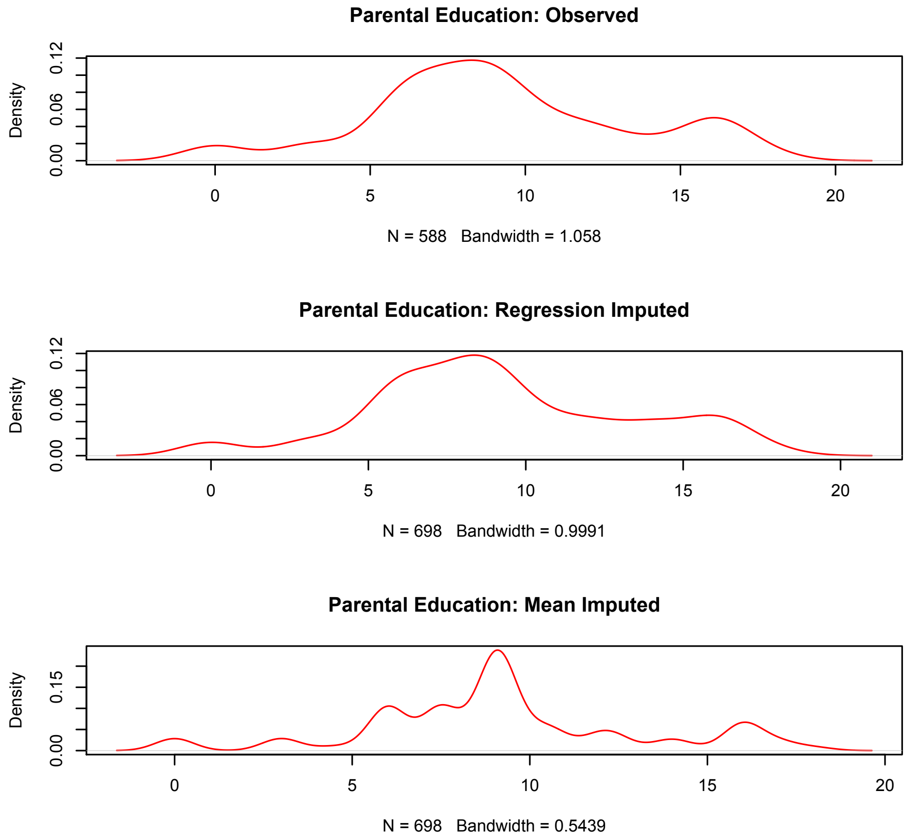


Figure 5.2: *Density plots of parental education in years*

are in Hengshan. It therefore appears that the constant variance assumption has been violated. However, sometimes it can be difficult to discern constant variance by naked eyes. In that case, I run a regression of the absolute values of all residuals on the fitted values derived from the linear model, which returns a new regression line called Model 5.2, as shown below:

$$absolute\ residuals\ from\ Model\ 5.1 \sim fitted\ values\ of\ Model\ 5.1 \tag{5.2}$$

The null hypothesis for regression Model 5.2 is that there is no significant difference in the variance of the residuals from Model 5.1. As the output in `R` indicates, the test has an F-statistic of 0.89 on 1 and 586 degrees of freedom, which is too small for the difference to be big enough for me to reject the null, suggesting that the variance is constant, as reflected in the big p-value of the test at 0.35.

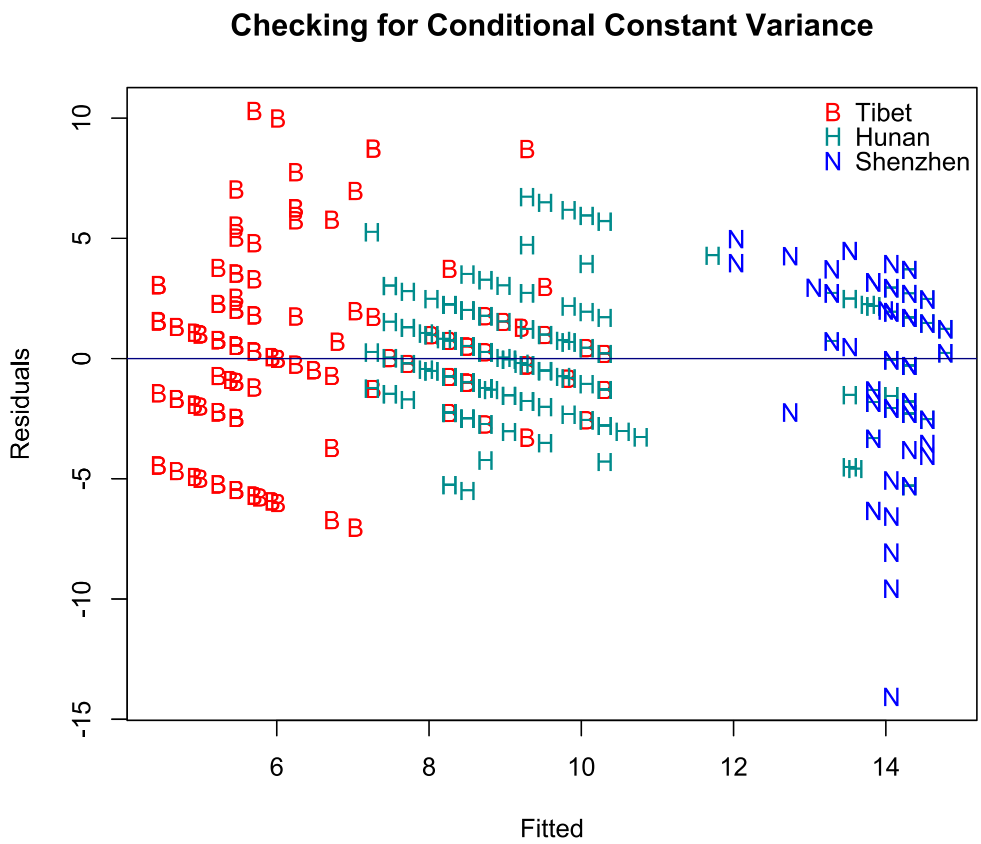


Figure 5.3: *Residuals vs. fitted values*

To check for normality and linearity of the residuals from Model 5.1, I visually display the Q-Q and Partial Residual Plots of the residuals. As Figure 5.4 shows, the distribution of residuals has heavier tails on either side, suggesting that the normality assumption has been slightly violated, despite most residuals do follow the theoretical line of normality. This is not surprising, as Q-Q plot is sensitive to outliers on either side, and when sample size is big, even a small violation of normality can be easily detected. As Faraway argued, this violation can be reasonably ignored, for the problem that may have resulted from the violation of normality is “mitigated” (p. 60) by the large sample size in the study.

Regarding the last assumption about linearity of residuals, Figure 5.5 shows that the

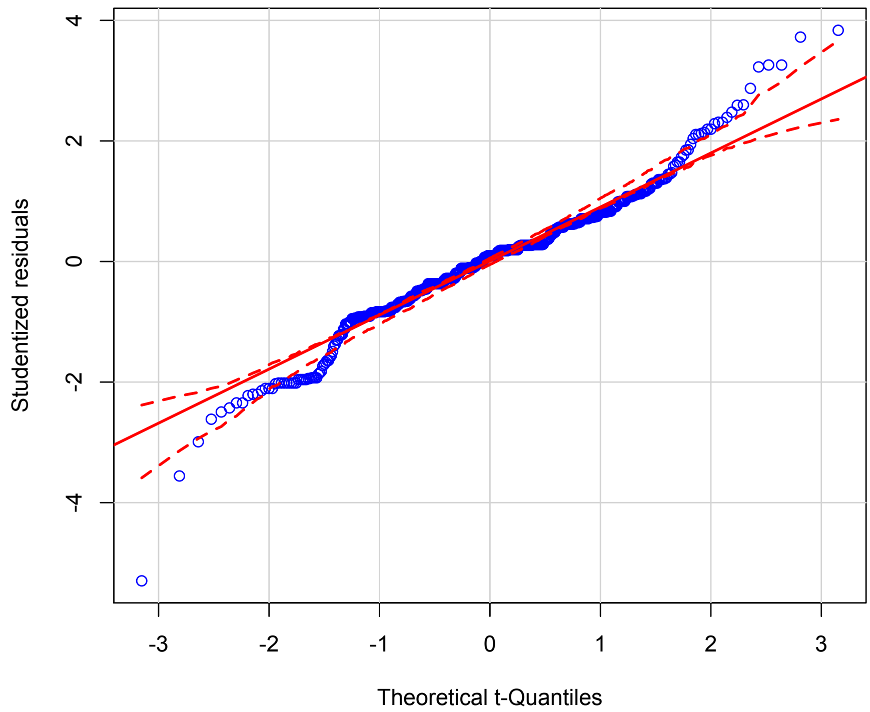


Figure 5.4: *Q-Q plot of residuals*

linear model is largely adequate to fit the data, particularly for the predictors of home access to ICT and sources of support, where the observed trends (in green) in the sample almost completely cover the theoretical dashed linear trends. However, small problems might result from the predictor `school` where big differences exist in both the means and medians of at least two of the three box plots. However, this does not pose a serious problem either. According to Adam Glynn (personal communication, Fall, 2012), I can actually relax, thanks to the Central Limit Theorem, the last three of the aforementioned four assumptions about linear regression, given a big enough sample size. I shall come back to this point later in the thesis when I utilise simulation methods to check for certain underlying population parameters. That means the only assumption I should be strict with is the independence of residuals, namely, random sampling in the quantitative strand, which was satisfied in the study, as discussed in Section 5.4.1.

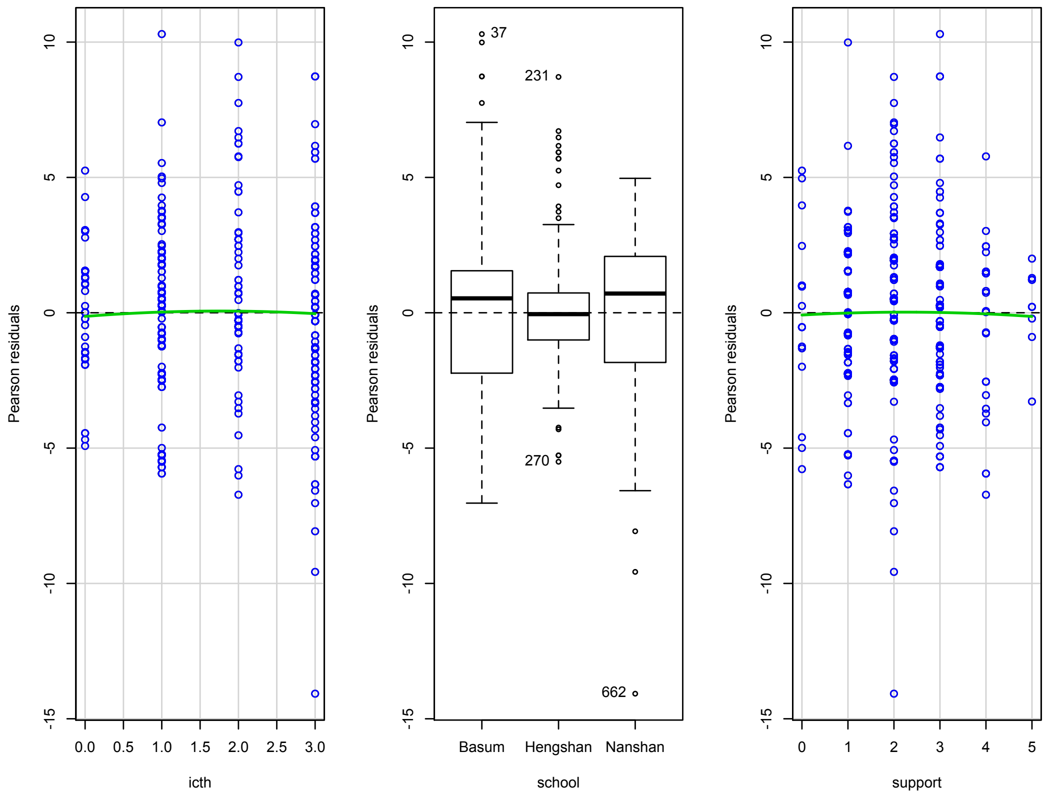


Figure 5.5: *Partial residual plots to check for linearity –* `icth` *stands for home access to ICT, and* `support` *is the quantification of sources to which students can turn when they encounter difficulties in using ICT.*

5.5.4 Multiple imputation in Amelia

According to Garry King (personal communication, Spring, 2013), mean imputation tends to flatten the regression line, and the regression imputation as discussed above fails to incorporate both estimation and fundamental uncertainties, for the model is based upon fixed coefficients and assumes away ϵ. Although the final results derived from the original and differently imputed datasets are by and large consistent in the study (cf. Tables 9.10 and 9.11), I need to be very optimistic to use the regression model alone, for all the imputed values will lie perfectly on the regression line, while most observed values scatter around it. In that case, as King said, I do not have evidence against such an approach. To address such a problem and sometimes the divergence of visual evidence and test results (e.g., the constant variance assumption of Model 5.1), I will use `Amelia II` to impute missing values whenever possible, for it accounts for

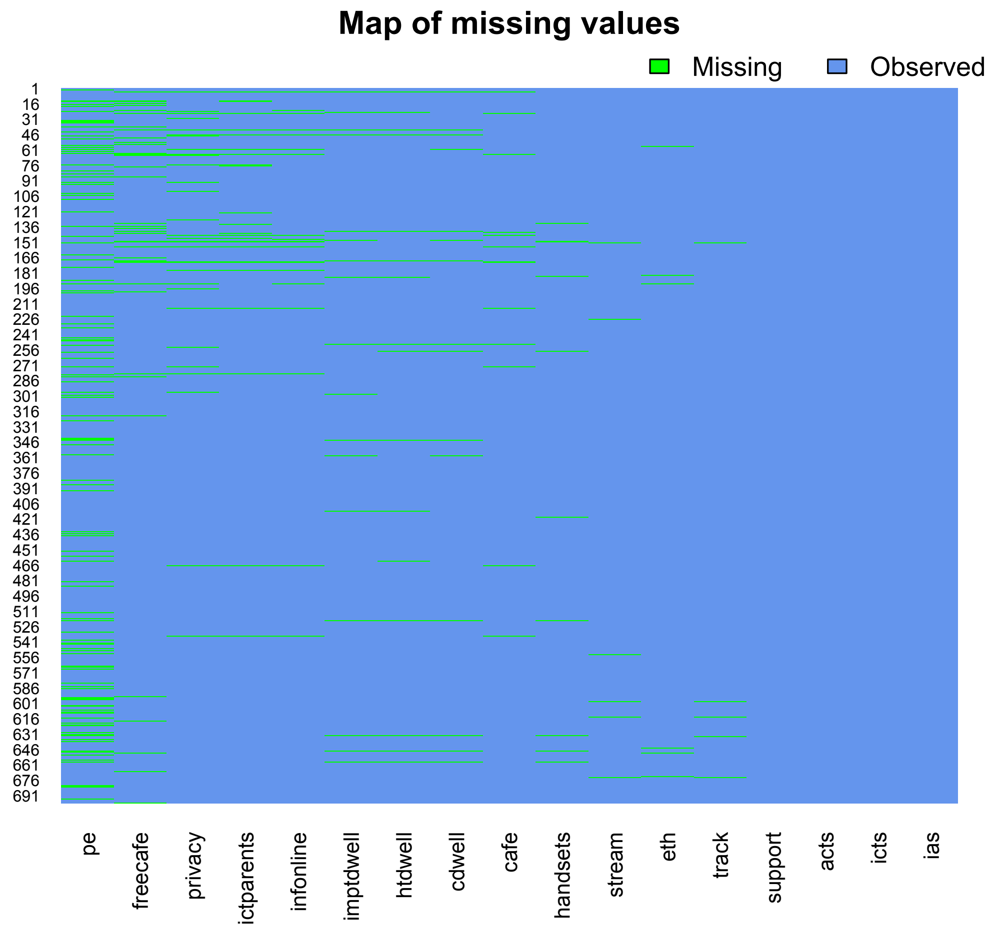


Figure 5.6: *Missingness map – please see Appendix D.1 for a complete description of the variables appearing in the map; the vertical axis has observation numbers with missing values in at least one of the variables listed along the horizontal axis (not all observations with missing values appear here for a better visual presentation).*

the above mentioned uncertainties (Honaker, King, & Blackwell, 2012), and results combined in `Zelig` (Imai, King, & Lau, 2013) from multiply imputed datasets have proved robust (King, Honaker, Joseph, & Scheve, 2001).

When imputing missing values in `Amelia` II, it is more effective to include all relevant variables in an imputation model than it is to use only a few that eventually appear in an analytic model, for extra information will always be more informative than otherwise for

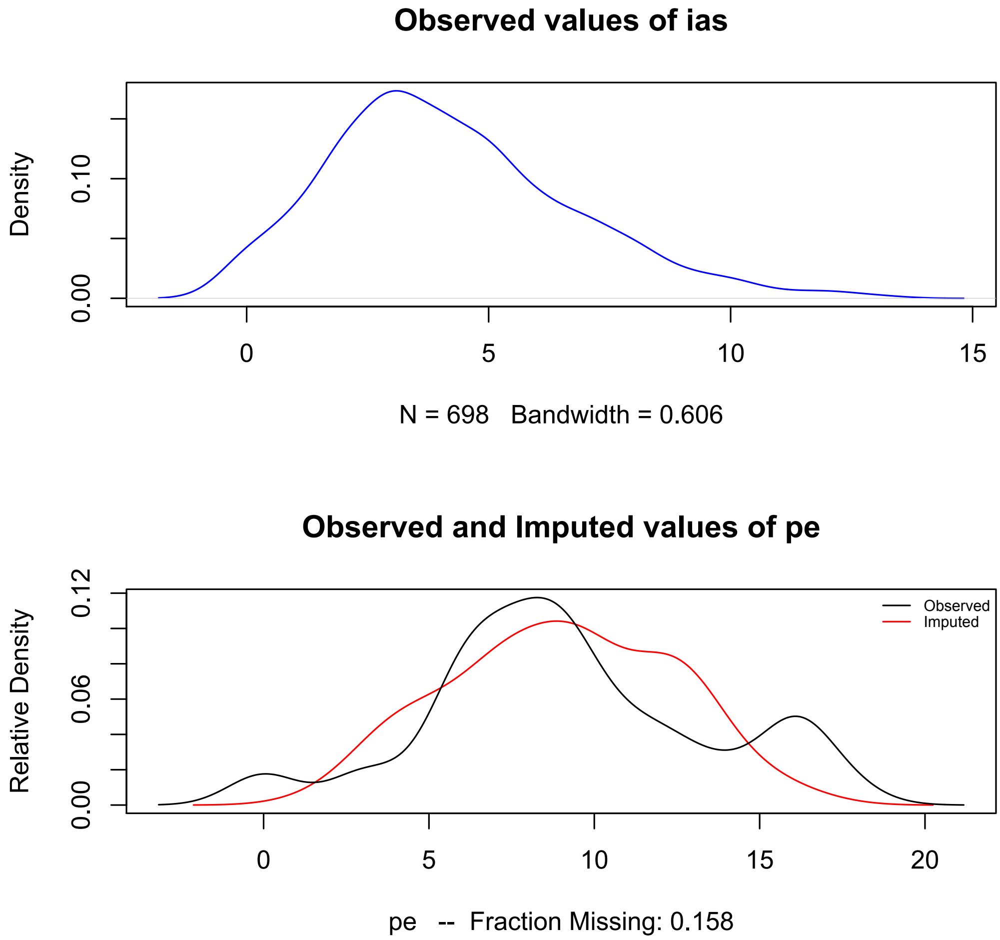


Figure 5.7: *Imputing missing values in parental education with full predictors – `ias` is the number of non-academic activities students do with the Internet, which has no missingness; `pe` is parental education in years, which has most missing values (15.8%).*

missingness (Honaker et al., 2012, p. 10). For instance, I will use ethnicity and parental education in years to explain non-academic Internet activities in the analytic model of 9.2. But to impute parental education, the variable that has most missing values (see Figure 5.6), I used 16 predictors* to compute the missingness for parental education in years. Of course, I could use the three variables that actually appear in the analytic model to fill in the missing values in parental education. But the distribution of parental education with imputed missing values based on more predictors (full prediction model)

* All variables but parental education itself in Figure 5.6.

resembles the observed distribution of parental education more than does the one based on fewer predictors (minimal prediction model, compare the effects in Figures 5.7 and 5.8). Actually, when I overimputed parental education – treating the observed values as if they were missing and then imputing them using an imputation model (see Honaker et al., 2012, p. 30) – I found that the full model predicted the outcome quite well, with all 90% confidence intervals covering the observed values of parental education (see Figure 5.9). Therefore, for all imputations in the study, I will use as many predictors as possible. Having resolved the missing data problem, I now turn to the other key instrument of the study – interviewing.

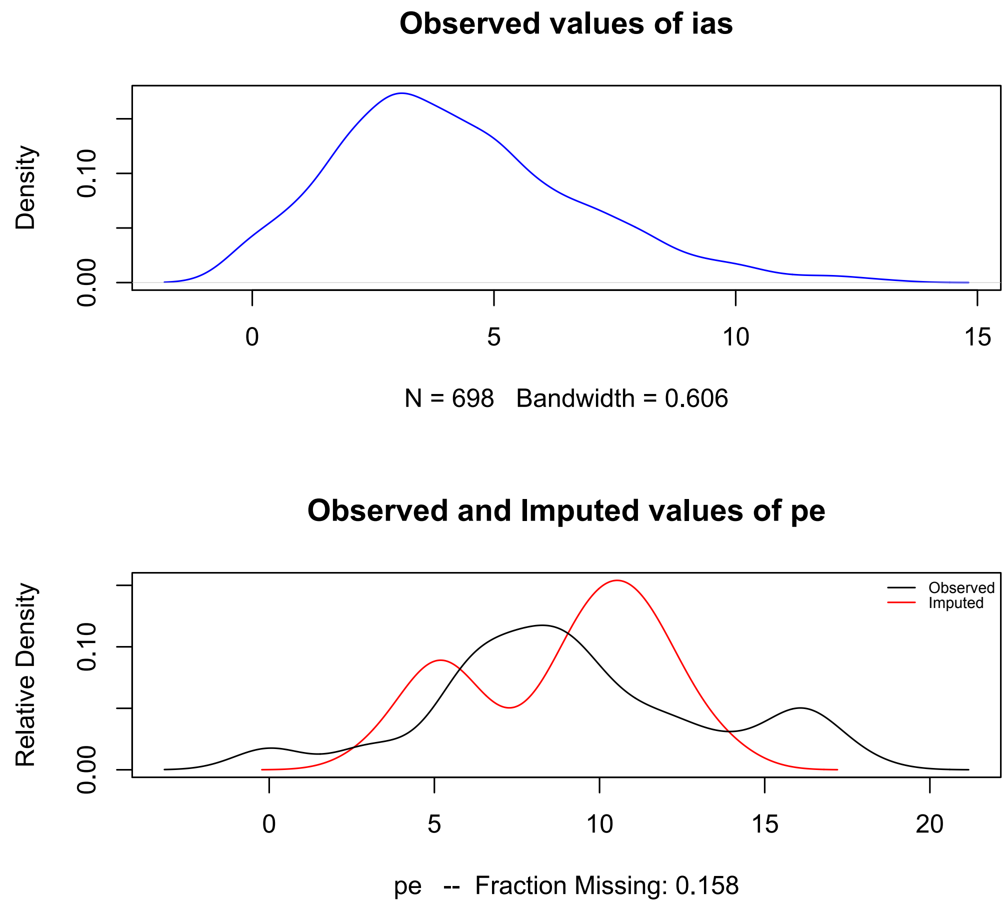


Figure 5.8: *Imputing missing values in parental education with minimal predictors – `ias` is the number of non-academic activities students do with the Internet, which has no missingness; `pe` is parental education in years, which has most missing values (15.8%).*

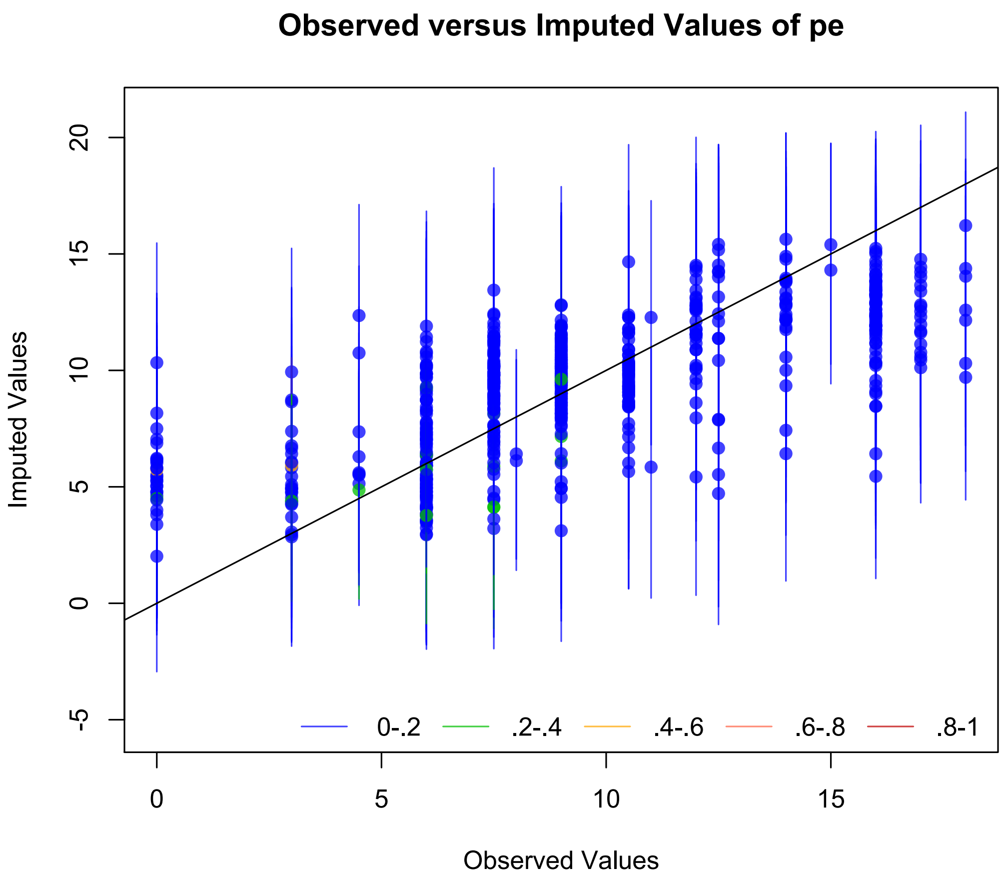


Figure 5.9: *Overimputing missing values in parental education in years (`pe`) using the full prediction model.*

5.6 Interviewing

As for interviewing, one obvious advantage is its adaptability, implying participants' ideas, responses, motives, and feelings can be followed up, probed, and clarified. It can also yield rich data which allow me to "put flesh on the bones of questionnaire responses" (Bell, 2005, p. 157). Unlike ethnography, which requires a substantial amount of interviewing and participant observation, fieldwork in this study did not demand a sustained period of my time away from Durham. However, interviewing was equally time-consuming in the study, although it could be well accommodated into my personal life (Bryman, 2008, p. 436).

Although interviews are good at generating rich information, it does not follow that all students in the study were equally able to elaborate on or willing to reveal their experiences with ICT. In that case, I asked them about not just their own experiences, but also what they had witnessed of their peers in their engagement with technology. As most participants in the study lived in dormitory with a few others, they should know intimately many things about their roommates' use of ICT. Therefore, rich and detailed information could still be gathered from one-on-one and face-to-face interviews, not to mention the advantage that interviews were capable of providing historical information about participants and the schools under study.

Through fairly long (from 30 to 60 minutes each) and in-depth interviews, I was able to, from time to time, enter "participants' worlds" (Rossman & Rallis, 2003, p. 180) in relation to their experiences with ICT. Most interviews in the study were conducted face to face, but a number of students were "hard-to-reach" (Bryman, 2008, p. 457) while I visited their schools, some interviews were therefore conducted over telephone. Since most interviews in the preliminary study were conducted via Skype, I was able to compare those datasets with the ones gathered from face-to-face interviews in the main study. I found that there were no huge differences between them in terms of quality and depth, despite the fact that telephone interviewing was unable to capture the implications that body languages might have had on the data.

The finding above thus consolidated the conclusion made by Sturges and Hanrahan (cited in Bryman, 2008, p. 457) that telephone interviews can be an effective method to collect qualitative data when participants are hard to reach or it is impractical to conduct all interviews in person due to time and resource constraints. Although Sturges and Hanrahan (2004) did not compare the differences between telephone and in-person interviews, Bryman did and reached the same conclusion as I did in this study. He found that interviewees were quite elaborative and produced detailed and considered replies over telephone. When taking into consideration the saving of time and travel costs, he further argued that this method could certainly be regarded as highly efficient (2008, p. 458).

However, there are significant differences, according to my own experience, between interviews and online conversations via texting and emails, which I used in the preliminary study with a small number of students. Given that the schools I visited are widely dispersed in China and that Tibet is not easily accessible,* I decided to keep telephone interviewing but give up collecting data via online instant messaging and emails for higher quality data in the main study, although some students expressed their strong preferences in "chatting" online via texting. However, telephone interviewing did not play a significant role in the main study, for it was also important for the study to find out the viewpoints of those students who did not have mobile phones (or with them) or use the Internet at all. Therefore, face-to-face interviews comprised the majority of my qualitative data, indicating that I was able to interview students with little or zero access to ICT during my visits to the schools.

Unlike structured interviews often found in quantitative studies where they mainly reflect researchers' concerns and discourage nuisance topics, interviews in this study emphasised interviewees' perspectives and allowed students to ramble off at tangents. This way, as Bryman (2008, p. 437) noted, I was able to see what interviewees viewed as relevant and important in their schools and lives pertaining to ICT and to raise new questions in response to their replies. I also interviewed a few students more than once, whereas in structured interviews, participants are normally interviewed once, unless it is a longitudinal study. Apparently, interviewing in this study was more flexible, in the following paragraphs, I will elaborate on the specific procedures involved.

At the very beginning, I used an interview guide (see Appendix E) when talking to students and at various points I felt very unnatural when there was a pause as a result of my concentration taken away from students to the questions listed on paper. However, when I asked questions in later interviews, I changed the ordering and wording of questions from time to time. The interview guide, therefore, served as memory prompts of topics to be covered. It did not close off alternative avenues of inquiry that did arise during the course of my research. Otherwise, premature closure of research focus would be inconsistent with the qualitative strand of the study, and with the emphasis on students' perspectives about ICT (Bryman, 2008, p. 442).

The interviewing technique I employed in the study is therefore semi-structured in nature (Bryman, 2008, p. 438), which means I did have an interview guide and asked all questions listed in the guide in most cases, but I also gave interviewees a great deal of leeway in how they chose to respond to my questions. The interview guide was necessary also because the study collected data from three schools, and I needed to

* High altitude and political sensitivity, see Appendix A for a recount of my experience in Tibet.

facilitate cross-case comparability. That said, the interviewing is not that unstructured in the sense that I have no control over the research focus. In each interview, I also followed certain procedures such as showing my appreciation of their willingness to participate in the study, re-stating the purpose of the study, asking for their permission to record the interview, and recording "facesheet" (Bryman, 2008, p. 442) information such as informants' names, which proved vital when I transcribed interviews. In my preliminary study, I did not say students' names when I started recording interviews, and it caused unnecessary difficulty when I managed to match interviews with students and tried to contextualise their answers in analyses. In the section that follows, I will explain what I did in order to increase the quality of interviewing in the study.

5.6.1 What constitutes a good interview?

During interviewing, I did my best to stick to the following criteria suggested in Kvale (1996) and Bryman (2008, p. 445) about successful interviewing. First, being knowledgeable about school policies regarding mobile phone and Internet use – to achieve this, I first skimmed through survey responses to gain a rough idea about students' engagement with ICT in specific schools, and then located individual survey responses prior to meetings with selected informants.

Second, each interview was structured in a way that research purposes were re-stated, permission to record conversations gained, and opportunities for interviewees to raise questions about the research given. Third, being gentle and sensitive — I tolerated pauses and gave time to students to think, and reassured them that it was fine even when they had no opinion to give at various points, which was not uncommon, and some students just told me that they did not know what to say or how to put it properly. I also listened attentively to what they were saying or even not saying and how they expressed their opinions. By so doing, I could be "active without being too intrusive" (Bryman, 2008, p. 447). At various points, I was able to tell from students' body language, pace of speech, and level of excitement whether or not the questions I had raised interested them. This was rarely possible in online conversations via texting or emails, and it is why I insisted on talking to them in person or at least over telephone when face-to-face interviewing was not feasible.

Fourth, being open and critical – I allowed students to elaborate on what they regarded as important and interesting, but at the same time, I was prepared to challenge what they said if inconsistencies occurred in their replies. Fifth, I interpreted and kept balanced in talking — occasionally I asked students to clarify their answers to avoid imposing my own meanings upon the data provided by them; I also kept in mind not to talk too much or too little so as to avoid making students feel either passive or not talking along "the right lines." Finally, being ethically sensitive — I promised confidentiality when students hesitated in raising certain issues. Some students in Shenzhen remained anonymous throughout the study — they did not leave their real names in the survey, neither did they report their real names during interviewing. According to Bryman, being ethically sensitive also means cutting short those questions that are sources of concern or anxiety and removing undue pressures placed upon informants because of those questions (2008, p. 447). Despite the measures taken, I am well aware of the disadvantages associated with interviewing, which is the topic of the section that follows.

5.6.2 Drawbacks and remedies

Among the drawbacks of interviewing, one is that it can be very time-consuming – I could only collect data from a much limited number of informants at the same time. Indeed, "like fishing, interviewing is an activity requiring careful preparation, much patience, and considerable practice if the eventual reward is to be a worthwhile catch" (Cohen, 1976, p. 82). In addition, data generated from interviewing are largely subjective and often leave much room for bias, because "interviewers are human beings and not machines, and their manner may have an effect on respondents" (Selltiz, Jahoda, Deutsch, & Cook, 1962, p. 583). That is to say, the presence of me as a researcher might bias the information given by the students, and the data provided could be filtered through their views too, let alone that not all interviewees were equally articulate and perceptive (Creswell, 2009, p. 179). During analyses of interview data, bias can also occur simply because one person's "fair and unbiased point of view" could be considered "prejudice" by another (Bell & Opie, 2002, p. 233), and "people (researchers included) habitually tend to *overweight* facts that they believe in or depend on . . . we do this by differentially weighting information, and by looking at part of the data, not all of them" (Miles & Huberman, 1994, pp. 253 - 254, original italic).

For example, in the preliminary study where most interviews were conducted via Skype, one student expressed his willingness to be interviewed by leaving his contact details in the survey, but when I rang him, he told me that he did not know what to say and thus requested to withdraw from the study. Also in the preliminary study, some interviewees had a lot to tell, whereas others only or even barely answered what I asked in a few words. This drawback of interviewing further justifies the necessity of conducting in-person interviews and gathering data through other means, such as the survey employed in the study.

Another issue regarding interviewing is about leading questions. Although it was not my intention to prompt all students through those questions, I needed them to help some informants "thematise" (Francis, 1996, p. 38) their experiences with ICT and make their thinking explicit. That is to say, from time to time, I did "lead" students to comment on specific aspects of mobile phone and/or Internet use in particular contexts so that the reporting of their past became a situated, restricted and focused re-creation of experiences (Uljens, 1996, p. 123), for we as individuals have different ways of telling about the very same event or experience, and it depends on to whom, when, and where we are talking, and research interviewing is just one of those settings (p. 124). Therefore, in Francis's words, "some pre-determined 'leading experiences' and 'leading prompts' are required to focus the interview appropriately for the aims of the study in question" (p. 39). That way, students' experiences could be better captured through their reflection as "reporting subjects" rather than "interrogated objects" (p. 38).

Nonetheless, it is not easy to reach that level of subjectivity and avoid seeing their digital experiences through my own eyes rather than theirs. When I listened to the interviews during analyses, I began to realise how much I talked at various points in the field and asked some questions that the students seemed to have no interest in. Nevertheless, the interviews were largely open-ended, and I could feel an increasing degree of confidence in the fidelity of what students revealed when they spoke at a faster pace and with a higher level of engagement. At such points, I felt that the interviews were more like dialogues, which I emphasised at the beginning of each meeting. I always hoped every interview was a dialogue that could facilitate the thematisation of aspects of students' experiences with ICT which had not been thematised before.

While I cannot fully accept Marton's statement that students' experiences and understandings are not out there and ready to be "read off" prior to interviews, I do agree that informants should not be "forced into some kind of strange meta-talk about issues which they have never talked about before" (Säljö, 1996, p. 21). In other words, interviews should not be merely situational social constructions. Instead, high quality interviews should bring about interviewees' awareness that some aspects of their experiences have changed "from being unreflected to being reflected" (Marton, 1994, 427). Psychologist Dan McAdams also echoed this point in his book The Stories We Live By, which documented ways of exploring personal myths in order to know somebody you want to know better through interviewing.

Even if all my informants' reported experiences with technology are faithful representations of their true experiences, there is another issue, an issue regarding what I as a researcher have to bring to the reported experiences. Since people as hermeneutic beings make sense of what they read, see, and hear, to read the transcriptions and interpret them under particular social and communicative circumstances is to achieve something and attach meanings to it (Säljö, 1996, p. 22). Essentially, it is a matter of researchers such as me as social and cultural beings decoding and making sense of messages mediated through texts. This is an important issue in social research when a literate society is highly dependent on such a form of mediation (p. 23). Ultimately, as in many other forms of human communication, what is being talked about in research interviewing is no longer decided by one individual person alone. It is a two-sided engagement; neither the interviewer (me) nor any interviewee (student) is out of the equation.

Certainly, as a researcher, I am not an objective questionnaire in human form. Instead, I am a flexible person, trying to discover an objective reporting of my students' statements and comments on their level and nature of engagement with ICT in and out of schools, although whether or not that objectiveness is possible to achieve in social and behavioural research is debatable, for in certain cases such as psychoanalytical analysis, "fantasies and wishes carry their own significant messages" (Turkle, 2011, p. 240) and it does not always make much sense to ask what is true.

Nevertheless, truth is important and, in the study, I was still primed to stick to that objectiveness. On the one hand, I needed to help those students bring their experiences under concern into awareness and ask them to reflect upon them. On the other hand, I also needed them to help me do the same to the information they had provided. Francis (1996, pp. 40 - 41) viewed this process as a dialogue, which requires participants to draw upon each other's awareness and reflection so that the data collected become "more honest than socially desirable, more actual than official, and more consistent than context-dependent" (Livingstone & Bober, 2006, p. 94). Ultimately, I aimed for the best sample of students' narratives about their experiences under concern in terms of accuracy in meaning rather than accuracy in my iPhone's capability in recording.

In that regard, according to Bowden (1996, p. 65), the outcome data owes its content both to the relation between the students and the phenomenon in question and to the nature of the dialogue between me as a researcher and each informant and the context of the conversation, which includes the relation between me and the phenomenon under investigation.

Although I could hardly escape from making my own interpretations throughout the study, I endeavoured to maintain a reasonable level of "interpretative awareness" (Sandberg, 1996, p. 137), which means, instead of ignoring it, I acknowledged and openly dealt with my own subjectivity. When I reviewed the literature about education in Tibet, I must say that I felt very uncomfortable when reading some highly politicised reports. Yet, I managed to check and control what Kvale (1994) called "biased subjectivity," which is the theories and prejudices that lead researchers to primarily taking note of those "statements that support their own opinions" and selectively interpreting them so as to justify their own conclusions while overlooking counter arguments. That way, such awareness, as Sandberg (1996, p. 137) argued, becomes a strength rather than a threat. But, is it really possible to withhold those theories and prejudices in a study like this? Here, I intend not to give a straightforward answer. But in the study, I think I was able to hold back my own theories and prejudices to the extent that I as a researcher could be freshly and openly present to the interviewees (p. 138). That implies, at least some drawbacks of qualitative interviewing can be offset, at least partly, by the strengths of the quantitative survey. This further justifies the need for a MMR in the study. Next I will talk about how I went about analysing and interpreting the data gathered through the two primary instruments I have so far described.

5.7 Analysing mixed methods data

5.7.1 Qualitative data

Analysis of qualitative data is, according to Schwandt, an "activity of making sense of, interpreting, or theorising data. It is both art and science . . . If data speak for themselves, analysis would not be necessary" (2007, p. 6). Like any other analysis, it is a process of thinking of and examining "something to determine its parts, the relationship among parts, and their relationship to the whole" (Spradley, 1979, p. 92). In this study it involved the following steps.

First, it was a process of immersing myself in the data. I carefully transcribed all the interviews. By listening to them again and again and assembling students' voices, feelings, and thoughts on my computer screen as texts, I felt I could from time to time, as I listened and typed, enter students' lives and minds. In order to increase the validity of the study, I avoided transcribing more than two interviews within any single day. At first, I managed to find out how I worked best in transcribing those interviews. I then realised that some attractive nuances could be found if I listened to the same interview on a different day while transcribing it. As such, no transcription of an interview was completed within a single day. I thus deliberately kept the time interval between versions of transcription. In addition, I made sure that written texts in transcription reflected exactly what interviewees had said, word for word. However, there were points where I could hardly figure out what students actually said either because of external noise or the fast pace of their talking. In that case, I listened to the sections more often, or marked in the transcription "it is not clear here" – I did not attempt to guess or make them up (see Bryman, 2008, p. 454).

Second, as Taylor (2001, p. 110) did in her PhD project, I identified recurring themes and sought subsequent evidence or events to test or explain explicit statements which I treated as hypotheses at earlier stages. While culling, coding, and cutting the data, I established categories and looked for relationships between themes and patterns by reading and re-reading the data. I employed three types of coding. The first is inductive, which involves examining the data, identifying meaning units, and attaching codes to them. The second is deductive, which means I adopt codes from the literature and find instances that match those codes. The third is abductive coding, which refers to an interactive process between literature and data (Onwuegbuzie & Combs, 2010, p. 409). This process required both in-depth examination and "global scanning" (van Lier, 1988, p. 16), metaphorically speaking, I employed both microscope and telescope and utilised them in turns to view the same landscape.

To summarise, analysing qualitative data in the study was "a comparative, evaluative, summarising and generating process" (Uljens, 1996, p. 123), during which I employed both within-case and cross-case analyses. The former means analyses that are bounded within each school, both survey and interview data were analysed one school at a time. The latter involves simultaneous analyses of data from three schools (see Miles & Huberman, 1994). According to the typology described in Onwuegbuzie et al. (2009), data analyses in the study are case-, variable-, and experience-oriented. Case-oriented analyses (schools as cases) focus exclusively on individual cases in a hope to particularise and make analytical generalisations. Variable-oriented analyses (survey responses) examine relationships among constructs so as to produce external generalisations – the building blocks here are variables rather than cases (Miles & Huberman, 1994, p. 174). Experience-oriented analyses (interviewees' experiences) explore and investigate experiences of key informants within their specific school and home contexts (Onwuegbuzie & Combs, 2010, p. 418). Next I shall talk about analyses for the quantitative strand.

5.7.2 Quantitative data

When analysing the survey data, I report whether the results of statistical tests are significant or not, how they answer the research questions and why certain results occur in the study. The results from the survey thus provide both descriptive and inferential statistics. The former refers to numerical properties of the sample, and measures central tendency (a single numeric value that is most representative of the entire distribution), dispersion (an index to tell how much scores vary from one another, or how spread apart they are), relative standing (where does a score fall relative to others in the distribution), and distributional shape (how does the shape of sample distribution differ from a normal distribution with the same mean and variance).

The latter produces parameters that are numerical properties of a population, and involves making predictions and judgements about the population based on sample characteristics through either parametric or non-parametric analyses. According to Onwuegbuzie and Combs (2010, pp. 401 - 402), parametric analyses are based on a few assumptions about parameters, for instance, regression residuals should be normally distributed, have equal variance, and observations are independent from one another. Nevertheless, these assumptions can hardly be met in social and behavioural sciences. This is when non-parametric analyses come to rescue. Assumptions for non-parametric analyses are less stringent, for instance, they do not require normality of distributions. That's why they are often utilised to analyse ranked data, which often risk reducing data by ordering them without considering their raw values.

5.7.3 Towards an integration

Although the study involves analyses of both quantitative and qualitative data from both strands, it is not to say that each strand is restricted to either quantitative or qualitative analyses. For instance, qualitative data from interviews could be converted into quantitative data and analysed by quantitative methods, and vice versa. However, they were first or at the same time subject to qualitative analyses prior to the conversion (Onwuegbuzie & Combs, 2010, p. 414). This transformation of data in analyses is called "cross-over mixed analyses" (Onwuegbuzie & Teddlie, 2003), which means one type of analysis often associated with one tradition is employed to analyse data from another tradition. Essentially, a cross-over analysis is a cross-paradigm analysis, which integrates quantitative and qualitative analyses to a greater extent (Onwuegbuzie & Combs, 2010, p. 423).

The two traditions can thus be linked in analyses, just as Miles and Huberman (1994) noted: the question "is not whether the two sorts of data and associated methods can be linked during study design, but whether it should be done, how it will be done, and for what purposes" (p. 41). Since I adopted multiple yet interactive philosophical assumptions in the study, their roles in analyses thus lay on a continuum from no philosophical to multiple philosophical assumptions. That is to say, I recognise the differences they have but believe that they are compatible in a mixed methods design such as this one. That explains why the two strands were kept separate, in sampling for instance, but they also complemented each other (Miles & Huberman, 1994, p. 412). In other words, while the two sets of analyses were distinct, they both contributed to better understandings of the phenomenon under concern, and the understandings could be "linked, combined, or integrated into meta-inference" (Teddlie & Tashakkori, 2009, p. 266), which ultimately lead to convergence or divergence in results.

To increase the quality of meta-inference in MMR, Onwuegbuzie and Combs (2010, p. 425) advocated one basic principle in "mixed analyses," and that is to analyse data in a way so as to produce five types of generalisations, namely, external (statistical), internal (statistical), analytical (or theoretical), naturalistic (or particularistic) generalisations, and case-to-case transfer (p. 417). In this study, mixed analyses involved both quantitative and qualitative data, occurred sequentially over two phases, had approximately equal weight on each strand, and produced multiple types of generalisations as suggested above.

5.8 Methodological epilogue

This study treated MMR as an independent approach to the investigation of students' engagement with ICT. It was influenced by philosophical assumptions in design and placed under theoretical frameworks of disciplinary knowledge. The research carried equal weight for both quantitative and qualitative strands and proceeded in a sequential order over two phases of fieldwork. The rationale for the adoption of MMR to address the digital divide problem in China is two fold. First, students' relations with ICT are complex, therefore, a combination of methods from across paradigms are more likely to achieve a broader and deeper understanding of the phenomenon. Second, data collected from both quantitative and qualitative strands are able to complement, illuminate, and corroborate each other, particularly when regional cultures in the study are diverse and distinct from one another.

Just as the quantitative and qualitative components were methodologically integrated in the study, normally regarded incommensurable and incompatible paradigms were brought together under a dialectically pragmatic umbrella. That is to say, the study valued differences as well as common grounds under different philosophical and theoretical frameworks and treated those differences as the starting point of an interactive dialogue — the warm human mind and the cold natural world are not necessarily two separate and un-crossable worlds, as Dewey and Zhu Xi in history both believed, we are actually parts of the world and the world is indeed somehow in our mind before it can be meaningful.

The chapter also detailed the procedures I took in order to gather trustworthy and valid data. Since the study aimed to capture both factual and meaningful aspects of students' interaction with technology, it adhered to the principles associated with probability and purposive sampling strategies. Nonetheless, the two sampling processes, as their underlying philosophical assumptions did, interacted with each other, and the purposive sample was nested within the probability one, suggesting that the study sought both statistical and theoretical generalisations.

The two primary instruments for data collection in the study, namely a pencil-and-paper survey and interviewing, were employed in both preliminary and primary fieldworks. The survey treated the world as a given and examined events surrounding students' participation in the digital world after they had occurred. Interviewing in the study treated informants as "reporting subjects" rather than "interrogated objects" (Uljens, 1996, p. 38), meaning the study aimed to capture faithful yet reflected representations of students' experiences with their ICT by creating a two-sided dialogue between me as a researcher and students as the researched.

In data analyses, the dialogue between quantitative and qualitative strands was equally treasured. Together the two datasets contributed to a better understanding of Chinese high school students' engagement with ICT through a process called meta-inference, by which I mean they were analysed in a way that produced statistical (both internal and external), analytical (or theoretical), naturalistic (or particularistic) generalisations, and case-to-case transferability.

Chapter 6

School Hengshan of Hunan

> 唧从哒咣网吧对呃有害，【但】呃从冒感觉到！
>
> *She always asserted that wangba were harmful to me, [but] I never so felt!*
>
> – *Yao*, male, 17

6.1 *Wangba*: When culture and technology clash

6.1.1 Depicting *wangba*, defining people

While the condition of *wangba* is sometimes regarded as an indicator of economic development for a town, visiting *wangba* is often viewed as an indicator of quality (*suzhi*) for a student. Dark, messy, smelly, and crowded, as *Yan* and *Heng* described, the unpleasant environment in most *wangba*, reasoned *Yao*, is due to the low level of urbanisation in Shihong, a town where School Hengshan is located.* *Yao*'s argument implies that *wangba* in bigger cities should be more comfortable than are theirs in Shihong. This view is not rare among Hengshan students. With experience in *wangba* of Guangzhou, a southern metropolis in China, *Chengsu* revealed that *wangba* there are quiet. *Wei*, a drop-out working in Guangzhou as a migrant worker when interviewed, also reported that *wangba* near his workplace are better equipped and ventilated than are those in Shihong of Hunan, an inland province. However, he revealed that there are "black *wangba*" there too, for they allowed him in even though he was a few months away from 18 – a practice quite normal for *wangba* in Hunan.

* Like the names of informants in the study, Shihong and Hengshan are pseudonyms for the town and school respectively. Hengshan does not refer to the real place of Hengshan in Hunan. Likewise, Nanshan and Basum are pseudonyms for the schools in Shenzhen and Tibet.

The main difference, therefore, lies in the environment of *wangba*. For instance, *Yang* recalled her experience with *wangba* in Shihong: “I don’t like the kind of smell there. I think it is hot inside, and fresh air does not circulate in. I don’t like staying there for long, maximum 10 minutes. Then I have to come out.” *Liu* expressed similar feelings towards *wangba* of the town: “I think it is very unpleasant. I am averse to the sort of feeling inside, for I can’t stand with the smell . . . The facilities there [Foshan, Guangzhou] are much better than the ones here,” where *wangba* are often filled with smoke or a mixture of smell from fast food and areca nut* sold and consumed right inside the public place. *Wen*, a 17-year old female, tellingly described the odour in a group interview as such:

> 重要应该不算吧，趄都不想趄，每次都爆满 . . . . . . 好多行，机子又好夯；而且那里咯行，好多男生喜欢恰烟，烟肥，果子肥，好难逢。得那里呆久哒，觉得自己西岸都有股烟肥。
>
> [*Wangba*] cannot be viewed as important, for we normally do not want to be there. They are always full [of people] . . . actually many people; and the machines are very outdated. Moreover, many males there smoke. The smell of cigarettes and areca nuts is so unpleasant that you would come out smelly after staying there for long enough.

While most students, no matter how often they visit *wangba*, agree that the typical environment in *wangba* is unpleasant, they disagree on whether or how much *wangba* can influence students like them. To those who never or rarely visited *wangba*, such as *Ting*, they are probably as poisonous as opium in the sense that they do attract flocks of students to spend days and nights there often without sleeping, which apparently has negative impacts on their body, mind, and academic performance. However, such an “addiction” is unlike the seductive power of drugs – it weakens by itself as time progresses. *Yao*, once deeply “addicted” to the Internet, revealed that it is no longer attractive to him, and he often admonishes those middle school students currently in a situation similar to his before.

But to many adults, such as those in *Qing*’s hometown, visiting *wangba* has a moral connotation. To them, students visiting *wangba* frequently are not “good” students. Although *Qing*’s parents share a different view, *Weizhou*’s parents are unfortunately among them and do not want him to surf the Internet in *wangba*, for, to them, *wangba*

* Similar to chewing gum and very popular in Hunan.

are not places "good" students ought to visit, and those who frequent *wangba* are generally speaking not good at their studies, or they would become "bad" should they carry on going there. *Qing*, however, argued that visiting *wangba* is not necessarily "bad" in itself, for there are students doing "proper" and "improper" things in *wangba*. She thus rejected the adult way of defining a person based on whether or not she visited *wangba* and advocated a comprehensive way of judging a student.

While adults often portray *wangba* in pejorative terms, students also acknowledge that it is not uncommon to find in *wangba* "unruly" youngsters. *Jie*, for instance, pointed out that most *wangba* are "black" – they are illegal because they admit under 18s. He also viewed students frequenting *wangba* as lower in quality (*suzhi*), although he stressed that it was in general true – not absolute. *Jie*'s classmate, *Taowen*, used even stronger words to describe *wangba* "addicts." He commented that there are too many "human dregs" (*renzha*) in *wangba*, although he exhibited a level of hesitation when he uttered the words. To *Taowen*, a student with home access to a computer and the Internet, visiting *wangba* against the school policy is simply incomprehensible: "It is more or less the same to surf the Internet at home and in *wangba* ... It is even difficult for us to walk into *wangba*. But it seems that they can do whatever in order to ..."

Other students, while not using strong words to depict those *wangba* "addicts," also stated that there are people from diverse backgrounds in *wangba*, implying that undesirable or nasty people are also there. For instance, *Yang* noted that last year fighting involving knife injuries took place in her community *wangba* and incidents like that were not uncommon. Furthermore, she asserted that *wangba* in less-developed areas such as Shihong are not safe places for young females, particularly decent looking ones. That is why her parents made home access available to her years ago. *Yan*, another female informant, also revealed that safety concerns are another reason for not visiting *wangba*.

6.1.2 Academic performance and time spent in *wangba*

It is generally viewed that spending too much time in *wangba* has negative consequences for students' academic performance, and those who have experienced a decline in exam scores also agree. However, they do not necessarily believe that it is the Internet itself that has the undesirable effect. *Yao* for instance did not attribute his fall in academic ranking to technology alone, as he reasoned:

> 烬级，一般冒吗影响，就是象学集影响哒。丙来是捐校第九，现甲是21哒…… 可能不是向网咯原因，是同学喜欢一起曲趄玩，把心玩散哒……一般就是跑到衡三趄溜冰啦，象学集经降趄，国庆节放七天假，趄哒六天。咯里甘岸冒吗好玩的，到那里总会趄一哈网吧。溜冰兹后恰饭，贤后就趄网吧，总会趄网吧…… 网吧对烬级基本象冒吗影响。以前初中一个同学烬级跟呃不相象下，【唧】跟呃一起向网，兹后呃哼都比较向瘾，经降一起向网，包吖。但是唧娘呀管得年，呃娘呀吖管得年，呃哼一起向网次素就小哒。唧娘呀叫唧莫向网，就买哒甲朽机得唧，唧就开斯玩朽机游戏，象课哈课都玩，烬级下降好快，后来就比呃落后。中考兹后，呃考到哒重点班，唧就趄哒普通班。但是唧咯网瘾越来越代，现甲就冒读哒…… 可能是因行而异吧。对呃影响不代，对有咯人影响今咯蛮代 —— 举要是因为向网咯行，而不是网络里咯东西影响行。网络里咯东西如果影响到你哒，你可以克自到自己就影响不到你哒。
>
> [As for] exam results, usually it [visiting *wangba*] exerts little effect. [However], it had some influence [on me]. Last term I was the 9th, now I am the 21st. [But] it's probably not because I spent too much time online — it is more due to the fact that we often went out together, which distracted me a lot from my studies [the right mindset was disturbed]. We went out to skate in Duxi [county headquarters] quite often last term, actually six out of the seven days for the National Day holiday … there isn't much we can do in Shihong. But after skating and enjoying a meal together, we always visited *wangba* … But I don't think *wangba* have any [direct] consequences for exam performances. For example, I used to have a friend in middle school. We performed equally well in school and visited *wangba* together often. We both got so addicted to it that we often spent whole nights there. But our parents also restricted us more, which subsequently reduced our time spent there. In order to prevent him from visiting *wangba*, his parents bought him a mobile phone, which he began to play with incessantly, even in class. His scores therefore dropped quite dramatically. As a result, he was assigned to an ordinary class, whereas I got into this key class. But he became addicted to the Internet, and eventually dropped out from the school.

Upon analysing what he experienced and witnessed, *Yao* was not quite sure if there is a direct link between addiction to the Internet and academic performance. He first reasoned that those around him in the real world – in *wangba* – pose no risk to him if he manages his own business in cyberspace. Instead, reasoned the second year high school student, it is those in the virtual world – in games – who affect him as a player. Another 17-year old, *Wei*, shared this view and noted that there are only benefits associated with *wangba* if students can control themselves well. Upon a second thought, *Yao* joined *Wei* in making the conclusion that what really matters is not the people in the virtual (what one encounters in cyberspace); rather, it lies in the person himself – if he can discipline himself well, the Internet would have no effect on him.

Yao then reflected further. He said he was no longer addicted to the Internet and *wangba* were no longer important to him – he could better control himself than before, so his exam scores rose again. However, he noted that his performance could have been better had he visited *wangba* less -– the Internet certainly contributed to his academic decline. While he realised that his time spent in *wangba* resulted in a decline of his school performance, he still performed much better than did his friend, suggesting that playing with technology simply deflated his score, but ruined his friend's academic advancement. In the end, he concluded that the effect varies from person to person – while it did not have a huge negative impact on him, it had on others around him. As such, Turkle was right in arguing that not all students are equally prepared to withstand the effects of online risks (1995, p. 204).

Note that *Yao* is a top student in a key class of the School. By pointing out the different consequences of technology, he also exhibits a strong will power in the control of himself — he triumphed in the battle by performing well in his studies. But how do those who failed academically view the consequences of being with technology? *Yang*, a female student who had lost any hope for academic success, remarked with a sort of let-it-be laughter or what Maugham (2010) called "a magnificent assurance" (p. 187): "What it does to me is merely on my eyesight, for academically speaking, I have totally given up." Now in the very same battle, *Yang* also felt she had "defeated" technology. But this time, it was by accepting her academic failure – what else could technology do to her when she was prepared for the worst in her studies?

6.1.3 Monitoring behaviour, managing *wangba*

As analysed above, what lies at the centre of the issue is students themselves, rather than the technology under concern. However, parents and educators often argue that ICT have to be removed from students' daily lives, rather than guided into their studies. Unsurprisingly, it is not uncommon to hear reports about what students viewed as "parental ignorance."

With parents working in another province as migrant workers for most of his formative years, *Yao* recalled that his mother once returned to specifically monitor his behaviour with ICT. He revealed that his parents were deeply concerned about the fact that he was once fanatic with the Internet. But his mother was not always that effective in her control. What she could do was often left to catching him in *wangba*. When successful, she normally scolded him, and occasionally beat him. Most of the time, however, the battle between *Yao* and his mother took the form of quarrels. He noted: "She always asserted that *wangba* were harmful to me, but I never so felt." Consequently, he kept doing what he wanted to do with the Internet, and simply ignored what his father told him not to do over the phone.

In Hunan, *Yao*'s parents are not unique in their way of regulating their son's engagement with technology. To *Wei*'s parents, *wangba* are associated with "only disadvantages, no advantages," lamented the student, for "they know nothing about the Internet, nor have they ever visited [*wangba*] . . . what they see about it is often the negative side of it – all they see is people playing games." *Ting* also reported that her parents "believe in whatever others have to say about the Internet." However, unlike *Yao*'s parents, there was barely anything for her parents to worry about her, for she rarely visited *wangba*, and indeed, her academic ranking was even higher than *Yao*'s.

While how much parents do in their regulation of adolescent interaction with ICT varies from one case to another, most parents oppose their children's visit to *wangba*. According to *Jie*, their opposition usually stems from the concern that their children would get addicted to the Internet and their academic performances would suffer. Nevertheless, not many parents in Hengshan actually visited *wangba*, as *Jie* commented: "I don't think my parents have ever visited one. They merely heard about what it [or the consequence of addiction] is like."

To parents knowing enough about computers, technology should be something their children ought to have, even though they are uncomfortable with *wangba*, or to put it more accurately, the environment of *wangba*. Involved in an IT business in Shenzhen, *Lu*'s father, for instance, bought her a home computer and had it connected to the Internet. He himself visited *wangba* often for commercial reasons during his time at home, but his experiences there in Hunan convinced him that he should keep his teenage daughter away from *wangba*. According to *Lu*, her father does not want her to surf the Internet in *wangba*, for people there are "complicated" (*fuza*) and the environment there is "messy" (*luan*).

Despite their awareness of certain *wangba* conditions, parents without much knowledge about ICT occasionally encourage their children to spend some time there too. *Guoyu*'s parents for example are supportive in that regard, for they believe it is necessary for their high school child to get used to keyboard, and to know something about technology in case he would not even know how to switch off a computer.* *Si*'s parents hold similar attitudes towards *wangba*, but they ask her not to go there too often. To her parents, teenagers having not visited *wangba* are likely to be laughed at, and there is always something for them to learn from those machines. *Heng*'s parents share more or less the same view, but ask her not to spend more than two hours per day on the Internet during vacation.

In general, parents' knowledge about or awareness of technology has an effect on how they regulate their children's engagement with ICT. In other words, the more they understand technology, the less restrictive or more skilful they are in regulating adolescent access to and use of ICT. Since most parents in Hengshan are migrant workers, their regulation of adolescent engagement with ICT is often delegated to their parents, who usually have more limited, if at all, knowledge about technology than they do. As a result, grandparents' monitoring of youth technology access and use often turns out to be cruder, even when the usage is for the benefits of their grandchildren. For instance, *Qinxiao*'s grandfather always forbids her to touch computers in such a coercive way as described in Section 1.1.

While it is unlikely that all grandparents are like *Qinxiao*'s, they often have a say in how teenagers under their guardian relate to ICT. For instance, *liu* revealed that her grandmother follows her mother, who is a migrant worker in another province. If she really needs to use the Internet, she must first justify the need via a phone call to her mother, who then releases the permit normally held by her grandmother back at home. According to her mother, *wangba* in Shihong are worse than those in bigger and more developed areas such as Duxi and Yangheng, and her daughter should visit better ones

* For those who are totally illiterate to computers, switching off a computer is just like what they do with a TV -– they only need to press on a physical button.

in those cities if it is really necessary for her to use it.*

Parents, however, can sometimes be no less coercive than grandparents like *Qinxiao*'s. For instance, *Yu* recalled her experience in *wangba* when she was in her second year of middle school:

> 呃总记得，那次，反进呃，开始向网。呃得那网吧里，有个家讲捞根好强咯棍子，咯粗 ...... 到那里来抓行，哈死呃哒，哈得呃卷星都抖起来哒，好恐怖！因为唧仔得里落。外头有行，【唧】扒开别个，把唧拽曲来，好恐怖！家讲暴力，得网吧里好多，经降有。还有一乏，一个家讲，一个女咯，唧仔看唧来哒就跑开哒。唧一路追，围着操强跑哒几圈，后来唧仔跋围强曲趄哒，唧就站得那里骂，做死咯骂。
>
> I always remember that time a parent holding a big cudgel came to catch her son in *wangba*. I was even scared to see it. It's terrifying that she pushed away those sitting in her way to reach her son further inside. That happened quite often in *wangba*. Another time, one student ran away immediately when he realised that his mother had arrived. But the mother chased after him all the way to the end of a school playground, where he climbed over a fencing wall to escape. His mother eventually stopped, but stood there cursing him for a long time.

Having documented how parents regulate students' visit to *wangba*, it is worthwhile to compare how educators respond. The schools studied all have policies regarding students' visit to *wangba*. But the degree of severity varies from one to another. In Hengshan, visiting *wangba* repeatedly can sometimes result in students being expelled from the school. According to *Qing*, a few students she knew received such a punishment. For those who were penalised but not dismissed, their experiences showed how seriously their teachers took the issue. *Yao*, once caught and then subject to some disciplinary action, recalled his experience:

> 以前呃距校，中午午休曲趄【向网】...... 呃回来咯是侯老丝就开始调杂，问呃中午不安闭到哪里趄哒。哦开始早哒好多借口，咣到别个请习趄哒。但是老丝比较需哦，唧问哒好多小事，【比徐】是别个来早呃还是呃趄早别个。呃咛临时冒对口供，一哈子就露哒马脚 ...... 呷哒一份检讨

* Shihong (town government seat) is a less developed and smaller town than Duxi (county government seat), which is smaller than Yangheng (A city with five districts of its own and seven constituent counties).

> 须，还有一篇两千字咯论文 ...... 比许向网咯危害，还要叫家讲到学校来交流一哈。吗取乏都可以放弃，娘呀总要来。取乏可以从轻，但是一定要告诉家讲，酿唧尽晓得扭屋仔得学校是咯烬炕，酿家讲明白你得学校是甲咯样子，不要怪老丝冒告好 ...... 检讨须300字左右，得班里读取来，把事交代取来。论文休先呷自己咯事，贤后咣向网有哪些危害，贤后举班里咯例子，比许某某行，做火切到广久趄见网友，得【广久】火切站得唧屋呀拦到哒。
>
> Once, [a few friends and] I broke out from the school during lunch break in order to surf the Internet in *wangba*. After we returned, the teacher in charge began to investigate ... I eventually confessed the misdeed, but was later asked to write an essay and a note of apology, the former was about 2000 words long and the latter about 300. The essay was about the harms associated with the Internet. My parent was also asked to visit the school, for the teachers insisted that a parent must come in order for the sanction to be released. It is important [for them] to inform my parents that I am such a student in the school, and it is not their fault if I fail — don't blame teachers if that happens ... I then had to read the apology in front of my class. In the essay, I first debriefed what I did wrong, then listed the disadvantages of visiting *wangba*. I also utilised negative cases I knew from middle school, for instance, one classmate took a train to meet his virtual friend in Guangzhou,* but his father stopped him in the destination station.

The school also took other measures to penalise those who had violated the school policy. *Lu* revealed that she once witnessed a number of students standing in front of the National Flag, from AM to PM. She also mentioned one top student in her class who went to *wangba* during a lunch break but was unfortunately caught. As a result, he was asked to undergo all the procedures described above. But luckily he was not asked to leave.

6.1.4 What makes *wangba* so mesmeric?

While blaming *wangba* for various negative consequences, people rarely spare time to seriously reflect upon why the technology has drawn so many students to it, despite their expressed aversion to the environment inside and the restrictions imposed upon them. For instance, *Yan* reported that some of her classmates were so "addicted" to *wangba*

* Over 500 kilometres away from the school.

that they attempted all means possible to pay a visit, even if they had to overcome considerable psychological and physical barriers – they sometimes jumped from the first floor of their monitored dormitory to the ground floor in order to escape surveillance cameras and then cross the campus wall.

To account for their classmates' behaviour, *Xin* and *Guoyu* explained that many students are bored or lonely. As Anita Chan argued: "For them [addicts], addiction is not a state to be diagnosed but is itself diagnostic; addiction leads them to social criticism" (2008, p. 130). That is to say, had the students' social and informational needs been met, they might have been viewed or behaved differently. When the real world cannot satisfy, what *wangba* have to offer thus meets where students fall. Unsurprisingly, they are well pleased even when all machines in *wangba* are occupied and what they can do is often left to watching others interacting with those slow yet seductive machines, as *Xin* recalled his own experience in *wangba*:

> 原先有40多待，现甲那里又增加哒一岗屋，那里吖有电脑，应该七、八系待吧。【但是】网速快咯子有原来屋里咯两待，集它机子都好卡。徐咯机子卡，呃就不想向，苏以呃就得那里看。经进向咯时侯好小，因为放假好多行得那里向网，呃恰完饭都1点多哒，超那里基本向冒得机子哒，好多行得那里。有时呃就得那里看看，看到机子就向，看不到就得那里看 ...... 现甲网吧啊，象呃咛年龄咯行有，而且还有好多细该仔仉，小学该段咯行，好多行得向。
>
> There used to be 40 or so machines, now they have an extra room, where 70 or 80 computers are available. However, there are only two fast ones in the old room. Most are very slow, which I really have no desire to use. I often prefer to watch. It is in fact only occasionally that I myself get a chance to have my own hands on a machine, for there are too many people there whenever I have time to pay a visit. Usually, there are rarely machines available after 1 PM – post-lunch time. There are so many people there that I can only watch. But I would occupy one as soon as it becomes available ... Most visitors there are high school students like me, but there are also many children – primary school students.

Some students visit *wangba* because they want to socialise with others in computer games, and they often find various excuses to get the permission to leave the campus and go there together. Since permissions are restricted to certain groups of students, some simply break out, and occasionally they get caught. Students visit *wangba* in groups also because of safety considerations, particularly if they are girls.

However, not all go there to play; some have social and informational needs. For instance, *Ting* visited *wangba* once. She went there with her friend because that girl needed to search for information online regarding how to choose a major, and the entry requirements of subjects such as medicine in a university, as well as how difficult the subject is and what is involved in the career. Other students, such as *Qing*, just wanted to experience what it is like to be in *wangba*. Most informants are not "addicted" to the Internet, and they visit *wangba* mainly to hang around – they play games, but not mega-Internet games, which, according to *Jie*, is very seductive; they read news, log onto QQ, watch films, and listen to music.

Occasionally, they visit *wangba* for academic purposes. For instance, *Guoyu* found the Internet so resourceful that he could easily find sample compositions when he really struggled with his own. He revealed that last term his teacher asked them to write a report, which he did not know how to even start. Then he went to *wangba* after school and copied one from the Internet by hand — he chose one that was not too long to copy. He justified his decision by pointing to the fact that his teacher did not say students could not copy from the Internet, and that there were simply too many assignments and they were very difficult, not to mention the TV programmes he had long wanted to watch.

Others also consult sample essays online, but in different ways and for different purposes. Unlike *Guoyu*, *Weizhou* did not copy ideal essays verbatim – he rewrote them according to his memory after reading them online. He did that also because he sometimes found homework too difficult to cope with. If they were easy, emphasised *Weizhou*, he would not copy. However, he did not search model essays online using specific search engines — he searched on whatever website that had a search engine, in his words, "I search wherever the home page is." But if the home page he happened to visit in *wangba* did not have a search engine, he would visit `baidu.com`, an equivalent of Google in China. However, not all students are like the two mentioned above. *Yao*, a top student in his class, also used online search engines to find sample essays. But he said he did that usually after he submitted his own. He noted that he could learn from others by reading their essays.

Students in Hengshan visit *wangba* for a wide ranges of purposes. For some, it is a window to the world and the future when they utilise the technology to satisfy their informational needs. For others, it is an ideal place to socialise with like-minded people of roughly the same age. While most students are not able to see the educational benefits of using the Internet in *wangba*, students do find themselves taking advantage of the resources freely available online, albeit sometimes in uninformed ways. As *wangba* draw students from diverse socioeconomic backgrounds and with varied academic capabilities in Hengshan for better or worse, it is inappropriate to remove them from adolescent lives in a wholesale manner, neither is it possible to ban outright students' engagement with mobile phones on campus, which is the topic of the section that follows.

6.2 Mobile phone: not just a connecting device

6.2.1 Coping without it or sleeping with it?

Despite the school's restrictive policy regarding mobile phone use on campus, most students bring one to the school. However, students use their phone in diverse ways, and they often invest the devices they have with values and meanings. To *Yao*, a phone is indispensable once he gets used to a life with it:

> 冒用兹前觉得冒吗事，用过兹后就离不开哒。一般好久冒看到哒【就】总觉得小哒吗东西，得学校读须冒杇机还好，但是放假哒冒杇机就感觉好无聊，冒事做。
>
> I used to feel nothing towards a phone, but I become attached to it after some time of use. I always feel something is missing if I don't see it for a while. I can cope without it in school, but I feel bored without a phone during vacations.

A mobile phone is thus more significant to *Yao* when he is alone than is it when he has friends around him. In other words, it is the phone's capability to connect and/or entertain that makes him feel attached to it. *Chengsu* also considers her phone a good company when she feels lonely. She began to use her phone a year ago. She recalled that she was overjoyed when she had the phone, for prior to that, she had to borrow a handset from others to make a phone call to her migrant parents in Guangzhou. But her phone is more than a connecting device — it is also a music player, a camera, and a diary book. To *Yao* and *Chengsu*, a phone is something, something necessary.

To others, a life with a phone and one without a phone are two different ways of life. Without a phone, *Shan*, for instance, feels she "needs a phone to do this, and a phone to do that." But once she gets used to it — to a life without one, she takes extra care in doing many things. Gradually, she realises that she can still achieve a lot without a phone. A phone in that regard thus delivers and reduces. It delivers because it makes life easier. It reduces when students rely so much upon it that they often feel they cannot cope without it.

Heng regards her phone not just as an added convenience to her daily life, but also as "three meals a day" she takes every day. She says it is not important, yet acknowledges it is necessary — she is so used to a life with a phone that it takes her a life without one to realise how significant it is. Unsurprisingly, *Heng*, in a life with a phone, views those without a phone or in a life without a phone "a bit out." By commenting on the same point, *Yao* tellingly noted:

> 唧尽得冒得屋里用【朽机】呃不晓得，唧尽冒用可能是因为暂时哈冒发现，等唧尽一用哒就吖离不开哒。
>
> I am not sure if they [students without a phone] use a phone at home or not. They don't use it now probably because they have not yet realised [a phone's seductive power or necessity]. They will become attached to it once they start to use it.

Weizhou's experience illustrates *Yao*'s point well. He once lost his connection to his QQ account, which he normally logged in from his phone. He was overwrought until "it suddenly came back again," which made him elated. When asked why he felt that way, he said he did not know, but added: "Probably [I am] used to it." It becomes even more understandable when he revealed how he used his mesmeric phone — he not only brought his phone to the school, he slept with it – the phone helped him fall asleep by playing its music to him on those numerous sleepless nights.

To many, however, a phone is just a phone; it is not that important. *Ting* says she does not have the need to contact other people as a student, for "everybody is busy." *Qing*, a girl without a phone, sometimes feels the need to use a phone, but she does not see much value of having it in high school. *Jie* has a phone, but he leaves it at home, and he will do the same in his final year. *Yan*, the only informant with an iPhone in the school, also acknowledges that it is not that important. *Yong* has parents working in another province, but agrees that a phone does not make that much difference to him.

Without a phone, he says he can still borrow one from his teacher to make a call to his parents whenever necessary.

However, the view that a phone is not important may result from the school's restrictive policy, for the official interpretation is that a life without a phone is better in school – phones can be too distracting to learning. Nonetheless, students do report that they or their classmates often play with their phone in class, log onto their QQ whenever possible, chat with significant others late in bed, or find electronic reading irresistible, even on a small screen.

All the activities listed above, according to *Yao*, *Qing*, *Jie*, and *Liu*, have negative consequences for proper learning. The four students then drew their classmates' lived experiences to show how much damage a little phone had done to their lives. As mentioned in page 123, *Yao*'s middle school classmate dropped out from his school. *Qing*'s classmate, though luckier than *Yao*'s, also suffered from a decline in academic performance. *Jie*'s friend dropped to the bottom of his class because, in *Jie*'s view, he played with his phone in class too much. *Liu*'s deskmate used to stand among the top five of her class, but fell to about 30$^{\text{th}}$ last term. This slippage, according to *Liu*, was due to her excessive amount of time spent reading from her newly purchased phone. Unlike *Liu*, *Weizhou* reported his own experience about electronic reading: "When I can't follow [his teacher in class], I automatically follow what happens in the novel." The students also stressed that a phone could do harm to human body, and a few informants were quite conscious about mobile phone radiation. They cautioned that their eyesight had deteriorated because of too much time spent on the screen.

While a life without a phone can be simpler for some, for others, a phone is not just something nice to have with. *Ting* regarded a life without a phone to be easier, for in her view all those with a phone in the school have to use it with a "psychological burden." *Gangliu* also commented on this invisible pressure: "[Regarding] using a phone in school, [I am] always concerned that my phone would be confiscated soon." *Weizhou* viewed the policy terrifying, as if the heaven would fall (*bu de liao*) once his phone was discovered by his teacher. He revealed that he had to go through a mental battle while making the decision on whether or not to bring his handset to the school. It turned out that most of the time, he went for a phone; only once did he leave his handset at home for one week. He did not know how to explain why he did that. Instead, he attributed it to his lack of will power. To him, his phone and music player is vital — he must use it from time to time, albeit under duvet, in order to fall asleep.

6.2.2 Negotiating access, coping with consequences

In order to use a phone, students in Hengshan first need to cross a material barrier – they find it very difficult to charge their handsets in either their dorms or classrooms. Since they have only one weekend off every two weeks, most mobile phone batteries cannot run that long. To resolve the problem, some have to ask those livers-out to charge their handsets for them, but the more they ask, the more inconvenient it becomes — they feel indebted to others. Therefore, it is easier not to ask and to cope without a phone or with a sleeping phone.

The second challenge faced by the students is the school's restrictive policy. Teachers, for example, normally confiscate handsets when they detect use among students. *Heng* reported that one student in her class once had three or four handsets confiscated in a single week. *Yao* himself had the experience twice. The first time, his teacher appeared when he was playing with his friend's handset in his dorm. Since the phone was not his own, he had to ask his mother to visit the school and ask the teacher for a release. The second time was during a lunch break, and again the handset was his classmate's. That time, he had to write a note of apology and a week later he was able to get it back for his classmate. Usually, students cannot get their confiscated phones back until a term ends. But the handsets *Yao* played with were not his own, he had to do whatever he could to redeem them. *Wen* also had such an experience with her classmate's phone, and she did the same to claim it in a timely fashion.

Although the most effective way of redeeming a phone is through a parent's visit to the school, most parents, as *Liu* pointed out, would not come for such an issue, for "it is the student's fault, not her teacher's." *Yao* concurred that had the handsets been his own, he would not have made all the efforts to please his teacher. *Qing* witnessed her classmate's handset confiscated. She recalled that once there happened to be a power failure, the student intuitively took out his phone to check time, but the teacher made the note and immediately enforced the policy.

Despite the strict confiscation-upon-discovery policy, many students, according to *Liu* and *Qing*, actually bring their handsets with them. Teachers are aware that their students have mobile phones with them. Some therefore ask their students to "deposit" their handsets at their places, and promise that they can go to use their phone whenever a need arises. But, as *Gangliu* reported, very few students had actually handed their phones in. To the teachers, a mobile phone is just a phone, a phone to make phone calls; but to many students, a phone can be a companion or even a world beyond their school world.

Nevertheless, teachers do allow certain groups of students to "openly" use their handsets. For instance, *Yan* is a class representative, and she can use her iPhone with her head teacher's permission. *Lu* participates in a creative writing programme; she can also use it to communicate with the teacher in charge. *Yong* himself is not allowed to use his phone, but he supports the rule that some students be allowed to use their phone. However, not all students think it is fair. One student initially handed in her handset to her teacher, but once she found out that some of her classmates were allowed to "legally" use their phone, she never handed it in again, given the minimal effect of her phone on her and her studies.

Since the school did not effectively control if and how students use their mobile phones on campus, *Yao* argued, the policy only forced their use of mobile phones to be "more covert and sophisticated" than otherwise. He further reasoned that the school can never entirely forbid mobile phone use. This point thus resonates with Turkle (2011)'s viewpoint that it is impossible to get rid of the technology (p. 293). Teachers may think that students obediently follow, but their ways of subverting the policy are often too unconventional to be detected. As such, "The effect might be better should the school allow us to use it openly, openly after class or during breaks." concluded *Yao*.

Jie also argued that the policy is rather rigid, but he supported the policy by asserting that mobile phone use does affect academic performance. In his view, students' capability to self-discipline themselves varies from one person to another. It is thus necessary to identify the differences within student groups and implement the policy accordingly. He also thought students should not "abide by the policy blindly." *Gangliu* agreed with *Jie*, for mobile phone use, in his view, does more harm to students than good, and the school's policy is for the benefits of the students. He then compared School Hengshan with his previous school that did not implement such a policy: mobile phone use during class there was rampant, and teachers often turned a blind eye to it. That is to say, students generally feel better when a school is more responsible to them by showing care through its strict policies.

Lu, however, found it difficult to present a straightforward argument in response to the policy. She noted that the policy is like one-size-fits-all, for many students with a phone are not using it to surf the Internet, chat on QQ, and so on; they need to stay in touch with their parents in other provinces – in Ling (2012)'s view, they have the responsibility to be available to their parents (p. 162). But she also pointed out that other students do use it for "improper" activities such as the ones mentioned above as well as virtual wooing. *Taowen* reasoned that the policy is right because most students with a phone, in his view, are not using it to contact parents, even when they contact them, they simply ask them for money — they largely play games with their phones, or read online novels, which has no positive consequences for a high school student. Therefore, mobile phone use should only be extended to a select group of students such as *Yan* and *Lu*, students deemed highly self-disciplined. *Yong* concurred with *Taowen* that the policy is necessary, and argued that today's students are simply spending too much of their parents' money.

6.2.3 To motivate and to intrude

In comparison with the school policy about teenagers' mobile phone use on campus, parental regulation over adolescent mobile phone use at home is much more relaxed. However, home regulation varies from family to family. Some parents ask their children not to use it for longer than two hours (*Gangliu*), others require them not to chat on mobile QQ (*Yan*) or surf the Internet (*Taowen*). Like teachers, most parents are concerned with their children's studies. If one's academic performance falls, it often has a direct effect on how her phone can be used at home. *Liu*'s parents, for instance, strictly restricted her mobile phone use once they noticed that their daughter's scores had dropped, and the policy often lasted for months in a row. Upon realising *Chengsu*'s overall ranking in class was not high enough, her mother asked her grandmother to control her mobile phone, which meant so much to her that she was not sure if she could cope without it in school. Apart from academic concerns, a family's economic status also relates to how parents regulate mobile phone use. *Shan*'s parents, for example, confiscated her phone because she spent too much money on it. In her parents' view, she does not know how to constrain and manage herself well. Of course, they also want her to focus more on her studies.

It seems that the Internet concerns parents more than do mobile phones. *Weizhou*'s parents do not oppose his use of mobile phone, but ask him not to surf the Internet, particularly chatting online via mobile QQ. For instance, he once received a call from his father because his online status on QQ became "available," which one of his relatives online noted and then informed his father of. But he did not do anything online, what he did was simply that he wanted to be connected or available anytime. Other parents, particularly those working in other provinces as migrant workers, often buy their children mobile phones and encourage them to use the technology in high school. They do that partly because it is more convenient for them to communicate with their children left at home, partly because they believe a phone can motivate their children to study harder.

For instance, *Lu*'s father, a businessman in Shenzhen, rings her every two nights, sometimes asking her for help in English; and her mother, a school teacher in her hometown, sends her text messages almost every night, asking how her life in school is or whether or not she minds if she comes to the school to pick her up when a holiday or weekend is approaching. *Heng*'s father bought her a new phone, which he used to oppose fervently. When he handed the phone over to her, he said: "You must study hard. I buy you this phone in order to motivate you in school. Remember, do not play with it in class!"

However, occasionally, parental regulation of mobile phone use can be too intrusive to teenagers. *Heng*'s mother, for instance, always browses her phone at home, checking if anybody she does not know has contacted her daughter. If a stranger to her, she would ring that number to see what had happened. Because of that, *Heng* sometimes censures her mother. She said last time she saved her cousin's name in her handset as an initial, which her mother did not recognise until she contacted that number. *Liu* likes to take photos using her phone, and occasionally there are males and females together in a photo. But when somebody at home sees the photo in her phone, they would suspiciously look at her, which she feels very uncomfortable with. *Qinxiao*'s mother often peruses her text messages stored in her handset while she thinks she is asleep.

Lu did not report if and how her parents monitor her mobile phone. While her parents' way of parenting may be an envy of many, it also reveals to her that they are actually overwrought about her in school. For instance, her mother would never allow her to leave the town alone. When it is necessary for her to visit somebody far away from home, her mother usually offers her company. Since her father is working in Shenzhen, sometimes he asks her to visit him; her mother does not permit her to take the long-distance train alone. As a result, she has never travelled far alone. She complained that she even has company when purchasing clothes.

Parents' inquiry over a phone call about their children's academic performance in school can also pose an intrusion. *Chengsu*'s parents have been working in Guangzhou as migrant workers for more than ten years, but they often contact her teachers for information regarding her performance, which she feels strongly against. She said she knows "what and how to do with certain things," so she objects how her parents intervene in her studies. She used to be a top student in her middle school, but in the key class of her high school, she is not always a top student, which often concerns her parents. In their view, she is not "good" any more, and she does not study as hard as before. But to *Chengsu*, it seems that her parents have lost their confidence in her. Although she understands how much they expect her to perform well in school, she does not like the way her parents communicate with her teacher, who often appears in front of her (which scares her) and tells her that her father just rang him.

6.2.4 Life on the screen

As the Internet becomes increasingly mobile, students can do more with their mobile phone than ever before, and among the things they do virtually, QQ chatting ranks very high. QQ enables students to chat and connect as they please, with friends, relatives, or even strangers, via texts, audio, or even video, either live or asynchronously. While most students use texts to communicate, they can log on to receive and reply messages via their phone whenever they wish. As reported earlier, some students prefer to be always online, albeit not always available. *Yao*, for instance, logs onto QQ first before he does anything else, as he described:

> 第一件事就是聊QQ，把QQ挂得那里，一般不聊咯。但是QQ一定要挂那里，朽机吖一样。QQ一天24小时挂那里，【因为】可以后带，总挂那里，别个发信息，冒吗重要咯事吖不回，就要挂那里。不晓得吗的，就要挂那里。
>
> QQ is always there, even though I don't chat that much. QQ must be there, so is a phone, 24 hours a day. Every now and then I receive a message, but I would not reply if it is not important. I am always available on QQ. But I don't know why, I just want to be there anytime.

To *Qing*, QQ is sometimes a freer way of communicating with her friends than any other means. Although she does not have convenient access to QQ via a personal device, she had one account opened years ago, and from time to time, she borrows her friends' phone to log on so that the account is kept "alive." She does not chat often, but when she does, she can say something via QQ that she would not normally say in person. Moreover, *Qing* views QQ an imperative for a high school student to be up to date — for not having a QQ is too outdated, as she realised: "When others ask me for my QQ number, how out of date it would be to say that I do not have one and I do not use the Internet! So it is necessary to just have a number there."

Like *Qing*, *Xin* opened his account also because many around him were using QQ in his middle school, and he hung out often with those who had QQ accounts. He would have nothing to do when everybody else was doing something online. Therefore, he just followed them. Although he has no access to a home computer or a mobile phone, he visits *wangba* often, and almost every day during vacations.

For those who have a personal phone or computer at home, QQ enables them to connect with even more — they have not only peers and friends online, but also parents and relatives on QQ. *Liu*, for instance, has two QQ numbers, one for her peers, and the other for family members. She does so because her family do not want to see her always online in high school — they assume that she must be doing something online when she is available online, and that she is certainly not doing anything appropriate to her studies. As such, when her family members spot her on QQ, she often needs to be prepared for questions from parents or close relatives.

Such parental responses extend to male students too. As mentioned earlier, *Weizhou*'s father once rang to question him after a relative reported his QQ status to his father. Unlike *Liu*, *Weizhou* was using Super-QQ, a special account provided by the software developer for a fee. Super-QQ allows him to have not just a luckier and easier-to-remember number, but also expands his connection, for he is on day and night. Since his number is not free, *Weizhou* does not use separate numbers for different groups, but the super-number sometimes has unexpected consequences.

Many students join QQ because their close friends are there already. But once on QQ, they mainly connect with those whom they know and know well. For instance, *Yao* rarely converses with strangers for long, and the friends he has online are often friends' friends, who either share the same interests with him, or come from the same place. From time to time, students such as *Yao* and *Xin* do encounter strangers online, but the conversations between them are usually limited in length and content. They may accept friend requests from strangers, but after a number of initial shallow exchanges, they often end up editing their friend lists by deleting those stranger friends.

Sometimes, interest-based conversations online with strangers survive longer than mentioned above. *Gangliu* occasionally has conversations with co-players of online games, and he knows where those players are because they oftentimes communicate with one another on QQ. *Yan* once met a stranger online who shared the same interest with her in literature. She communicated with the person in Hainan, another province on the Southern tip of China, for about a month before realising that the person was more interested in her than in literature. She then deleted him from her list (*la hei*) and refused to chat with or even accept friend requests from anybody she did not know well thereafter, as she concluded: "I think strangers are disingenuous (*hen jia*), tasteless (*mei wei*), and meaningless (*meiyou yiyi*); there is no point chatting with them (*mei yong*)."

Yet QQ continues to draw students from the real to the virtual in Hengshan. When asked why they engage with QQ, those students who are obsessed with the virtual usually reveal that school life is boring, or they feel lonely either on campus or at home. *Qing*, for instance, noted that chatting online is usually superficial and pointless, but school life can be even more boring and tasteless. She lamented that drill and practice sessions for exams in her school are never ending. Every day, they get up at about 7 AM and go to bed at around 10 PM. There is nothing but studying, no opportunity for the development and cultivation of personal interests and strengths.

But in her view, students must go through that one important yet competitive channel in order to win a place for higher education, implying that there is rarely any space for personal interests or extracurricular activities in her high school. She also reported that there are actually many talented students around her, for she witnessed once how well some students at her age and in the same school could sing and dance for the New Year's Gala. School Hengshan, to *Qing*, therefore suppresses individual interests other than study. Given such a school environment, mobile phones and the connection they make possible to the outside world are thus vital to some students, although they can be easily taken for granted.

Apart from chatting with others on QQ, another activity that many students fancy is electronic reading — they download freely available materials from the Internet and then read them on their mobile screen. To students in Hengshan, QQ meets students' communicative needs, whereas electronic reading satisfies their curiosity or intellectual thirst. As said earlier, school life is tedious unless one can derive much satisfaction from "proper" learning. However, the virtual world is attractive to many, for it arouses their imagination.

As a result, students often read until late in the night or throughout their lunch break. *Yao*, for example, once followed a novel every day. He read as the author wrote and shared online. Since he read on the nights of weekdays, he sometimes found himself catnapping through lectures during the day. When it was vacation, his reading intensified even more. He recalled that on a typical holiday, he could read from shortly after breakfast to three or four AM on the following day – except for meals, he spent most of his day in bed, reading on the screen.

Yong also had such an experience. He used to read electronic novels stored in his phone when he could not understand anything in his English class. But he was eventually able to resist the seduction by leaving his handset at home. *Weizhou* read electronically too, but largely when he was unable to fall asleep. He said he read novels as well as online blogs, including those written by one of China's most well-known youth blogger Hanhan. Both *Yao* and *Yong* pointed out that electronic reading had had negative consequences for not just their "proper" learning, but also their body such as eyesight.

The above two accounts came from students who were once enthusiastic about electronic reading, similar stories also came from those who witnessed others deeply drawn, if not addicted, to electronic reading. For instance, during term time, three or four students in *Gangliu*'s dormitory often read up to 2 AM or even dawn under duvet. In order to satisfy the appetite of their handsets for energy, they usually had reserve batteries, for it was close to impossible for them to conveniently charge their devices in school.

Electronic reading appeals to not just males. Both *Yan* and *Liu* saw their classmates reading on their tiny screen, even in class during daytime. *Qinxiao*'s reading desire was however aroused by her roommate, who read often in the night with a torch under quilt. But sometimes they shared the same bed and read together on the same screen. Shared reading did not last long, so she said she was not seriously affected.

6.3 "You are too out!": divides within Hengshan

The first difference between the haves and have-nots is in what they do with ICT. *Qing* and *Linci*, for example, sounded they enjoyed learning to type every time they had an opportunity to touch a computer. *Guoyu*, without access at home, learned to type in *wangba*. He revealed that he was slow and it could take him up to 20 minutes to complete one sentence, for the instruction language in Hengshan was the local dialect, and he could not speak the official language well. The slow speed of his typing was compounded with his limited knowledge about cyberspace. Last time, when somebody typed "88" to him on QQ, it took him quite a while to figure out the meaning of the two digits, which stand for "bye-bye" in Chinese cyberculture. When he asked his interlocutor for the meaning of the numbers, the response he received was: "You are too out!" However, to those who have home access, typing is often a pre-condition for online participation, and students such as *Yang* do type really fast.*

Another difference is reflected on the perceived benefits and costs associated with technology. *Xin*, for instance, does not have a computer at home, and the main benefits he can imagine of ICT are chatting with others on QQ and visiting some websites for academic purposes. *Qing* also realises the potential of a computer for learning, but expands it to the convenience of communicating with others and the abundance of TV programs for entertainment. While a high school student, *Qing* emphasised, too many popular TV series were shown to her "with only a start but without an end (*youshi wuzhong*) ." But a home computer with access to the Internet is about to change everything — she wants to watch all those programs that she missed out once she has convenient access to the technology. *Qing* was not alone with such an opinion; *Wen* and *Liu* expressed a similar regret. With a home computer, *Wen* said she would no longer waste any money in *wangba* to watch those long TV series. However, with a home computer well connected to the Internet, *Liu* did not know what else to do besides chatting and watching films online.

Other students and/or their parents view computers as detrimental to learning. For example, *Yan*'s family can afford a computer, but she sounds to be not very keen to having one. As a class representative, she is concerned that a computer may negatively affect her academic performance. *Jie* is from a similar background, and his reason for

* Most informants are now my QQ "friends." I have chatted with them from time to time about my fieldwork in China, which proved vital in analysis when I did member-checking for certain issues such as polyandry in Tibet.

not having a computer at home is the same as *Yan*'s.

The variety in ICT access and usage manifests not only in adult-student, student-student, but also student-sibling divides. The have-nots mentioned above were all amazed by their younger siblings' skills shown in *wangba*. *Xin*'s brother for instance was in Year Sixth of primary school, but he was a by far more sophisticated user than his brother. *Guoyu* revealed that his younger siblings, aged seven and eight, not only typed fast, but also knew a lot about games.

Finally, the gap in school versus home/society computers is so significant in the study that many students are willing to run all the risks associated with *wangba* in Hengshan. In the eyes of those who visit *wangba* often, school computers are mainly for females and those who abide by school rules, or "honest" students in *Yao*'s words, implying that those machines are extremely slow and limited in what they can do. Although the school provided a first year IT module, students said they rarely understood the theories about IT, and they argued that the computers they had were not up to the standard for meaningful learning of the subject.

To illustrate the point, *Ting* reported: "School computers die easily." Some machines, according to *Qing*, were connected to the Internet, but it took ages for one to even log into a QQ account. *Jie* pointed out that it was compulsory to go there in their first year, but they barely did anything meaningful with those machines, for "they spent most of their time in the IT room waiting." *Gangliu* had a similar point to make that it was even difficult to open a webpage. *Yan* is always conscious of radiation. She reasoned that the more computers they had in the IT room, the higher level of radiation they were exposed to, which deterred her from going there. Unsurprisingly, activities in the IT class were often limited to the very basic functional skills such as typing.

6.4 Conclusion

In Hengshan, *wangba* and the narratives about *wangba*, though largely created by adults, have the capability to "script" adolescents "in loose or close embrace" (for a similar analysis, see Miller, 2013, para. 20). According to a good many of informants, less economically developed towns like Shihong have less desirable conditions in *wangba*, and students of "lower quality" (*suzhi*) visit *wangba* more often. The concerns adults repeatedly express to their young clearly exhibit a technologically deterministic tone –

while they ban students' visit to *wangba*, they also consider unavoidable the side effects of use on those students with poorer will power, which in itself is an indicator of lower quality. Addicts to *wangba* are sometimes viewed as a failure of parenting style, for instance, the normal practice of parents working away from home as migrant workers and leaving behind their children poorly attended. Otherwise, *Yao*'s mother would not return to monitor his behaviour. Although schools like Hengshan regard it vital to implement *wangba* policies as strictly as possible, students sometimes believe it is the boring life and learning styles that have driven many to the unpleasant *wangba*. In that sense, the concerns surrounding technology are essentially social, familial, and educational problems, which are unlikely to be well solved through technologies alone without appropriate social and educational interventions.

Similarly, mobile phone use among students in Hengshan is believed to do more harm than good. Unsurprisingly, students are not allowed to have or use one in school, for it interrupts "proper learning" for the examination. While not many informants associate mobile phone use with a person's quality (as in the case of *wangba*), they do report that mobile phone use has *caused* shorter eyesight, *distracted* attention from lectures, *corrected* or *disturbed* sleeping patterns. Some students even believe that their school has the responsibility to enforce strict controls on mobile phone use on campus. However, others do not know how they are going to cope without one in school, for a phone not only connects, but also functions for them as a life companion, a window to the outside world, a reading device that inspires and distracts, and a relational tool that motivates and intrudes. In Hengshan, patterns of technology use are diverse, so are modes of access, which articulate generational, familial, and the less obvious yet underlying socioeconomic differences within the school.

Chapter 7

School Nanshan of Shenzhen

> 就是，你一个人不带手机，我会觉得，如果你一个人不带手机，就算她其它方面再怎么好，如果她没有手机，或者根本就不用手机，觉得，就会跟她保持一段距离，我觉得不是一个世界的人，有点异类吧，我觉得。
>
> *It is, if one does not have a mobile phone, I would think, [we are] not in the same world. If she does not have a mobile phone, or just refuses to use a mobile phone, I would keep a certain distance [from her], no matter how good she is in other respects . . . [To me, she would be] a little eccentric.*
>
> – *Yanzi*, female, 18

7.1 The meaning of a mobile phone

7.1.1 Mediating and mirroring relationships

Contacting parents via a phone is either too important or too awkward for Nanshan students. It is important when a phone is used as a "venting" machine – once a class is over, students talk over their phone with a significant other to moan or to share their joy, and they often do that while walking from class to dorm or dining hall. For instance, *Yajun*'s mother is almost always ready on the other side to listen to her. As she said, it is always she ringing her mother, rather than the other way around, for the school does not allow mobile phone use, and it is difficult for her mother to figure out when it is the best time to call. Therefore, "For the sake of my phone's safety," said the student, "it's almost always me calling my mother." To *Yajun*, her phone is thus a vital pressure releasing device, for she can always grumble to her mother over the phone when she messes up an exam, and she has access to her mother as soon as she steps out of the exam site.

However, talking to parents over the phone can be too awkward for others, and even for the same student, it can be essential to talk with one parent but not the other. *Yanhai*, for example, rarely talks to her father over her phone. She cannot even remember when she talked to him last time in high school. One reason she gave for her discomfort with her father is that she visits home only once a week and he does so once a few months, although he works in the same city. But the main reason is that they have no common ground for an affective conversation. As a result, she only responded to the questions he asked of her – no more, no less. Yet, when asked whether her father is her biological father, she burst out laughing and declared: “Of course, he is!” *Yanhai* is not the only one reporting negative feelings towards a parent or two. *Zhenyun* revealed that her parents ring her only when they think she should go home either from school or outside, and that the call is always as short as “Come home!” – her response to the way her parents communicate with her clearly bears a sense of resentment.

Nonetheless, *Yanhai* enjoys a very close relationship with her mother, as she revealed, her classmates do not even know that the person she has been talking to on the phone is her mother. To her roommates, she is talking to a very good friend, a sister, or a soul mate, although in reality she is talking to her mother. Other students who engage in intimate conversations with only one parent because they know their parents discuss everything together. *Yajun* communicates with her mother on a daily basis, but rarely with her father, because she knows that her mother tells everything about her to her father. In a sense, her family is like one organic whole, and no one is unregarded by another. As such, the ways students communicate with their family through their mobile phone somehow reflect the ways family members interact with one another. In other words, the virtual space mirrors, in one way or another, the home space.

Most Nanshan students have at least one QQ account, and they use it mainly to stay in touch or re-connect with people they know offline. As in Hengshan, some students prefer to stay online all the time, albeit invisible most of the time. While students can be very active on QQ, they are rarely active in conversing with their parents on QQ. This partly results from the fact that many parents do not have a QQ account, or even if they have one, they type very slowly. But the primary reason informants have provided is that they do not want to be seen online by their parents.

Yangcai, for instance, explained that his parents would scold him if they see him on mobile QQ; and to his parents, time spent online is time taken away from study, it is time wasted. While this type of reaction from parents is understandable, other students view their parents too conservative to see their children, in *Zhenyun*'s words, "being trendy (*bijiao chao*)." Their thoughts are so "outdated (*luohou*)," protested the student, that she often has to think twice before leaving a signature in cyberspace.

Occasionally, *Zhenyun* borrows words such as "love" and "fuck" from lyrics to express her identity. But once her mother sees them, she looks up those English words in a dictionary first, then incessant quarrels ensue. To prevent such conflicts from happening again, this rather rebellious girl begins to lock up her computer screen and that of her mobile phone to ensure that her mother would never be able to see anything anymore. *Boyi* also reported keeping parents away from her mobile phone. As she put: "I find it weird when my parents sometimes check my handset for a clue about my 'unusual' behaviour with my phone. When I notice that, I then secure my handset with a password."

In Shenzhen, it seems to be an unspoken rule that one is not supposed to browse the information stored in another's mobile phone unless the persons concerned are very close friends. This etiquette should apply to family members, but parents often take it for granted that they have the right to view their children's personal data. That explains why the intrusion often results in abiding resentment. It also implies that parents can often get closer to their teens if they stay farther away from their phones. Or it is to say, trusting parents are more likely to win their children's hearts than are those who always keep a close eye on their virtual behaviours.

In certain cases, parents even need to stay farther away from their own gadgets in order to nurture harmonious relationships among family members. According to *Yanchang*, his father believes mobile phones in his family have negative ramifications for familial relationships. The student lives in school during weekdays, when he visits home on weekends and the whole family get together for dinner, he often notices that his father is staring at his little screen for stock market information, his mother is checking her Weibo while he is chatting on QQ with his friends — every member in his family is immersed in his or her own digital world, even though they meet only once a week as a family.

But according to his mother,* *Yanchang*'s mobile phone has fragmented his way of thinking, which leaves less room for meaningful reflection. Moreover, it has transformed the communication between persons into the interaction between screen and person. In his father's view, the digital world has considerably changed the feelings family members have towards one another, as he contended:

> 比如说手机，有事就打电话，以前说要去北京念书，一走就没有联系了，这时就有很多挂念，思念，这种感觉是很强烈的。这种感情体验很强烈。现在呢，不能说没有思念。但是现在的思念跟以前非常不一样了 …… 当时我去读书，我跟我母亲半年都见不到面，半年放一次假，顶多就写信。没机会，那种思念，挂念，很强烈。
>
> Let me take mobile phone for example, today we can ring whenever we want. But in the past when I went to college in Beijing, I was out of touch with my parents for long shortly after I left them. That feeling grew stronger and stronger as I missed them more and more. Nowadays, we can't say that feeling is gone, but it is fundamentally different from the one you had when you could only meet your mother once or twice a year and what you could do was left to writing ... That sort of feeling and level of missing were so strong [that today's phone call can hardly replace].

Given the experience *Yanchang*'s father had when he was young, it is not difficult to fathom why he is opposed to the phenomenon that every member of his family occasionally interacts with a screen instead of one another. As the student revealed what his parents do for a living, it becomes even easier to comprehend why his family value human interaction so much. According to *Yanchang*, his father is developing the Chinese equivalent of Apple's iPad, and his mother's job is related to mobile phone games. He also said his parents want him to study what his father calls "social-soft-science" (*shehui ruan kexue*) which holds human interaction as central to scientific progress. In that regard, what we dislike of the virtual registers what we fear of losing, or what we treasure, in the real.

Another case to illustrate the point made above is the way *Yanhai*'s mother raises her. Unlike many overwrought parents (see Chua, 2011; Sandel, 2007, pp. 45 - 58), her mother does not care much how well she performs in school. What she values most is her daughter's health. Her way of bringing up a child is disclosed in her daughter's interaction with ICT. Instead of limiting and monitoring *Yanhai*'s engagement with ICT,

* This student asked his parents and a grandparent to join him in the interviewing.

she sometimes asks her daughter to watch TV together with her and use ICT when she visits home on weekends. As *Yanhai* revealed, her mother suffered from a disease before, now she wants her to be as healthy as possible. Therefore, she values health over everything else. As a result, *Yanhai* does not face any restriction imposed by her family upon her use of mobile phone either at home or in school, and the relationship mediated through the phones between her and her mother is like the close ones between bonding siblings.

Yet, there is no evidence that lack of parental control over adolescent interaction with ICT necessarily leads to risks such as addiction that many parents fear. Put in another way, more restrictive parental intervention tends to go with teenagers' heavier involvement with ICT that overbearing parents do not want to see. Although this does not imply that parental exercise of power has caused children's addiction to ICT or the decline in academic performance, it does demonstrate that adolescent interactions with ICT express certain aspects of parent-child relationship.

To illustrate the point further, let me take *Yanhai*'s roommate for example. According to *Yanhai*, her roommate is "addicted" to computer games. As *Yanhai* reported, she does not have a good relationship with her parents, and her brother is married already. The girl spends most of her time online playing games while others in her room are either out for shopping, or watching news online, following Weibo, or chatting with friends or family. That girl does not talk much either, but she often stays up to 2 or 3 AM, fully absorbed in gaming. "She does not know what else to do when she is free," described *Yanhai*, "as we don't know what to do when we sit [in front of computers] for two or more hours."

7.1.2 Blogging into being, protecting wellbeing

Not just familial relations are revealed in cyberspace, so are school ones. In Nanshan, one clear evidence of differentiation in use from that in Hengshan is that more students participate in content creation and follow others on Weibo. These activities, to some, are meaningful because they record not just wonderful moments of their time in high school, but also their ways of growing up. The virtual space helps capture those memories in a way that students can go back and retrieve their personal as well as interpersonal history whenever and wherever they please. The virtual space thus provides a way to the past by giving life to those evocative bits that once made students laugh and cry.

In cyberspace, those who recorded the past in either words or photos can even decide with whom to share what moments of rapture for how long. A blog entry is like a diary, remarked *Yajun*, it does not just capture specific moments, it also channels personal feelings to them:

> 然后我印象深的那次就是高二分班的时候，因为我们高一那个班是感情非常好，很好的同学很好的老师都在一块。上了那么多年学最好的一个班，每个同学都很好，而且很有个性。都认识是上了那么多年学最好的班。高一的班是最喜欢的班级。分开很不舍，然后就把不舍之情记录下来。还会记录当时一些搞笑的事情，感人的事情。比如高一篮球赛，我们一直赢，后来输了，特别感人。虽然输了球，但是我们班还是团结在一起。就有些片段特别感人，现在回忆会觉得当时有那么多感人的事情。那么多搞笑的事情。然后就会看到，原来是那么搞笑。而且用文字记录下来，就是回忆那段时刻嘛。还有就是朋友同学可以在上面留言。
>
> In the first year, I had the best classmates and the best teachers, actually the best in my entire life as a student. Everybody was nice and with character. It's a class I like most. I remember I set down those moments when some of us found it too difficult to leave the class because of the Arts vs. Science division in our second year. I entered those moments of us bursting into laughter, and some touching events. For instance, we once won a basketball match, but eventually we lost. However, the defeat united us even more tightly. When I reminisce about the bits captured in the blog, I suddenly realise our past was so rich with that many moving and amusing episodes. When the details exist in the form of texts, my friends and classmates can even leave their comments.

However, not all virtual spaces are meaningful to all. Weibo, for example, discloses the desires people have today to want more and want everything fast. To *Yajun*, Weibo is rather shallow most of the time because every entry is limited to 140 words and it is not conductive to the fostering of deep reflection – what it represents is mostly gossiping. Messages conveyed on Weibo are not meant to engage people with deliberation; instead, they are impulse-driven and meant to overwhelm subscribers with the bombardment of information. Consequently, *Yajun* uses blog much more than Weibo, although she admits that Weibo has justified its prevalence through its function to follow whatever she has an interest in and its capability to spread news fast. For instance, she first learned about the death of Kim Jong-il on Weibo. However, those entries have no long-lasting effects on her – they disappear from her mind or attention span in an equally fast way they reached her.

Yajun's opinion on blogs and Weibo finds resonance in others' voices. *Yanhai* also registers her chapters of life in her blog. She used to write online every day. When access to the Internet was limited, she "wrote" on her mobile phone and she could type reasonably fast. She even praised her phone's capability to automatically organise words and provide options for her to choose from. Her mobile screen was small, yet she could update her feelings to her "enormously large" blog space on NetEase, where she kept those entries, or more accurately, her inner self, open for a limited period of time before she locked them up with a password. As for Weibo, *Yanhai* also appreciates its ability to inform the public with news, even world news. However, on Weibo, she mainly follows others — she sees no point of repeating what she has said in her blog.

As students leave more about themselves online, they become increasingly concerned about the information they have willingly provided. To *Yajun*, the diaries she wrote online years ago are like the finest wine she brewed — the longer she keeps them, the more value they accrue. As time goes by, said the girl, she feels better every time she opens them — they become more salient to her. As the value of what she wrote increases, she becomes less willing to share it with others — she wants to keep it for her own, and sometimes she feels it is herself in cyberspace.

The reason *Yajun* keeps others out of her cyberspace is that she does not want them to know too much about her. If too much of her past thoughts become open and transparent online, she feels like "running naked (*luoben*) " online. So she prefers to hide it away, partly because she thinks her thoughts formed years ago are too naïve. But primarily, it is because of her unease with every details of her inner history becoming available to anybody. In her view, once others know all your thoughts, they know how to control you. So it is better to keep it safe with a password.

But password-protected content online is not 100% safe. For instance, *Yanhai* harbours a concern that all her diaries written over the years may vanish if NetEase collapses. She is rightly aware that online companies can go bankrupt easily. Even if the company is healthy enough, pointed out *Yanhai*, people out there can still break into her personal space, for she knows some around her – her brother being one of them – can successfully decode passwords to QQ accounts. "It all depends on technology," she remarked, "even if you can't do it yourself, you can always hire someone who can." *Yanhai*'s point is not groundless. As she made the comments, news reports were warning users of QQ, particularly parents with children studying overseas, against false requests in texts from "their children" in need of financial help.

Unsurprisingly, *Yanhai* employs multiple levels of security measures to safeguard her privacy and ultimately her wellbeing. For example, almost all functions of her mobile phone require a password. When asked if she would mind others borrowing and browsing her handset, she uttered a few words with some delightful confidence: "I don't mind." Her openness, however, does not stem from her confidence in others' etiquette or the fact that she has nothing private inside her phone – she has locked up whatever she can! As she continued: "You can borrow my phone to make a call, but you can't see my message or directory, for they are all kept private by a password."

7.1.3 Texting romance

Text messages entail sensitive messages, which are personal to the students. As Turkle (2011) contended, online data are likely to be always there and the persistence of digital texts can sometimes provide written proofs of one's misdoing, despite the words may represent only "spur-of-the-moment" feelings (p. 258). In other words, digital footprints can have far-reaching consequences. In Tapscott (2009b)'s view, those impulsive bits may come back to "bite" those in question even years, if not decades, later (p. 7). Although the students studied are largely unaware of such a risk, they fear the leakage of text messages to less remote others in terms of time and space – teens really care how peers view them on- and offline.

Students feel so strongly towards text messages also because they often stand for intimate relationships – they are words they prefer to keep for themselves. *Pin* for instance keeps those text messages he sent to and received from his ex-girlfriend for a long time. He revealed that whenever he reviews the archive of texts, he thinks of their time together; and when he comes across her name stored in his handset, he misses her. Since that was his first time in love with a girl, he recollected that relationship with a strong sense of loss.

However, they are still studying in the same school and of the same grade, meaning they often bump into each other on campus. Those moments to *Pin* are extremely embarrassing. In appearance, they pretend to know almost nothing about each other, as he said: "It's like she is passer-by X, and I am passer-by Y. We have no eye contact, like total strangers, even though we promised each other we would continue to be friends when the relationship ended." But, to *Pin*, she is not a stranger, and those text messages she sent him can attest that. Her texts still keep her alive in his heart. He is trying to forget her, but he can hardly get rid of her text messages' effect on him. In that case, cyberspace is no longer a virtual space – it underlies a real life that people are not willing to accept in the real space, and the virtual becomes more real.

Other students keep their text messages private because they are associated with sweet memories. *Yanzi*, for instance, got to know her boyfriend more and better via texting. They met in Nanshan, but at the beginning, they knew very little about each other and it was rather inconvenient to talk with each other in person. But the phone helped her strengthen the bond with her boyfriend in real life by forging a link in the virtual, and it enabled her to say something rather disconcerting to express face to face, and occasionally, they stayed attuned to each other till very late (or early in the morning).

Text messages can be more than sweet; they sometimes help turn a public relationship private. *Jingwen* is sensitive to how her classmates view her. She feels she is always under a spotlight. Even when we met up for the interview, she asked me to enter a quiet classroom first — she must avoid the unnecessary "scandal" of being with a male stranger.

In her class, as she described, there is one publicly recognised handsome guy. Although she said she views him as a buddy, a close friend, and she mingles with him quite often, her classmates all treat them "as if something has happened." She also happens to sit in front of him. Because of the tittle-tattle, she decided to keep a distance from him, in public of course, like the way she avoided entering the classroom together with me. However, she feels the boy is innocent and it is unfair to cease talking to him. Fortunately, she could send him text messages, and for quite a while, they refrained from conversing with each other except by texting.

However, their virtual communication has an effect on their real untoward interaction — she turns her head to catch a glimpse of him so often that the male's deskmate one day decided to count how many times she turned her head in a class. It was reported to her that she did over 20 times, which certainly, in her opinion, upset the handsome boy's deskmate because she had ignored him – she should have interacted with him too.

7.1.4 "Not in the same world"

While mobile phone as a relational tool is widely appreciated, students harbour diverse attitudes towards those who either leave their phone at home or have no access to a personal one. To some, those who can refrain from using a phone on campus are admirable. *Zhenyun* praised them as having a strong will power. *Yanchang* viewed them as having perseverance as well as the capability to derive pleasure from learning, but he did not think he was among them. Holding a similar view, *Tongzi* put: "Those who have a phone but decide not to use it are totally detached from the device. Students of this kind are worth commending, but I can't do that." However, in *Xiumeng*'s view, students determine to leave their phone at home not because they have a strong will power. Rather, it is because they know their will power is so weak that they would surely be affected had they decided otherwise – so it is better to leave their phone at home.

Not all views towards those without a phone are positive and the have-nots in Nanshan are sometimes excluded from "the flow of social events" (Ling, 2012, p. 169) or unable to fully participate in social lives. For instance, *Yanhai* once chose not to use her mobile phone on campus, and her roommates called her "Miss Extinction" (*Miejue Shitai*), implying she is rare to find these days. *Yanzi* is probably one of *Yanhai*'s roommates. Her attitude towards have-nots was presented in page 146. *Haofang* shared a similar poignant view, he considered weird those with a phone that could only answer calls.

Pin, however, associated have-nots with socioeconomic disadvantage. He grew up in Chongqing, a Southwestern metropolis, and transferred to Nanshan a few years ago. In his view, Shenzhen residents should be relatively richer than those in Chongqing. When he sees someone in his school without a phone, he is first surprised and then wonders why.

To unravel why students hold diverse views towards have-nots, it is necessary to decipher the meanings students pour to their devices. Mobile phone is meaningful to many not just because of the convenience it provides and the relationships it mediates, it also equips them with a safety net and "facilitates the smooth functioning of everyday life" (Ling, 2012, p. 3). For instance, Bella's parents know where she is when she is out, and she can dial for help when something happens. To others such as Eason, a phone is vital in building and maintaining healthy ties with others. "It's an essential tool. I'd feel disowned [by friends] if we are out of touch for long," reasoned Eason. Sin echoed the same point by drawing the analogy that a phone is like a means of transportation, without it, we would be like "a deserted island in a remote ocean."

Understandably, most Nanshan students have a phone in school "just in case they need it," even that is against the school's policy. In that regard, mobile phone becomes what Richard Ling called a "necessary evil" (2012, p. 2), and students are sometimes obliged to be available to their significant others, just as *Nali* articulated:

> 朋友吧，就联系，多数会通过手机联系，特别是一些你不在同一所学校。哪怕是你同一所学校不是同一个班的，哪怕是你同一个班的也许你不在同一个宿舍，哪怕你在同一个宿舍也许你不在同一个地方，都会用手机联系。然后家人也有，比如说跟家人产生误会了，你需要道歉，然后有通过这样的渠道。或者关心家人，特别是在家，我妈有时会埋怨说一个星期也没见到你发几个短信给我。没怎么给她发，她就会怪我这个，有时就起到了联系感情的作用。
>
> Most likely, we need a phone to contact friends, particularly those who are not in the same school. Even in the same school, we may not study in the same class; even in the same class, we may not live in the same dormitory; even in the same dormitory, we may not be together with one another. We need a phone in all such circumstances. Furthermore, a phone can help us stay closer with our parents. For instance, it helps to clear misunderstandings with family, and to show how much we care for them – my mother sometimes gets upset when I send few text messages to her during weekdays.

Mobile phones have thus become an integrated part of adolescent daily life, albeit somehow unconsciously. "I'd find it extremely difficult to get used to life if my phone were taken away from me," said *Pin*. To some students, it takes a period of time without a phone to realise the importance of a phone. *Jingwen* used to have a handset, but after her phone slipped into a toilet, she found her life inconvenient wherever she went and herself feel "awkward (*bieniu*), bored (*wuliao*), and depleted (*Kongxu*)." Bearing these points in mind, one can better disentangle why the haves hold those attitudes towards the have-nots.

7.1.5 Regulating access and use

Students may decide not to use a phone in school, contended *Xiumeng*, nobody leaves a phone at home because it is the school's policy. In fact, many students have nurtured strong feelings against such a policy. For instance, *Yanzi* argued that banning mobile phone use on campus is pointless:

> 我觉得很没用啊，我觉得。你写在那里不带，结果我们大家都带，而且老师他们都睁一只眼闭一只眼，而且老师他们都知道我们都带，他们最后还不说。那等于这条校规写在那里是没有任何一点意义的，更本就没有用。而且现在社会，就算是，任何一个学校，只要不是太贫困的地方，像这种发达城市的话，那肯定得用手机，你不用手机你怎么能当现代都市人呢？学校有这个校规，我就觉得很离谱的，而且我觉得社会越来越发展，这条规定迟早要被废掉，我是这么觉得的。
>
> Although the policy is there, we all bring our phone to the school, and teachers keep one eye open and the other shut, they all know that we have our phone with us, yet they do not object. It is to say that the rule is meaningless, absolutely useless, given that mobile phones are indispensable to a modern society, [and to] any school, as long as it is not extremely poor. In a city like ours, how can you become a modern citizen without a mobile phone? I can't understand why such a policy exists in our school, and in my view, this regulation should be abolished sooner than later, as our society progresses further and further.

This opinion is widely shared among students in Nanshan. *Tongzi*, for example, contended that the policy is "inhumane (*bu renxing*)," for there are two groups of students, one having a genuine need to use a phone, and the other using it simply for entertainment. Therefore, the school's wholesale policy has both pros and cons. This student abided by the rule in his first year, but it proved impossible for him to obey it throughout, for it was extremely inconvenient without a phone.

However, the problem is not simply a matter of convenience. To Sin, such a rule is no different from the state's regulation over sex industry — the government claims to have zero tolerance towards the industry, yet it is rampant throughout the country. Other students, such as Eason, *Pin*, and *Yangcai*, view the policy as outdated, but they support the school's good intention, because it is for their own interests. The bottom line for the students is thus: It is okay to bring a phone to school, as long as one abstains from using it in class. Still others, such as *Fuli*, ratify the policy on the following basis:

> 绝大部分学校都不会允许学生带手机。我没看法，我觉得这条规则是可有可无，也不管允不允许，大家都会带，会带的人会带，然后不会带的人也不会带。这不会有什么改变。不过有这条规则大家不会那么嚣张，会躲避一下，这样，但是不管怎样还是会带。
>
> Most schools in China today would not allow mobile phone use on campus. I am not against that. In my view, students would do the same no matter such a policy exists or not – those who bring a handset to school will continue to have one with them, and those who choose not to use a phone will not use it. Nothing will change. But under such a policy, students will at least hold back, although they will bring one to school anyway.

Others who endorse the policy such as Bella,* *Boyi*, and *Pin* asserted that not all students are equally capable of disciplining themselves. Given that some students' academic performance will surely fall if the school allows everybody to openly use mobile phone, it is better to ban mobile phone use while tacitly leaving space for those who need to use mobile phone for various reasons, particularly when students such as Bella and *Xiumeng* perceive the outside world in Shenzhen as being "unsafe."

Xiumeng's words illustrate well the above point above about mobile phone as a safety device. She has developed a habit of reporting her wellbeing and whereabout to her parents wherever she goes. She feels insecure without a mobile phone, as she reasoned: "It is up to you to decide whether or not to use a phone when you have one with you, but if you don't have one, you no longer have that option."

As a result, many teachers do not intervene if they see nobody use their phone in class, for having a phone is not just for students' own convenience, it also bears a responsibility to significant others. In Ling (2012)'s view, it is expected that students are available to others and others to them in their closest social sphere (p. 162), and the weight of expectation is even greater in romantic relationships where non-response to text messages or phone calls often hints a suspicious change of mind to a boy- or girl-friend (p. 174).

* When an informant chose an English name as a pseudonym in the study, I do not italicise it in the thesis.

Other students analyse the school policy by maintaining that many students and parents prefer to have a strict school. According to Sin, the school would never say students can openly use their phone; otherwise, parents would point their fingers to the school should their children fail in their studies. Therefore, it is reasonable to conclude that in Shenzhen and Hunan, "good" schools are supposed to be strict. Recall that in Hengshan, one student actually praised the restrictive mobile phone and *wangba* policies, for his previous school was very relaxed on students' ICT use and it was one reason he transferred to Hengshan. In Nanshan, an informant echoed the same attitude:

> 我们班很猖狂，在班上都打。有时上课有电话他们都接，不过这样的情况不会太多，下课接电话多点。上课一般都挂了，或偷偷接 ...... 我不知道其它班，其它班应该蛮严得。但是我们班的老师，我们在后面充电他看到也不会说。我以前的班没收期末才还，别的班很严。他很松的，其实我们都想换老师的。我觉得严格点好，只要不管手机什么都好。
>
> In our class, [mobile phone use] is very rampant. Students sometimes answer their phone in class, although that is rare, more people use their phone after class. During a lecture, they usually hang up, or talk secretly. I don't know what it is like in other classes; I presume they are very strict. Our teachers would not say anything even when they see students charging their handsets in the classroom. My previous head teacher would not return a phone until a term ended. Other classes are very restrictive. He [her current head teacher] is very relaxed. To be honest, we want to have a different one. I think it is better if it is more restrictive so long as we are free to use our phone.

From an ordinary class, this student revealed at the end of her interview that she actually skipped her class in order to be interviewed. When I apologised for that, she said that was the ideal time for her and reminded me that her break time was too precious to be wasted for the meeting. We actually met twice, the first was on a morning and when the school bell rang for lunch break, she asked to be interviewed later that day. During the conversation, she was interrupted a few times by text messages. She realised that her mobile phone had negatively affected her, and her scores dropped. She also revealed that her parents did not allow her to have a mobile phone, and the one she had was given as a birthday present. Although she had been using the phone for over a year, she said she never rang home from that phone, for her parents did not know that she had gotten a mobile phone.

While accepting her phone's negative impact, the student also argued that being classified as an ordinary class student had had an equally negative consequence for her. She does not think she is less academically capable, for she once scored very high in subjects like history. Her self-esteem is further crippled when she visits home, where her parents and neighbours all wax lyrical about how clever her neighbours' children are. Partly because of that, she has no liking for her mother. She protested also because her mother is rarely nice to her, particularly when it comes to the issue of her engagement with ICT. She said whenever she touches her home computer, virus creeps in, her mother then keeps her away from it. Whenever her secret phone rings at home, she feels the noise her vibrating handset makes is so loud that she has to firmly cover it with two hands — she so feared that her mother would one day discover her mobile phone.

It thus appears that ICT usage has exacerbated the above girl's relationship with her mother and *caused* the decline of her score in school. However, the root problem is perhaps not her phone, as the girl herself stressed: "It's not the phone that has affected me so much; it's everyday happenings that have nurtured the strong feelings of hurt." That said, life events and real life relationships leave their footprints in the student's digital life, which in turn exacerbates the problems she has in the real.

However, parents normally believe ICT are the ones to blame if anything goes wrong with their children. For instance, they often view ICT as harmful to their young's eyesight and/or body because of radiation, as *Tongzi* remarked: "My parents would not admit my short eyesight is the result of my intensive reading of books, they always point to my interactions with computers and mobile phones." Parents holding such a view are not uncommon. *Boyi*'s father is a university lecturer. According to her, he also believes mobile radiation poses a real risk to her body.

7.2 *Wangba*: between experience and discourse

Unlike students in Hengshan, most Nanshan informants did not have much to say about *wangba*, for they either rarely or never visited one while in high school. While most informants in Hengshan reported their lived experience of *wangba* in high school, Nanshan students largely recollected their middle school time spent in *wangba*, and a few described their high school acquaintance with *wangba* when they visited their hometown outside Shenzhen where shared access to ICT was common.

However, a small number of students did frequent *wangba* in Shenzhen. Sin, for instance, visits *wangba* while in high school, although he is not spending as much time there as he did in middle school. When asked what he usually does in *wangba*, he named computer games, and regarded addiction to games as an unavoidable stage of growing up. He also disclosed that his parents vehemently oppose his time spent in *wangba* and he often goes to see those further away from home. Sin completed his middle school in Henan province in the North where he said *wangba* were common place for pastime.

As Sin enjoys playing games online, he has a high demand for speed, which has shaped his preference for *wangba*. He noted that his home access was unbearably slow, and his parents never considered upgrading the service. Whereas in *wangba*, he can find the delight associated with speed and the joy derived from co-playing, which *Yangcai* spelt out vividly: "I like that atmosphere where we can play together and shout to each other. We go there for games, but not just for playing, it's mainly because I have those friends, although most *wangba* are unappealing."

Among the students interviewed in Shenzhen, Sin also had the most to say about *wangba*. Although he admitted that most *wangba* are distasteful, he emphasised that one can find comfortable ones in Shenzhen: "It depends on which type of *wangba* you visit, some bigger ones have visitors with higher quality, they would not smoke there; but if you go to those smaller ones, there is nothing you can do about it, for people there have lower quality."

Although Sin associated visitors of smaller *wangba* with lower quality, he challenged the view that students visiting *wangba* are of low quality. He treated such a judgement as an outright prejudice. "Following this logic," continued he, "no student could be counted as a 'good' student. To be honest, in my former class, nobody would believe that one had never visited *wangba*, the best students all went there." However, the class Sin described was the situation in Henan, not his class in Nanshan. According to Sin, Henan is not very different from Hunan, where rural population is large, shared access is common, adults often encode *wangba* with pejorative meanings, and students haunting *wangba* are in general viewed as "bad."

Although *wangba* are rather irrelevant to many in Nanshan, students such as *Fuli* still feel as if they were doing something wrong when they do have some time to spend in *wangba*. Such a stance students internalised in their formative years largely represents "adult fears and values" (Herring, 2008, p. 75), but it still has an effect on their behaviours in high school. *Pin* harbours similar feelings towards *wangba*. He does not patronise *wangba* in Shenzhen, but he went there regularly when he was a student in Chongqing, where he said there were by far more *wangba* and he could see flocks of children to his waist's height playing games in front of computers. Understandably, his parents barred him from *wangba*, and he sometimes went there without his parents knowing it.

Females in Nanshan had even less to say about *wangba*, and their viewpoints of it were predominantly dismissive, as if they were repeating media reports. For instance, Bella never visited *wangba*. Actually, she fervently opposes it because many children are allowed to be there. She then quoted official discourse discussed in page 26 to explain why her impression of *wangba* was never positive, and why her parents purchased a computer for her years ago. In middle school, all her classmates knew that she detested *wangba*, and when they went out together, she was rarely invited.

The adult discourse has also shaped others' perception of *wangba*. To *Yajun*, *wangba* is a double-edged sword. It has cons and pros. On the one hand, she regards it necessary for those who unfortunately have no home access to computers and views *wangba* as a way to relax and to increase the overall quality of Chinese people. On the other hand, *wangba*, if not managed properly, would affect, in her opinion, the proper development of young people, for they are too young to distinguish right from wrong. Therefore, *wangba* must be governed so that those knowing how to use it can capitalise on its advantages and those who are likely to abuse it stay away from it. Moreover, it is necessary to crack down on "black *wangba*." "This is the mainstream view of the media," added *Yajun*, "mine does not differ from the mainstream that much."

Nanshan students' aversion to *wangba* can be so intuitive that they call it common sense. *Xiumeng*'s first response is that students visiting *wangba* are "no good" and the conditions there are grimy. With a computer at home, she does not see any point of going there. *Wangba* to her are simply places for computer games, which girls like her do not play. Without any time ever spent in *wangba*, she said her impression of it was never positive for a single moment. When asked why she held such a viewpoint, she drew the analogy of *wangba* as cockroaches, which was quoted in page 1. Nevertheless, the student did realise that some students might not have a computer at home. In that respect, *wangba* function as an important equaliser, which is the topic of the section that follows.

7.3 Reflecting, ameliorating, or creating gaps

Wangba clearly satisfies the informational, relational, and recreational needs of those who are digitally disadvantaged, but its role as a great equaliser is open to debate. Let's see how it relates to social inequality in Shenzhen, which is stark according to *Pin*'s observation:

> 我在这边也呆了一年多了。这个城市比重庆来说现实得多，明明白白的贫富差距，有些东西很残酷的 ...... 中心书城吧，来来往往的人那么多，至少能够像我们坐在这里很悠然地喝东西的人，但是在不远的地方还有人在那里要钱。这个别说，光在我们学校，就存在攀比心理强的人。哪怕在我们班上，虽然在我们学校都穿校服，你看学生背什么样的书包，平时吃饭吃什么，还有用什么笔，有些同学可以扔掉，有些同学如果笔坏了，他会纠结很久的。【深圳】至少在我看来是比较现实的。重庆可能是我读初中，大家都不会想这些东西，都想怎么开心。
>
> I have been here for over a year. This city is much more realistic than Chongqing in that inequality here is so striking that certain aspects of daily life are harsh. ... There are so many people here in the Central Book City. People like us can sit down and have a coffee, but a few meters away from us stand those begging around. Let's leave this aside and take the students in our school for example, there exists among us a mentality to catch up with others in material wealth. Even in our class, although we all wear the school uniform, you can see the differences in the bags your classmates carry, the meals they take in school dining hall, and the pens they use — some students can throw it away without hesitation when it is slightly broken; but it would take others a long time to make such a decision. [Shenzhen,] at least in my view, is more pragmatic. In Chongqing, I didn't think much and only contemplated how I could be happy, probably because I was a middle school student then.

Reflected in cyberspace, Nanshan students exhibit considerable variances in what Andy Furlong called "digital capital" (personal communication, May 9$^{\text{th}}$, 2012). For instance, *Qingpeng* is a student of the school's international class, where students prepare for overseas exams and aim for higher education outside China. This class has its own teachers and follows its own curricula. As for ICT policy, students of the class are free to bring with them their mobile phones, laptops, and so on. As *Qingpeng* commented, all his classmates have gadgets like iTouch, iPhone, etc. Unlike the ordinary track for the *Gaokao*, the international track also has their own classrooms where students can conveniently charge their ICT, notwithstanding that they are based on the same campus and share the same library and dining hall.

The contrast manifests not just in the level and nature of access to ICT, but also in how students use them. For instance, *Qingpeng* visits Wikipedia often, and follows Open Yale Courses online. He also searches information online regarding universities and colleges in the US and UK. For example, he knows the endowment sizes of many American liberal arts colleges and those of some British universities. He compares the information before making decisions on where to apply. Being a high school student, he already knows certain rules about doing a PhD and making grant applications in America and England, for his cousin is pursuing a doctorate at Columbia University. Apparently, the social and digital resources *Qingpeng* enjoys have placed him in a competitive edge for better life chances, and his classmates in the international track are more likely to follow very different life trajectories from those of the students in the ordinary track.

In Nanshan, one needs not to compare the ordinary and international tracks to spot the sharp contrast. For example, *Yanchang* is following the ordinary track and preparing for the *Gaokao*. But during his winter and summer vacations, he attended training courses in Shenzhen and prepared for the SAT in America, for it is his parents' plan to have him educated in America for a degree. In 2008, he joined a summer school in London. In Shenzhen and other cities of China, there are many students like *Yanchang* and *Qingpeng* today, they either entirely follow foreign curricula and ways of learning, or combine the best of both Chinese and Western systems. Meanwhile, their counterparts in schools like Hengshan and Basum or even the same school of Nanshan are facing very different life chances, and such divergence often translates into the ways students appropriate and engage with ICT in and outside school. In other words, technology access and use are expressive of adolescent socioeconomic profiles and the ways they are taught and supposed to learn.

Since most Nanshan students own a home computer, they have the most to say about it. To some, a home computer is more important than a mobile phone, despite they do not use it much for the *Gaokao*. To Sin, a computer connected to the Internet opens a whole new world for him. “Without access to the Internet for a month,” said he, “you would know nothing about the world.” Sin relies heavily upon the Internet for information about events of the world and the country. He praised the roles the Internet has to play in government transparency and his own understanding of political corruption:

> 贪污这种事情在我看来相当正常了，政府的“清官”不是不贪的官，而是为人民办事的官，而不是不贪的管。就是啊，网上看到句很经典的话：“贪，无所谓，你一定要为人民做事！”清官，书面对清官的定义是不贪污的官叫清官，现在是真正为人民做事的官才叫清官，不是不贪的官。
>
> Corruption to me is all too normal. “Upright officials” are not those who were never corrupt, but those who have accomplished a lot for the people. One classic comment I would like to borrow from the Internet is: “Corruption, who cares! But you must do something for the people.” Upstanding officers, meaning executives who are not unprincipled, now refer to those who are genuinely concerned about what they can *do for* the people, not to those who only concern themselves with what they can *get from* the people.

While many students in Hengshan and Basum are still learning how to type, Sin is utilising the Internet to expand and challenge his understandings of the world. This is what Norris (2001) called a “democratic divide” — users of ICT are divided in how and how much they seek political knowledge in cyberspace. However, Sin was the only informant in the study expressing so much of his concerns about the society in China. He is also critical to a number of issues surrounding the study, for example, parental views and public discourses of *wangba* and computer games. Yet, critical views like his are not short of subscribers, among whom is *Yajun*, a top student in her class.

> 我一些同学很有才华，写的东西写得很好。虽然他们成绩不是那么好，但是很有才华，其实分数不能体现一个人的全部，只能体现应试水平而已，有些人很有才华，不能体现出来。拿个例子啊，哎呀，你是外国的嘛，所以我就可以跟你讲一下。我有个同学很反共 ...... 而且他也是个很有才的人，跟他反共没有关系，他是一个很理性思维的人。他会在网上写一些评判社会的东西，因为他个人很崇拜韩寒，他的风格也很像韩寒，他的文章很理性，批判社会 ...... 其实我会去看一些有才的同学的文章。去学习一下，有时也装模作样去写一下，没有，我觉得自己是一个没有才的人，就是死读书的那种，跟他们比起来还差很多。

> I have a very talented classmate. What he writes is very engaging, although his exam grades are not high. Scores, in my view, cannot represent a whole person. They can only indicate how well one performs in an exam. For example, aha, you are not in China, I can tell you this. He is very anti-communist rule . . . He is also a gifted person, but it has nothing to do with his views on communism. He is rational and logical, and his style is like that of Hanhan,* critical yet sensible . . . I often read those brilliant blog entries in a hope to learn something from them. Occasionally, I even mimic them, but I don't think I have the aptitude. I only know how to learn for the exam. I am way behind them in that respect.

Yajun is now reading a degree in a key university of China, but the two most talented classmates in her mind went to a Tier B university, which is lower in the hierarchy than key and Tier A universities. In her view, naturally gifted students in China do not necessarily attend the best universities, for "they do not devote all of their time to their studies, instead, they are doing something that is more important. Compared with them, I have nothing unique. I don't have much independent thinking. I am truly an ordinary person."

Digital inequality is not simply mirrored in critical thinking, it also exists in students' knowledge about computing. As introduced in page 149, *Yanchang* has both parents working in IT industry, and he is fascinated by the ways computers work. To his father, *Yanchang*'s passion for technology is a desirable attribute. But his parents have set up strict rules regarding computer use at home. First, his father has no objection to his interaction with computers, but he must know when to stop. What annoys his father most is the fact that once he switches on his computer, he needs plenty of persuasion to switch it off. Second, while his parents expect him to have diverse interests, he seems to forget his homework all the time. But to his parents, schoolwork should always come first. Although his parents reveal that he has changed a lot since middle school, there is still room for improvement in terms of self-discipline. That is why his father insists that he would not do anything good when he turns on his computer. But to *Yanchang*, it is also why he has lagged far behind his classmate, who he thinks knows how to program and has won a prize while his knowledge stagnates on computer itself as a machine. *Yanchang* even doubts his interest still lies in computing – it was half a term ago that he last touched his computer.

* A youth blogger born in the 1980s, widely known in China for his style of social critique.

7.4 Consequences for learning

Since students spend most of their weekdays in school, Internet-enabled mobile phones are of significant help when they encounter difficult questions. For example, *Yangcai* often searches for clues on Baidu when he has problem sets for certain subjects. To him, Baidu is also a dictionary and translator, for his electronic dictionary can only do one word at a time, but Baidu can handle a sentence. When the results Baidu returns conflict with one another, he works on them until he is sure which one is correct.

While the Internet provides students with food for thought, computers also distract them. *Senyu* said time spent with his home computer is often time taken away from homework, for he always has a desire to chat online. *Qingpeng* is very popular among his classmates. Once his iTouch was confiscated, the entire class wrote a petition for him. But this popularity comes with a cost. He finds himself constantly interrupted by pornographic materials sent online from his classmates. "I can't just ignore them because I know it takes them long to find," he giggled, "that was why I transferred from my previous school to Nanshan." Bella loves watching films online, but when she realises it is time for homework, there is often no time left for homework. *Yangcai* writes his assignment at home on his computer desk. Whenever he raises his head, he can see what is shown on his computer screen. When he can concentrate on his work, the computer has no effect on him; but when he cannot, its effect on him is big — he would play music and surf the Internet, particularly when the assignments are difficult. While he enjoys the music played from his home computer, he suffers from inside, for those difficult assignments can be an endless pain.

Nevertheless, *Yangcai* feels he is better than his deskmate in school in terms of self-discipline. His classmate often plays on his mobile phone a game called "stealing crops" (*tou cai*) in class. When *Yangcai* shows his concern over his friend's schoolwork, the reply he receives often is as calm as: "The more you steal, the healthier you become" (*tou yi tou, geng jian kang*). *Yangcai* then asserted that mobile phone has negatively affected many like his deskmate in school. *Pin* would certainly agree with *Yangcai* on the point if he were interviewed at the same time, for he always works on his homework with his mobile phone in sight. He checks as he writes, even when nobody texts him, he often thinks a text message is coming. But when he really wants to concentrate, he usually puts his phone away.

Other students in Nanshan do not see any value of using the Internet for their studies. *Ruijie* does search online from time to time, but what he finds is irrelevant to his schoolwork. According to *Fuli*, a top student in his class, "The Internet has nothing to do with Chinese education [in high school]." What he finds online is normally what interests him, but not necessarily about his studies. *Nali* also asserted that none of her classmates in the school uses a phone to search and learn.

When mobile phone is associated with learning, students either use it to search or as a dictionary. For instance, *Yanchang*'s mother revealed that he brought his phone to school mainly because of the English language exam required for admission in North America – TOEFL, for which he had been preparing. He uploaded TOEFL vocabulary to his handset so that he could study/memorise those words while in school. However, he prefers to use a traditional dictionary, where he can find much more detailed explanations of the words he needs to know, as he put: "Electronic dictionaries are too simple." For those who search, not all take a critical view towards what they find. *Pingyan*, for example, often searches for answers from Baidu, but she rarely questions what she finds, as some students in Hengshan do.

7.5 Home and school computers

In Nanshan, most interviewees reported home access to at least one computer either specifically bought for them or shared among family members. However, having computers at home does not mean that they are equally interested in the technology. *Nali* and *Yanchang* divulged that their home computers no longer appeal to them. *Yanhai* shares a computer with her brother, who uses it a lot. To *Yanhai*, the only benefit of having a home computer is the possibility of watching her favourite TV series online rather than on TV, which plays too many commercial adverts. *Yangcai* reported a similar problem by arguing that the more channels they have today, the more adverts they watch. While most students with a home computer engage in similar activities online, *Boyi* often uses the Internet for her subject knowledge, which is not taught in her school. With an interest in fine art, she attends a private institution during winter and summer vacations, and the Internet has provided her with a great deal of valuable information.

Regarding school computers, students in Hengshan and Nanshan reported similar experiences. "The functions you want to use on those computers can also run on your mobile phone. It is not necessary to go there," said Eason. Sin cannot tolerate the speed of their library computers either, so he rarely goes there. *Yanchang* builds his own computer at home for speed, and echoes the same point. School computers thus have no benefits to those students.

However, junior secondary students in Nanshan are happy with whatever they have. According to *Yangcai*, they flock into the library as soon as the school bell rings for break. That is why *Senyu* always finds those 50 or so machines occupied every time he visits the library. Apart from speed, school computers in Nanshan do not appeal to senior secondary students also because of their incompatibility. "Although they are connected to the Internet, you can't use those USB ports. You can only read and watch, it is not possible to download anything from the Internet," described *Haofang*.

To other Nanshan students, it is adult control that has stopped them from going. According to *Nali*, many websites are blocked by the School. She recalled her awkward experience in the library: "Once I wanted to watch an animation on a website, but the site was blocked. What embarrassed me was the response from the administrator, who stood behind me and announced with a loud yet deliberately ambiguous (*aimei*) voice that the website I visited was *inappropriate*."

7.6 Conclusion

Mobile phone use amongst students in Nanshan is more expressive of familial relationships than it is in Hengshan. When the relationship between parents and children is close (enough), mobile phones function as soothing instruments for stressed high school students like *Yajun*. However, when the close bond is not bonding (well), they work as intruding or escaping devices. In Nanshan, the content created in cyberspace via a phone can be treated as a part of one's inner self, which is so precious that students are deeply concerned about its loss. As writing online about one's experiences offline has psychosocial benefits (see also Pennebaker, 1997), issues surrounding privacy and safety in virtual space are also looming large among adolescents, who are not just anxious about the potential wipeout of data due to factors beyond their own control, but also sensitive to the disclosure of private text messages to people they actually know. Since mobile phones often play vital roles in romantic relationships, not having a phone can sometimes be viewed as not having a normal life in high school and as a teenager. As in Hengshan, mobile phone (non)use registers familial and social relationships, which adults often take the other way around – they usually believe it is the technology that has done harm to the students under concern.

Wangba in Nanshan are less related to students' daily lives than they are in Hengshan. As most Shenzhen students have home access to computers, their views of *wangba* largely represent those of media reports, namely, narratives that mainly reflect adult views and values. When a few students do have something to report about their lived experiences with *wangba* while in high school, their attitudes do not diverge much from those of students in Hengshan. However, the Internet seems to play greater roles in promoting political knowledge among Nanshan students than it does in Hengshan. This may result in a gap in political participation and critical thinking not just within the school, but also between Nanshan and Hengshan, where many students are still appropriating the functional skills of typing in *wangba*. The divide in political knowledge compounds even starker socioeconomic inequalities in Shenzhen than it does in Hunan, where all students study for at least the same exam and face the same polices regarding ICT. Nevertheless, students in both Hengshan and Nanshan express similar attitudes towards school computers, and they use ICT mainly for social, informational, and leisure activities, despite more in Nanshan engage with technology for "proper learning" because of more diverse ways of learning and teaching exhibited in the school.

Chapter 8

School Basum of Tibet

> 到大学别人都去上网，我们连开机都不会，很没有面子。
>
> *It would be a shame if we don't even know how to switch on a computer while others are all surfing the Internet in a university.*
>
> – *Yuzhengesang*, female, 17

8.1 Voices from a contested context

Unlike Hengshan and Nanshan, Basum in Tibet is unique in that the vast majority of its students (197 out of 200 sampled in the study) are ethnic Tibetans in China and about half of its teachers are Tibetan. Although there is not much difference between the schools in how teaching and learning are organised, the state has designed a range of policies specifically for Tibetans in the TAR.

For instance, Han teachers working in Tibet are treated as state employees* and enjoy certain benefits that high school teachers in many other regions of China are not normally entitled to. For example, they are paid by the state and their salary is often twice as much as what many of their inland counterparts officially earn. Although Basum rewarded its staff accordingly when their students did really well in the *Gaokao*, Han teachers in Tibet do not necessarily think they earn more, for they reckon their inland colleagues receive substantially more financial incentives that are more likely to result from their students' better exam performances.

* I choose not to use "civil servants" here, for Basum teachers are paid by the central government in Beijing, whereas their counterparts in other provinces are subject to specific fiscal policies.

Figure 8.1: *The slogan, written in both Chinese and Tibetan, reads: "Strengthening ethnic unity and achieving the great rejuvenation of China!"*

However, in Tibet, according to at least one teacher, teaching is more like "a political task," which is reflected in the political slogan of Figure 8.1. What the teacher meant is that they do not have as much pressure as their counterparts have in inland China. This comment is not surprising, for the liberal approach employed in the 1980s to the governance of Tibet failed in the 1990s due to regional, national, and international political disturbances of the period, which witnessed a series of uprisings in Tibet, Tian'an Men Pro-Democracy Demonstration in Beijing, and the collapse of the Soviet Union.

As a result, hardliners within the Party concluded that "excessive freedom only meant excessive splittist sentiments" (Zenz, 2010, p. 307). Since then, the paramount mission of minority education in the TAR has become ethnic unity (as conveyed in Figure 8.1 and the teacher's comment mentioned above) and political stability (Bass, 1998, pp. 54 - 60), apparently still so is the mission there today. Whereas in inland high schools, the emphasis is on results, and a teacher's income is often tied to performance. That is partly why School Hengshan has only one weekend off every two weeks — students and teachers work extremely hard towards one goal and that goal is to send more students to higher tier universities, which then translate into financial benefits for those teachers.

The state's specific policies for education in Tibet are also manifested in financial support and college entrance requirements. In order to attract more Tibetan youths to state education, the state has increased the stipend from 90 to 180 Yuan per month for each student of either agricultural or nomadic background. Starting from 2011, high school students from eligible families are no longer required to pay tuition fees. This policy used to cover compulsory education only in the TAR. As compulsory education becomes universally free, high schools in many provinces still charge fees beyond many families' capability to pay. This is particularly true in rural schools like Hengshan, where students have to pay and receive no state support for maintenance. In terms of facilities, Hengshan does not even have, for instance, chairs for their overcrowded dining hall, whereas Basum and Nanshan are better equipped in that regard.

When it comes to college entrance requirements, the differences are even more striking. Due to the state's preferential policies in education,* Tibetans need much lower scores to enrol in the same university than many of their Han counterparts do in Hunan and Shenzhen. For that reason, those Tibetans who win places for higher education are often required to study for an extra year in order to earn a degree. Despite those policies, the percentage of Tibetan high school graduates progressing onto higher education is not necessarily greater than the average of many inland provinces. It is therefore not wise to argue at this stage that rural students in inland provinces such as Hunan are the most disadvantaged in that respect. However, it is clear that minority students have certain rights guaranteed by specific laws, whereas rural schools are less likely to have a voice in the system.

Nevertheless, students across the schools studied consider their school regulations "strict." Like elsewhere, Basum has various rules to regulate students' behaviours. For instance, *Dazhen* and *Cangjuenima* revealed that their school does not permit mobile phone use on campus, and they are not allowed to sit on lawns, to modify school uniform, or to wear their hair long. Unlike Hengshan students, Tibetans are more satisfied with the foods served in their dining hall and their living conditions. When asked about such issues, students in a focus group answered: "That's okay. We now have 180 Yuan per month. Last year it was 90 per month." However, the allowance can only be expended in the school dining hall, as the informants reported, they cannot use it to purchase coca cola from a grocery store on campus as students in a neighbouring teacher training

* Some might prefer to call them "culturally sensitive policies."

school can.

Although students in the teacher training school receive a slightly higher stipend, Basum students are happier to study for the *Gaokao* and pursue other careers than teaching in future, as one student in the focus group commented:

> 师范不好…… 我们父母不希望我们考师范，因为那边的学生都不怎么好。一般班里最后几名都去读师校，最好的读这个高中，比较好的读我们隔壁的高中，最不好的读师范学校，他们有保送读大学的。*
>
> Teacher training schools are no good . . . Our parents do not want us to attend a normal university, because students there are not as good. The bottom few of our class [in middle school] are all in teacher training schools. The best came to this school [Basum], better ones to our neighbouring high school, only the worst went to the teacher training school [in the town]. However, they are guaranteed a university place in future.

As in inland China, schools are supposed to be strict with their students, and the general perception in Basum is that stricter schools have higher qualities. For instance, *Bianba* has a sister attending a high school in her home city of Shigatse, where she completed her primary and junior secondary education. The two sisters compare their high schools every now and then. While her sister's school, Shigatse No. 1 High School, has over 60 years of history, *Bianba* does not view Basum as less privileged. "The school environment and living conditions are all very good. Teachers are very dedicated here. I am satisfied with everything and I think it was a right decision for me to come here," with a giggle, *Bianba* so described her school.

Since Basum was established a few years ago, *Bianba*'s parents had barely heard of the name of the town in Chinese when she was admitted, and it took her and her family a long time to reach the decision, for "nobody saw it before," said *Bianba*. However, they later learned from others that the school had won a good reputation in the TAR. *Cangjuenima* reinforced the view in her comments:

> 我本来是不想考这里的，因为我觉得，就是不太喜欢吧。本来是想上拉萨的，但是在那边不太习惯，拉萨那边我同学大部分都到这里来了，去拉萨那边很少的，然后从那边转过来，我也觉得学校管得太严了。

* I am using "this" and "neighbouring" to anonymise the real school names mentioned here.

> Initially it was not my intention to come here, because I felt, it's because I didn't like here. I wanted to study in Lhasa. But I found it difficult to get used to the life there, I then transferred from Lhasa to Basum. Actually very few of my classmates went there. Most of them came here. I also think the school is very strict.

While Hengshan expelled a few students because they visited *wangba* in defiance of school policy, Basum dismissed a few because they drank too much alcohol on campus in disregard of school warnings. When commenting on the strict rules the school has put in place, *Yuzhengesang* reported that there used to be 12 students in her dorm, but two students were caught drinking alcohol a few times and refused to follow their teacher's advice. As a result, they were asked to leave. However, the student thought their living circumstances are better than those in other schools of the town, although she had to pay tuition fees and received no state allowance because her parents were working for the school. "Not everybody has the benefits. Only those from an agricultural or nomadic background have. I don't have, but he [her cousin] has." said *Yuzhengesang* with a smile, "Some students are even sponsored by the school in various forms of scholarship, but that applies to the very best students only."

Among the students interviewed in Basum, a few are from a similar background to *Yuzhengesang*'s. *Dunzhulaba* and *Zaxipubu* both paid tuition fees and received no state stipend because their parents were working for state units. It sounds that the same policy applies to Tibetans studying in inland Tibet schools too. *Zhuoma*'s brother was studying in Shandong province, she said the tuition was free for him, but her family were responsible for his living expenses there. *Dunzhulaba*'s sister also studied in an inland Tibet school and paid some fees. "But if you are from an agricultural or nomadic background, it is totally free and the government even provides a subsidy. We are not peasants or nomads, and both of my parents work for state units, so we have to pay for everything," grouched *Dunzhulaba*.

Notwithstanding the resentment, the student does feel his school is of high quality, although it is not the best in the TAR. "In Tibet, Lhasa Middle School is the best. Lhasa Beijing Middle School comes second. Our school is rising." said *Dunzhulaba*, "Those schools have higher progression rates, but ours is gaining a better reputation, because we had a student admitted to Peking University last year." However, the student echoed others in Basum and many in Hengshan when describing school policies, although he lived at home and travelled to and from the school every day: "The environment is good, but we are monitored all the time. There is no freedom. We used to have iron barriers fencing the school, now they are replaced by brick walls. It's really like in a prison."

8.2 The technological landscape

Among the 17 students interviewed in Basum, five reported home access to computers. Most students, like those in Hengshan, do not have a computer at home. Those with home access in Tibet are likely to have at least a parent working for the state. The have-nots tend to come from agricultural or nomadic Tibet. The haves also started using computers earlier.

Nonetheless, there are over a dozen of *wangba* in the town where Basum is situated. Most students go there during vacations; and as soon as weekends approach, *wangba* become full. Like the situation in Hengshan, *wangba* are primary places for Basum students to hang out, even for computer haves like *Dunzhulaba* who made the comment in page 3. It is clear that *wangba* have played significant roles in the digital know-how of Hengshan and Basum students.

Interestingly, Basum students rarely grouched about school ICT, although they do not differ much in what they did with school computers. For instance, *Dasi* maintained that they mainly learned how to type in IT classes of their first year. It also sounds that Basum has better IT hardware than the other two schools have. For example, *Yuzhengesang* considered the speed of her school Internet fast, and she revealed that Basum rewarded every teacher with a laptop last year because of the school's success in the *Gaokao*. *Cirenbianba* also testified the point by reporting that there are three computer rooms in Basum, one for teachers, one for students, and the third for IT class. However, as some Tibetan youths with computers at home do, this student prefers *wangba* to school ICT, which appealed to him only in his first year. But now *Cirenbianba* patronises *wangba* in the town.

8.3 *Wangba* as a social phenomenon

8.3.1 A public space for all

Unlike Hengshan and Nanshan students, Tibetans in Basum think it is normal to visit *wangba*, and all informants reported time spent there. While females in Hengshan and Nanshan rarely pay visits to *wangba*, Basum females are no less likely to stay in *wangba* than their male counterparts are. Like males, they even stay there full nights (*baoye*) on weekends, as *Cangjuenima* noted: "We usually spend one or two hours there, but occasionally we spend a full night inside. We do that once or twice a term." Tibetan female teenagers do not view *wangba* as risky as their counterparts do in the other two schools either. They sometimes go there alone, and other times with friends.

However, Basum students feel equally overwhelmed by the pressure from schoolwork. For instance, *Bianba*'s roommates all went to *wangba* on a Friday night when she was interviewed on the phone, but she did not. Otherwise, her entire morning on the following Saturday would be wasted. "There would be no time left for memorisation. I am doing arts, and there is too much to memorise. If I don't make any serious effort now, what would I do if I were to fail the *Gaokao*?" However, *Bianba* visits *wangba* once every two weeks, and every time she spends two hours or so there. She seldom remains in *wangba* for a whole night, but she did once. As a class representative of Chinese Language and Literature, *Bianba* is determined to earn a place in a good university.

Regarding online activities, students in Hengshan and Basum do not vary that much — they chat, play, listen to music, watch video, and play games. When they use the Internet for academic purposes, Basum students also search sample essays online. As students in the other two schools did, they also argued: "It's not copying; it's to see how others compose an essay" (*Cangjuenima*). When asked about their impressions of *wangba* and their attitudes towards it, Basum students were not as negative as their counterparts in Hengshan and Nanshan, but girls there tended to be more conservative. For instance, *Bianba* viewed *wangba* as complicated:

> 反正不是 ...... 有的时候也比较那个嘛 ...... 怎么说嘛，比较方便呀 ......【但是】比如说 ...... 游戏吧，有很多人那个。上网络游戏就入迷了。出事的不是都有吗？太沉迷于网络游戏不是有吗？我们这边好像没有，电视里面也会播嘛。对，然后网络游戏里不是有杀人之类的吗？然后到现实生活里都有啊 ...... 我不会，可能男孩子多一点吧。

> It's not ... sometimes it is ... how should I put it, it's convenient ... But, for example ... computer games, many people do that. They are addicted to it. Haven't you heard of incidents related to computer games? It seems that we don't have it here, but you see them in the news. Don't you see killing in games? And it sometimes translates into real life events ... I don't play games. Boys are more likely to do that.

Indeed, Basum males often play computer games. *Cirenbianba* is one such student matching *Bianba*'s description well. He usually plays games in *wangba*. He listens to music only when he is very tired. Occasionally, he writes diaries in Chinese in order to improve his proficiency in the language, which is the medium of instruction in his school. He finds the Internet helpful also because he can search past exam papers for subjects like Physics and Chemistry. He searches them on Baidu, and if he cannot understand the answers found on the web, he asks his teachers.

According to *Dunzhulaba*, *wangba* owners are usually Han Chinese businessmen, who hire local Tibetans to serve customers like him. Running *wangba* seems to be a lucrative business, from which *Dunzhulaba* thought they had earned a lot. However, he enjoys some discount because of his long-term membership. While the hourly price is high,[*] most *wangba* in the Tibetan town charge around 15 Yuan per night, a price low enough to attract those teenagers to spend their full nights there, as *Cirenbianba* described: "*Wangba* are packed with students on weekends, and you can hardly find a free place." *Cirenbianba* also revealed that all male students in his class frequent *wangba*, many females go there too, although some choose not to be there on Saturdays.

Yuzhengesang and *Qupeisuolang* are cousins.[†] The former's father is a Deputy Head of Basum, and the latter comes from rural Tibet. *Yuzhengesang* has at home a computer, and several mobile phones. While she can accept students spending some time in *wangba*, *Yuzhengesang* does not understand why some of her classmates stay there for two or three nights in a stretch. Once she reminded her cousin of the fact that spending full nights in *wangba* would do harm to his body. But his reply was: "I feel very comfortable while playing games [in *wangba*]." However, she did consider *wangba*

[*] The *wangba Cirenbianba* frequents charges five Yuan per hour.

[†] In Tibet, students were often interviewed as a group of two or more in the study. One advantage of interviewing that way is that one student may reveal something about the other which that student might not want to say if interviewed alone, particularly when they are close friends and know each other in an intimate fashion.

crucial, as she emphasised in page 171.

Zaxipubu and *Bianjiucilie* were interviewed at the same time too. Like *Yuzhengesang* and *Qupeisuolang*, the two students come from very different socioeconomic backgrounds. *Zaxipubu* has a British grandfather, and his parents are working for state units. *Bianjiucilie* comes from nomadic Tibet. Unlike *Zaxipubu*, *Bianjiucilie* is shy and less fluent in Mandarin. When probed with questions, *Zaxipubu* often offered his understandings of his nomadic friend's circumstances, and the latter usually nodded with an infectious smile on his face.

Despite the difference in socioeconomic profiles, the two students have many shared experiences with ICT. For instance, they visit *wangba* almost every weekend, and spend whole nights there often. Like many others in *wangba*, they play games, chat online, and watch films. However, *Zaxipubu* considers *Bianjiucilie* "addicted" to computer games, for, in his view, *Bianjiucilie* often forgets to eat while in *wangba*; and in school, he is many a time low in spirit. Sitting besides *Zaxipubu*, *Bianjiucilie* did not disagree with his classmate. Instead, he disclosed how much he spent per month.

Since students of agricultural and nomadic backgrounds in Tibet are not required to pay tuition fees, and every month they receive from the state 180 Yuan or so, *Bianjiucilie* has enough pocket money at his disposal when his parents and uncle give him extra 500 Yuan per month. With both parents working in state units, *Zaxipubu* is not entitled to the benefits. However, he pointed out that 500 Yuan is easy to expend in Tibet nowadays, particularly when the student highlighted: "We can't cope without *wangba* in school. We go there whenever we feel bored on weekends." No wonder Basum students often spend most of their pocket money in *wangba* and on foods, for they need to order meals from restaurants while in *wangba*.

8.3.2 "It depends on how you use it"

While *wangba* function as public places for students like *Bianjiucilie* to play games, they also provide opportunities for teenagers such as *Dunzhulaba* to develop interests in music and learn English. With a computer at home, *Dunzhulaba* still haunts *wangba*, for the speed there is much faster than at home. Apart from gaming and chatting, he actively participates in rap forums, particularly those in English. Although he said his English was poor, *Dunzhulaba* concluded that most English words he knew were from rap. When he came across a sentence he could not understand, he copied and pasted it to Baidu for a translation/explanation and sometimes even a pronunciation. Unsurprisingly, he viewed the Internet as a better place to learn English than the real place of his classroom. In the end, he underscored: "It depends on how you use it."

Dunzhulaba's way of using the Internet is shaped to a certain extent by how he has been raised and educated. Unlike many others in Basum, he spent two of his primary years at a private school in Chengdu, an inland city close to Tibet. According to the 18-year old, the foreign language school had better facilities and higher quality in teaching than most schools in Tibet had and he started learning English there. But he missed home so much that he did not want to complete his sixth grade there, so he returned to Tibet for year sixth and his entire secondary education.

Even in Tibet, his parents sent him to an experimental school for two of his three junior secondary years. The experimental school, said *Dunzhulaba*, had an ideal learning environment and high quality in teaching. It is clear that *Dunzhulaba*'s parents made great efforts to have their son educated in what they deemed as the best possible schools they could afford. That is not surprising, given the close tie his family has with inland China. As *Dunzhulaba* revealed, his sister studied in inland Tibet schools of Tianjin and Hunan before him. "She is like a Han girl," so he described his sister, who is now a teacher of a school in Lhasa. Since his parents work for state units (father as a veterinarian, and mother as a post officer), he is not entitled to the aforementioned benefits, which he views as a prejudice against students like him.

Even in high school, *Dunzhulaba* differs from his peers in that he lives at home while those from Naqu and Ali need to travel up to four days and four nights to get to the school. Living at home means he can use his home computer if he wants to. Yet, like other teenagers in Basum, he patronises *wangba* during weekends and vacations when most *wangba* are crowded. He enjoys playing computer games there, although many he plays with are strangers in cyberspace. When schools are closed for vacations, said *Dunzhulaba*, the only thing one can see in *wangba* is gaming, and most players are students. When asked whether his parents oppose online gaming, *Dunzhulaba* reported their attitudes in page 3.

8.3.3 Normalising *wangba* when "everybody visits *wangba*"

Like School Hengshan, Basum also bans students' visit to *wangba* during weekdays and it even warns that anyone daring to go would be expelled if caught. Unsurprisingly, *Dunzhulaba* found this policy unacceptable, for he argued that appropriate use of *wangba* is okay and his school should only penalise those who use it excessively, for instance, the ones breaking out of the school during weekdays. "Expelling students because they frequent *wangba* is a fascist rule," contended the student. "Everybody visits *wangba* today, even those kids do! We are over 18 and grown up," he continued. *Zaxipubu* shares a similar view regarding the school's *wangba* policy. He believes high school students are able to discipline themselves well, and the Internet can be of help to their studies.

While the two students lamented the restrictive side of the school policy, *Dasi* underlined that some teachers in the school actually encouraged them to use the Internet. For instance, he once went to *wangba* and searched online "how to improve exam scores?" When he found a good essay on the topic, he wanted to print it out, but eventually he had to copy it by hand, for no printer was available in the *wangba*. According to the 19-year old, those who forbid them to go are oftentimes school administrators, who once in a while raid *wangba* late at night on Saturday evenings. But most weekends, students are free to visit any *wangba* of the town; the only regulators then are the police, who usually check ID cards of users in *wangba*. When they find students under 18 there, they are likely to take them back to the school and hand them over to school administration.

However, if a student is over 18, they would not intervene. For example, *Zaxipubu* celebrated his 18^{th} birthday in *wangba*, the police checked his ID card after midnight. "Had they come a bit earlier, I would have been in trouble," said the student. *Dasi* was 19 when he was interviewed. As the oldest student in his class, he has no problem in *wangba*. Although it is known among the students that only 18-year olds or above are supposed to visit *wangba*, students below 18 still account for a significant proportion of users in *wangba*, which do not seem to care how old their visitors really are.

Clearly, *wangba* is an important part of school life in Basum. When asked whether or not *wangba* are of significance to them, six girls in a focus group simultaneously replied "yes!" However, *Quzhenlaba* did not know what else to do in *wangba* when she was not practising typing and a few other basic functions. She never paid a visit to *wangba* in her middle school. But in Basum, she went there so often that she got bored with it when she was interviewed.

8.3.4 In parental view

Compared with parents in Hunan, Tibetan parents seem to be less bothered about their children's pastime in *wangba*. When asked about parental reaction to their visit to *wangba*, most informants had little to say. When they had a comment to make, they even reported the endorsement they had received from their parents. For example, *Dunzhulaba*'s parents assent to his interaction with the Internet provided he does not spend too much time there. *Dasi*'s parents permit him to go when necessary, although they are concerned about the possibility that he might become "addicted" to it. *Yuzhengesang*'s parents used to object, but now they would not say anything as long as she goes home early.

While students consider *wangba* vital to them, their parents often have limited knowledge about it. *Zaxipubu* highlighted that parents usually listen to teachers – when teachers think students should not go there, their parents would normally intervene, although teenagers themselves think *wangba* have little, if any, (negative) effect on their learning. However, *Zaxipubu*'s parents set almost no limitations on his time in *wangba*, the only thing his parents oppose is *baoye* — they do not want to see him spend full nights there. This student seems to be aware of certain issues surrounding Tibet in China, he said: "I am very cautious online and I always take a blind eye to those subversive messages on QQ." *Bianjiucilie* also revealed that his parents are equally anxious about *baoye*, he noted that harassment and fighting did occur in *wangba* from time to time. For that reason, he sometimes went there without his parents knowing it.

While girls in Tibet are equally likely to frequent *wangba*, their parents step in only under certain circumstances. *Quzhenciren* used to haunt *wangba*, but after her score dropped, her parents started to prohibit her visit to *wangba*. Had her school performance gone well, her parents would not have forbidden her from going, as did *Zhuoma*'s parents, who never bothered with when and how often she visited *wangba*. *Lazhen*'s parents are nevertheless divided on whether or not she should go. Her father considers it necessary for her if she goes there to learn, but her mother is worried, for she fears that there are many rogues there and her valuable belongs might be stolen one day should she stay there at night. *Lazhen* added that once in a while robbery took place in *wangba* of the town. Therefore, her mother's concerns were not groundless.

The perceived risks and opportunities of *wangba* thus vary from parents to parents. According to *Yuzhengesang*, parents in rural Tibet, like *Qupeisuolang*'s, usually hold negative opinions about *wangba* and believe that students going there can hardly learn well. This parental view does not differ considerably from that found in Hunan, where parents also establish such a link between time spent in *wangba* and their children's academic performance.

8.4 Mobile phone: diversity in access, use, and consequence

Like elsewhere, mobile phone has become a crucial component of adolescent life in Tibet. *Dunzhulaba*, for instance, views his mobile phone as his "eyes and ears." Without it, he said he would not be able to obtain reliable information and he would feel uncomfortable. His mobile phone was repaired once and he knew what it was like without it, for all the data, as he put, were communicated via his phone. As many other students do, he also uses QQ run in his mobile phone, and relies upon his phone for music on his way to and from the school every day. Occasionally he takes photos with it before uploading them to his QQ space.

A mobile phone is perhaps more valuable for a life on the high plateau than it is in the other two schools. Coming from Shigatse, the second largest city of Tibet, *Bianba*, for instance, began to use her mobile phone when she was in middle school. She said her school was too far away from home and every day she had to walk a long way to and from her school. In high school, she said it takes her seven hours or so to travel from home to Basum by coach. "With a mobile phone, it is very convenient," the student thus asserted. As she lives in school, she calls home every Saturday and on Wednesdays her mother rings her on time. Once a week, she also communicates with her sister, who is studying in another high school in Tibet. Apart from the communication her mobile phone facilitates, *Bianba* said: "the phone is becoming more important as we progress onto higher grades, for we need to contact home more often and occasionally we have to ask our parents to send over to the school proofs of identity such as the *Hukou* book."

Despite the significance of a mobile phone, Basum students are less likely to own one than their counterparts are in Hengshan and Nanshan; and when they do have a phone, they are more likely to use a less well-known brand. There were indeed many students who could not afford a handset in Basum, among whom was *Qupeisuolang*. Unsurprisingly, when he saw a few of his cousin's used phones, he wanted one, as his cousin commented: "Every time he asks me to give him one of my used phones. When I tell him that he will lose it if I give him one, he is upset. He keeps asking me for a [used] phone."

"Some students don't have a phone probably because their family can't afford one. Others bring real Nokia handsets to the school. I am going to buy a Nokia 85 tomorrow." The phone *Cirenbianba* used when he was interviewed is a brand called *Hualu*, which most users of mobile phones in inland provinces are probably unfamiliar with. *Bianjiucilie*, a student from rural Tibet, also used a brand he did not know (neither did he care). *Zhuoma* had a phone called *Tianji*, also unknown to many users in inland China. *Quzhenlaba* did not know which brand her phone was – her sister bought it for her so that she could contact her family more conveniently.

Even with a mobile phone, Basum students often face certain barriers in use because of the fees incurred. For instance, *Bianjiucilie*'s and *Dasi*'s parents all asked them not to text or ring that much, for the bills could be too much for them. The two students mumbled about the economic obstacle they faced when posed the same question. Again, *Bianjiucilie*'s friend *Zaxipubu* answered the question on his behalf, and he nodded. *Dasi* responded with some sort of hesitation: "It's rather difficult for my family." However, students from better off families are more likely to have better known brands and use their phones with fewer constraints. For instance, *Zaxipubu* had a Nokia 5300, a phone his grandfather bought for him. He said that was his eighth handset — he played basketball a lot, and most of his handsets were damaged during his play of the ball.

Moreover, not all students without a phone in Basum were not able to afford one. *Dasi* thought two of his roommates decided not to own a personal phone until they go to university. They thought having a phone in high school would affect their studies. Others have no interest in mobile phones at all. *Cangjuenima* brought her father's used phone to the school so that she could communicate with her family when necessary. Other than that, she said she did not like mobile phones that much, neither did she care which brand she was using. *Quzhenciren* does not have a mobile phone and she has to ring her family twice a week from a public phone, which she considers inconvenient. She had a phone before, but in her first year, she talked too much with a boy outside her school. Her academic performance dropped dramatically; she then decided not to use her phone in the second year. But it took her some time to get used to a life without a phone.

While Nanshan students use their phone to store and study English vocabulary, Tibetans use it to improve Chinese. *Cirenbianba* is a rather shy student and his spoken Chinese is not as fluent as many of his classmates'. When he has difficulty in expressing what he wants to say in words, he turns to his mobile phone's texting service, which suggests words and expressions automatically when he types in *Pinyin* (pronunciation). He revealed that he chatted online with strangers often in order to improve his Mandarin. He said he could understand what others said, but occasionally found it difficult to make himself understood in Chinese. *Dasi* does almost the same thing when he is not sure about how to write a Chinese character — he types in *Pinyin* first, and then follows the characters shown on his screen.

As in the other two schools, Basum students use QQ and messaging service frequently to chat with their friends and classmates. However, they are by far less likely to text their parents, particularly those living in agricultural and nomadic areas. While parents in Hunan may not text a lot, they usually understand the messages they receive. In Tibet, texting parents can be the least effective way to communicate with parents, for many Tibetan parents do not understand Chinese.

Dasi's parents are almost illiterate. They cannot read text messages; neither do they speak the language. As the only person educated beyond primary level in his hometown, *Dasi* mainly rings his family — texting is largely with his friends. From an agricultural background in Tibet, *Bianjiucilie* does not text his parents either for the same reason. *Bianba*'s father works as a veterinarian, but he cannot speak Mandarin well. Her mother does not speak Chinese at all. So she rarely texts her parents. "They wouldn't be able to understand it," *Bianba* laughed when she revealed the information. However, two students interviewed did report texting their parents. *Yuzhengesang*'s father travels to other provinces of China often. As a Deputy Head of Basum, he is able to understand and type in Chinese. *Zaxipubu*'s parents are working for state units. He finds messaging a compelling way to ask for pocket money from his parents.

Although parents in Tibet use mobile phones in different ways from those in Hunan and Shenzhen, they hold similar views towards their children's use of mobile phones. That is to say, they are concerned that mobile phone use may affect their children's learning if they are "addicted" to games. For example, *Cangjue*'s parents opposed her use of mobile phone in her first year of high school, for they feared that her performance in school might suffer.

Mobile phone use sometimes brought about undesirable consequences for the students concerned. For example, *Quzhenciren*'s performance dropped to the bottom three in her class when she was in a relationship during her first year. "We chatted too much on QQ, almost every night we talked," said the student with a smile on her face, "he was not a student. But we are not in touch any more." What affected *Dasi* is the music stored in his mobile phone. More often than not, he plays his favourite songs at night when he is sleepless. But often, the more he plays, the longer he stays awake, and the direct consequence of that is his inability to concentrate on the following morning in class. "I used my phone too much. That was last term. It won't be like that this term," the student announced. To other students, it is electronic reading that matters. "Some students read novels on mobile phones in the afternoon, but I don't," reported *Zaxipubu*. "There are many students reading electronic novels on mobile phones in a key class of our year," *Yuzhengesang* revealed, "others play games on their handsets."

Unsurprisingly, teachers share parental concerns and School Basum adopts the same policy regarding mobile phone use as reported in the other two schools. Like elsewhere, Basum students do the same as their counterparts in Hengshan and Nanshan do. These are the similarities across the schools studied. Consequently, Basum students also reported mobile phones impounded by school administrators, and a student's mobile phone smashed by a teacher when he was found answering a call in class.

Moreover, many Basum students lock up their handsets in their dorm, for a phone is not supposed to appear in class. However, this does not mean that everybody does the same. *Bianba* said she was very careful when using a phone: "I would not let my teacher discover it." According to *Dasi*, different adults adopt different rules. Some teachers allow students to use their phone outside classrooms, but school administrators may implement the policy whenever they find students using a phone. "Therefore, there is no time we can use our phone," lamented *Dasi*. However, most students in the school use it if they have a phone, as their counterparts do in Hengshan and Nanshan. *Zaxipubu* also reported that the school has very strict rules regulating mobile phone use and other issues such as the length of hair. "They simply don't give us freedom," grumbled the student, "I don't see anything wrong with a mobile phone."

It is understandable that *Zaxipubu* made the above comment, for his phone was confiscated by a teacher on the Wednesday a week before the interview. He asked the teacher to return the phone to him several times, but he did not succeed. What annoyed him most, however, was the teacher's knowledge of his intimate messages stored in the phone:

> 没收了，上上周星期三，要了很多次。他们还翻了我的信息。就是在班里充电【的时候被没收了】。就是第二节课间操时被没收了。我回来的时候不见手机了，找老师说手机不见了，他们说在他们那里，问为什么在教室里充电，就没收了。【什么时候给你】没有说，要我带家长来。家长在那边，怎么叫他们过来？他们看了我的信息嘛，他跟我提手机里的信息 . . . . . . 侵犯了我的隐私权！
>
> It was impounded while being charged during the morning exercise break on the Wednesday the week before last week. It disappeared when I returned. I then went to see the teacher, he said it was with them and asked me why I charged the phone in the classroom. He asked my parents to come before he was able to return the handset to me, but my parents are far away at home, how can I ask them to come? They [the teacher and his colleagues] even read my text messages. When I was there, he hinted what I said in those messages! They intruded on my privacy!

It is evident that *Zaxipubu* considers privacy even more important than his handset. He does not mind if his close friends peruse his mobile phone, but that does not extend to his teachers and parents. At home, his parents sometimes request to have a look at his mobile phone, but if he refuses, his parents do not persist. Like students in the other two schools, students like *Zaxipubu* feel strongly against those who browse their text messages without their consent.

However, for those whose parents are not able to understand Chinese, text messages may be less of an issue. "They can't read. They know how to speak, but they can't write," one female student in a focus group described her parents' incapability to use Chinese. *Bianjiucilie* and *Dasi* too have parents unable to understand Chinese. However, their parents do ask about the person on the other side when they see or hear their children talking over a phone at home, and students respond in different ways. *Zaxipubu* rejects his parents' requests outright, *Cangjuenima* tells her parents before they ask her about whom she was talking to. *Yuzhengesang* sometimes lies to her parents, particularly to her mother, for she wants to know almost every time she uses a phone at home. As a teacher, her father however rarely monitors her use of mobile phone.

8.5 Conclusion

As in Hengshan and Nanshan, students' interactions with *wangba* and mobile phones in Basum bespeak Tibet's unique geopolitical, sociocultural, and economic positions in China. Geographically speaking, the high plateau shapes how and how much students visit home and places outside the town where the school is situated. Although the town is a county seat in Tibet, its administrative (not geographic) size is perhaps smaller than many villages in prosperous inland provinces. Since students in Basum come from across the TAR, the school and the town is their home during terms – unlike students in Nanshan and Hengshan, they cannot visit home until a long vacation approaches. It is therefore not surprising that many students view *wangba* as a central part of their pastime in school, and mobile phones play significant roles in students' supportive communications with their families. Politically, education is sometimes treated as a "task," which affects how students learn and teachers teach. For instance, students enjoy more free weekends, a monthly stipend, and need lower entrance requirements for higher education. All these indirectly influence the ways students use *wangba*. In addition, rural and nomadic teenagers in Basum are economically constrained in their access to mobile phones – they either have no access at all or use lower-end poor-quality mobile handsets. Culturally, Basum students rarely text their parents, who normally speak Tibetan and know little, if at all, Chinese. However, Tibetan parents share the same concerns about potential risks associated with ICT, although they intervene less than their Han counterparts do. Furthermore, teachers in Basum adopt similar policies regarding ICT access and use as reported in Hengshan and Nanshan, and students are equally sensitive to private messages stored in their handsets, which adults are not supposed to intrude upon.

Chapter 9

Social Shaping and Consequences

9.1 Balance by design

	Male	Female	Key	Ordinary	Arts	Science	Mean Age
Basum	90	107	99	100	105	94	17.7
Hengshan	163	147	123	189	131	180	17.1
Nanshan	100	86	87	95	96	86	17.3

Table 9.1: *Summary statistics by school*

In total, the study surveyed 698 students, among whom 200 are from Basum, 312 from Hengshan, and 186 from Nanshan. As shown in Table 9.1, students are well represented within and across schools in terms of gender, track (Arts vs. Science), and attainment status (Key vs. Ordinary class). Most students (589) live in school dormitories, 89 at home, only 14 board elsewhere. On average, participants were 17.4 years old in 2011. Regarding ethnicity, 197 Tibetan and 495 Han students were surveyed – only six are of other ethnic backgrounds or the information is missing. The data gathered thus confirm that students selected from the high schools are of similar age and conditionally homogeneous in terms of ethnicity and rurality/urbanity – variables well controlled for in the design stage for meaningful comparisons during analysis about the differences in access to and use of ICT across the three regions defined by ethnicity and rurality/urbanity, and within individual schools along student profiles of major concerns such as socioeconomic status, track, and attainment. The design process thus successfully incorporated the "most-similar" principle (A. Spirling, personal communication, Fall, 2012) often utilised in regression analysis.

9.2 Variations in the number of Internet activities

As the research is concerned with the ramifications of inequality in access and differentiation in use, I shall first examine the number of Internet activities that students in different schools and of different socioeconomic profiles engage with. In the survey, one question asks students what they normally do with the Internet. There are 14 options, and students can select all that apply to them. The question also provides an open option for those who either have no access to the Internet, do not know how to use it, do not want to use it, or use the Internet for other purposes than the 14 activities listed. During analysis of the answers to the question, a score of 1 was attached to each activity selected or given in the open space, and 0 to non-use. This implies that a score of 5 means a student often uses the Internet for five activities.

Summary statistics of total online activities reveal that on average students in the three schools use the Internet for about four activities (4.2), and the maximum number is 13. The top four activities that students do are “Chatting online” (selected 130 times), “Downloading video or music” (108 times), “Visiting social networking sites such as Renren” (98 times), and “Receiving and sending emails” (96 times). Although the overall distribution of the data for this variable is approximately normal, it is skewed to the right, implying that students in at least one of the three schools use the Internet for substantially more purposes than those in the other two schools do, and that school is Nanshan in Shenzhen, where students use the Internet for a much wider range of activities than those in Hengshan and Basum do.

To better illustrate how the number of Internet activities is distributed across different groups, I provide a few side-by-side box plots in Figure 9.1. As one can see from the plots by school, Shenzhen (SZ) has the highest mean (5.93), followed by Hunan (HN) at 3.77 and Tibet (TB) at 3.28. Although there are big differences in the outcome between the groups defined by school, stream, ethnicity, track, and parental education (with or without 12 or more years of education), males and females (4.27 vs. 4.17) do not differ much in this item. Similar statistics between males and females in their use of ICT for academic purposes exhibit no significant difference either (1.29 vs. 1.24).

Since the number of activities ranges from 0 to 13, it is easier for interpretation if I divide them into three bands — fewer than four activities are categorised as “Low,” between four and eight as “Medium,” more than eight but no more than 13 as “High.”

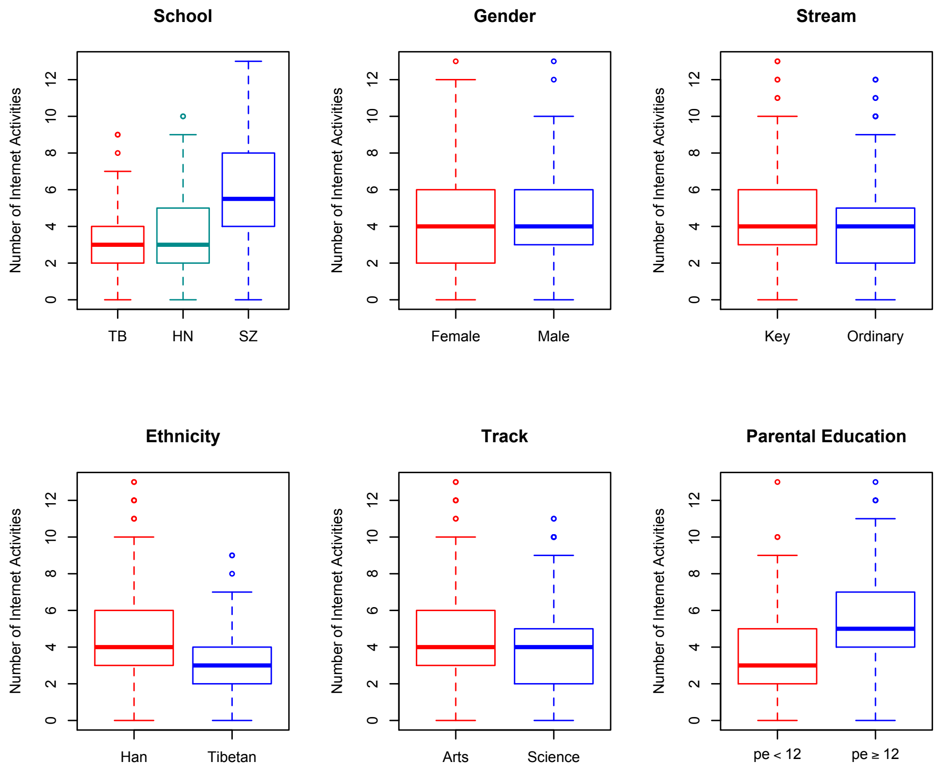


Figure 9.1: *Box plots comparing the number of Internet activities by different groups – TB, HN, SZ in the top left box stand for Tibet, Hunan, and Shenzhen respectively;* `pe` *in the bottom right box refers to parental education in years, which is made a binary variable, with values smaller than 12 years or not.*

According to the statistics generated in `STATA`,[*] the vast majority (about 60%) engage with low level of Internet activities, only 6% or so use the Internet for eight or more purposes. This is not surprising due to the restrictive policies regarding ICT use in the three schools studied. However, statistically significant variations concerning the item exist between and within the schools.

As shown in Figure 9.2, schools and the three categorical levels of Internet activities

[*] `STATA` is a powerful statistical software package widely used throughout the world. It is perhaps better-known than `R`, which I use for both statistical analysis and graphical presentation in the study. While `STATA` involves fewer codes than `R` does at the beginning of a user's learning curve, the latter is free and becoming increasingly popular and powerful. I learned and used `STATA` first to analyse the quantitative data, but re-analysed the data using `R` in later stages of the PhD. Since it is unwise to discard everything I found in `STATA`, I will incorporate the results from both, particularly some earlier findings. Please see Appendices G and H for `STATA` and `R` codes respectively.

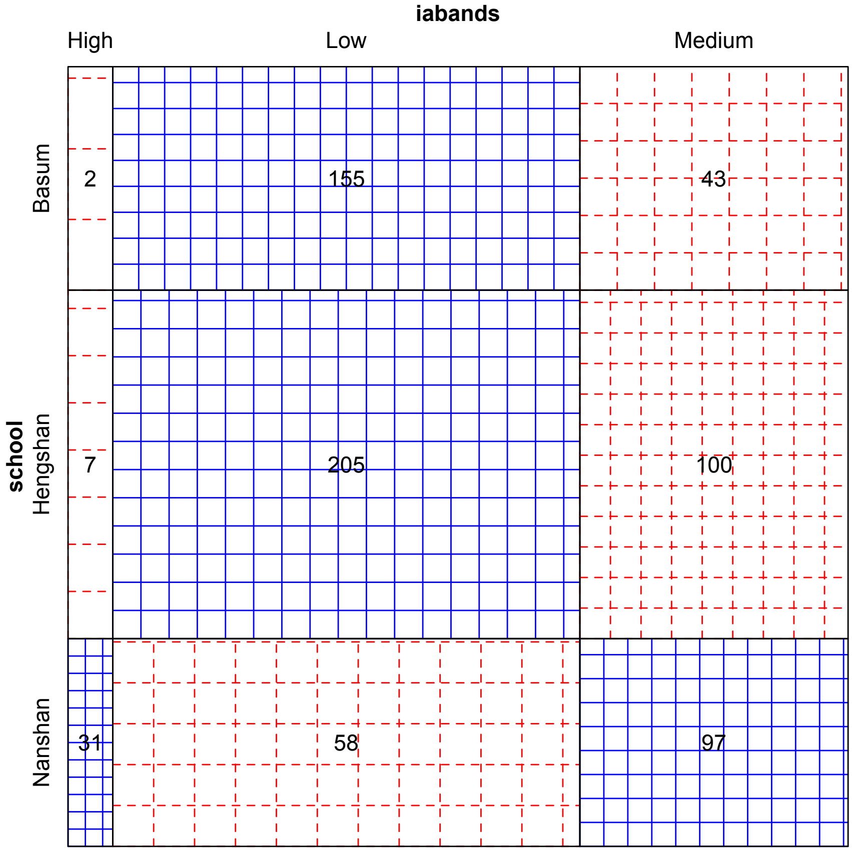


Figure 9.2: *The (non)association between school and categorical level of Internet activities (`iabands`), which divides the number of Internet activities into Low ($0 < \texttt{ias} \leq 4$), Medium ($5 < \texttt{ias} \leq 8$), and High ($9 < \texttt{ias} \leq 13$) levels. The three categorical levels of Internet activities are either associated (in blue) or non-associated (in red) with the three schools.*

have at times statistically significant associations. The principle underlying the chart is that the number in a bigger square (with black borders) represents the observed number of students under a specific category, and the number of smaller boxes (with red or blue borders) within the square symbolises the expected number of students for that category, given the null assumption that the school the square stands for is not associated with the corresponding categorical level of Internet activities. When statistically significant deviations occur, all smaller boxes are coloured blue and their borders become solid. That is also to say, squares with smaller red dashed boxes have similar observed and expected numbers, suggesting the school and the categorical level of Internet activities they denote are independent from each other.

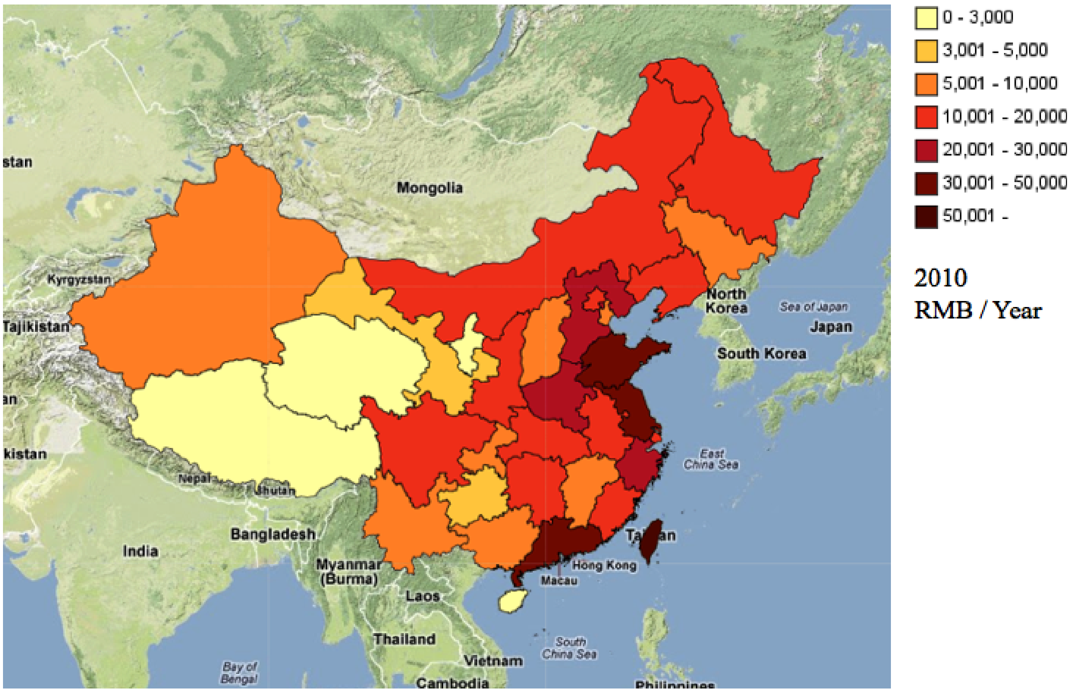


Figure 9.3: *GDP by province (Source: Harvard WorldMap)*

As Figure 9.2 illustrates, Basum in Tibet has the largest *proportion* of students with a low level of Internet activities (0.78), followed by Hengshan in Hunan (0.66), and Nanshan in Shenzhen (0.31). This is not surprising either, as illustrated in Figure 9.3, Shenzhen is among the most developed cities in China; and Hunan, an interior province, is less developed than Shenzhen, but more so than Tibet in economic terms. However, when I compare the proportion of students with a medium level of Internet activities across the schools, I can find a reverse trend. That is, Nanshan has the highest share (0.52), and Basum the lowest (0.22), with Hengshan still in the middle (0.32). It is worth noting that very few students across the schools engage with a high level of Internet activities, but the association between Nanshan and the high band category are statistically significant, meaning it has by far more students engaging with a high level of Internet activities than expected, if the null hypothesis were true. The graph thus powerfully demonstrates that Internet access and use are not random across the regions – they reflect levels of economic development, given the students across the schools confront with similar restrictions from adults, as reported in the qualitative strand of findings.

9.3 Tides turn in academic use

Apart from non-academic use of the Internet, the study also investigated academic purposes students used their ICT for. Unlike the question about Internet activities, this survey item has six options for students to select from and one open option. However, a similar approach was employed to analyse the data. In other words, each activity selected was given a value of 1, and 0 for non-use for academic purposes.

According to `STATA` output, students' academic use of ICT is very low across the schools – about 31% reported no use at all.* When students do use technology for schoolwork, they mainly utilise it to write homework (about 32%) or to make PowerPoint slides (about 22%). However, the numbers reported in each school for the item do not follow the same trend as found in non-academic activities with the Internet.

The data reported that 46.5% of the students in Hunan did not use ICT for academic purposes, followed by those in Tibet (27.5%), with Shenzhen students still leading the table (only 9.7% did not use ICT for academic purposes). This trend thus contrasts with the one found earlier about Internet activities. In other words, it no longer obeys the economic rule. How to account for the change? The answer should lie in either the level of restriction students face in each school, or other factors such as the quantity of access to ICT or the myriad of attitudes towards ICT. Next, I shall examine those factors one by one.

9.3.1 Overall access

The study measured access to ICT at individual, home, and school levels. For each level, there is a no access option. When analysing the data, I assigned 1 for access to any of the three items at each level, and 0 for no access. That implies the more items one has access to, the higher one scores. It also suggests a student can score a maximum of 3 at personal level if the person has access to a computer, a mobile phone, and the Internet. If one has access to none of the three items listed, then the score for

* Academic use refers to students' use of mobile phones, computers, and/or the Internet for any of the following activities: writing homework; making slides; searching academic related information online; logging into school website for assignment; communicating with peers for academic purposes; or anything else defined by the students themselves in the open option. In analysis, 0 was reserved for the option "I don't use ICT for schoolwork."

the person is 0. The same rule applies to the other two levels.

In order to gauge the picture of a person's overall access to ICT across the three levels, a new variable called `icts` was created. This variable sums up the values one scores for the three levels. As a result, the maximum and minimum one can score for overall access is 9 and 0 respectively. According to the summary statistics, the mean is 3.7 across the three schools, and the median is 3, meaning the distribution is again skewed to the right and that students in at least one school have significantly more overall access to ICT than do those in the other two schools.

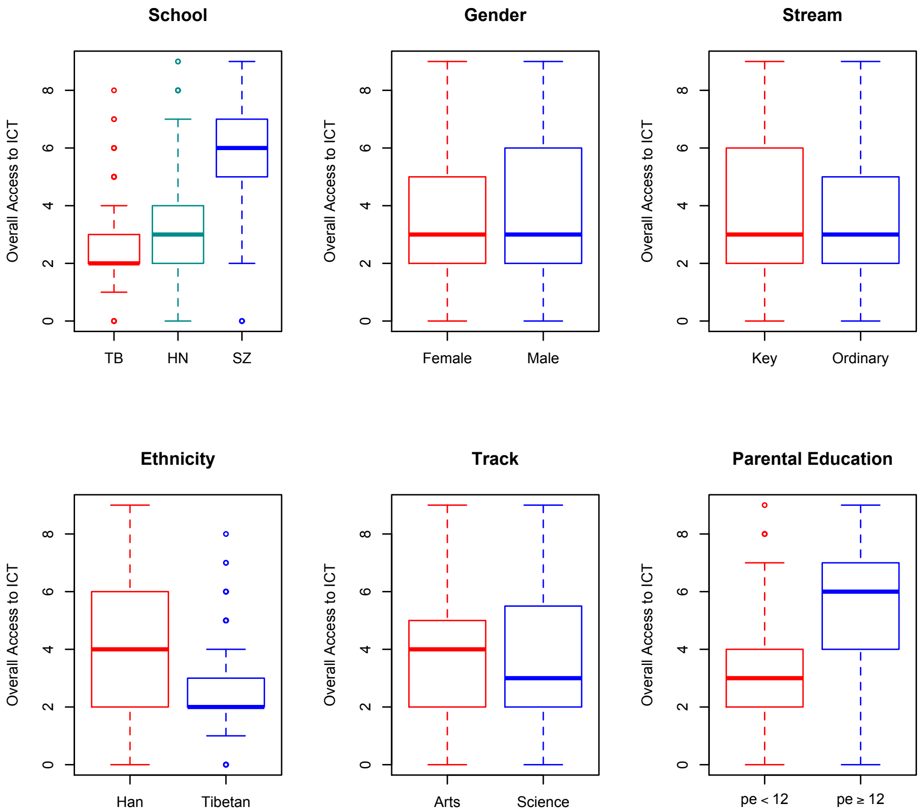


Figure 9.4: *Box plots comparing overall access to ICT by different groups – TB, HN, SZ in the top left box stand for Tibet, Hunan, and Shenzhen respectively;* `pe` *in the bottom right box refers to parental education in years, which is made a binary variable, with values smaller than 12 years or not.*

How does the distribution vary between different groups then? Let's examine a similar set of side-by-side box plots to the one in Figure 9.1 about Internet activities. As is clear in Figure 9.4, Nanshan is much higher than either Basum or Hengshan, suggesting its students have both higher mean and median than those in the other two schools have. Moreover, it has the fewest outliers, two compared with three in Hengshan and five in Basum, implying its students are not severely divided in terms of overall access to ICT.

Although the students in Tibet have the lowest average in overall access, some of its students have by far more access than others have within the same school. This is less severe in the other two schools. The greater number of outliers in Basum implies that students there come from by far more diverse socioeconomic backgrounds than do those in Hengshan and Nanshan, or that Tibetan societies today are more divided in terms of overall access to ICT than are those in Hunan and Shenzhen. This finding thus confirms not only Hu and Salazar (2010)'s argument that the state's "urban-centred subsidization" has created a striking urban-rural divide in Tibetan society (p. 296), but also some of the qualitative findings as reported earlier, for instance, rural and nomadic Tibetan teenagers' non-access to mobile phones and their use of less well-known brands. It also indicates that the state's shift of priority from urban to rural or nomadic Tibet, as evidenced in Goldstein et al. (2010), is timely and necessary.

The divide identified above is also reflected in students' experience of *wangba*. When asked how often they visit *wangba*, about 45% of the students in Shenzhen reported zero experience. Whereas in Tibet and Hunan, only 10.47% and 7.44% selected no experience respectively, suggesting shared access was common in the latter two schools. While more students in Hengshan reported no experience in *wangba* than did those in Basum, the latter scored higher in intensity, which was measured by the frequency of visits to *wangba* (cf. Table 1.1).

Hengshan students were least likely to use ICT for academic purposes, perhaps because more students there than those in either of the other two schools reported zero experience with *wangba*,* or because *wangba* there are highly associated with computer games, as discussed earlier in the qualitative findings of the thesis, students visiting *wangba* are not doing "proper things." However, these are not compelling answers to the question: Why did Hengshan students with higher overall access use ICT for academic purposes less than did their counterparts in Tibet with lower overall access? The search for a

* No access means no use, be it academic or not.

satisfactory answer shall continue.

9.3.2 Autonomy

Is the reverse in trend about academic use of ICT, as identified in page 194, due to a more restrictive policy regarding adolescent use of technology in Hunan? As reported earlier, 45% of Nanshan students had no experience with *wangba*, but Hengshan and Basum students were similar in that regard. To meaningfully examine if autonomy matters, I should exclude the data from Shenzhen and apply the "most-similar" principle to the comparison. According to `STATA` output about the freedom students enjoyed in their engagement with *wangba*, Basum has a higher mean (1.69) than that of Hengshan (1.58), implying the latter is more restrictive, for a higher score in this item means a higher degree of autonomy students have in visiting *wangba*. And the more they get a chance to use computers, the more likely they are to use them for studies.

However, students in Hengshan have a higher level of freedom (1.9) in mobile phone use than Basum students do (1.7). But this item is problematic, for 17.3% of the students in Tibet selected no access to a personal mobile phone, whereas the percentages in Hunan and Shenzhen are close at 4.5% and 3.8% respectively. Furthermore, students may not be able to perform all the activities listed for academic purposes on their mobile handset. Therefore, it is still reasonable to look at the freedom students had in visiting *wangba*. However, adult restriction can only provide a weak explanation. For a better understanding, it is worth exploring further.

9.3.3 Academic matters with access and use

	Estimate	Std. Error	z-score	Pr(>|z|)
(Intercept)	1.93	1.01	1.91	0.06
Hope to do well (`htdwell`)	-0.22	0.09	-2.49	0.01
Negative views of *Wangba* (`cafe`)	0.02	0.10	0.17	0.87
Ethnicity (`minzu`)	-1.34	0.57	-2.35	0.02
Parental education in years (`pe`)	-0.19	0.10	-1.98	0.05
Interaction (`pande`)	0.11	0.07	1.52	0.13

Table 9.2: *Regression coefficients from the logit model – `minzu` is the numerical version of ethnicity; `pande` is the interaction (product) between parental education in years and numerical version of ethnicity.*

While most students across the three schools hoped to do well in school (the average score is 4.2 out of 5) and agreed that it was important for them to do well in 2011 when they completed the survey (3.8 out of 5), they differed from school to school. Largely speaking, students in Hengshan and Nanshan were similar when asked how much they hoped to do well in school, for their average scores for this item were 4.3 and 4.4 respectively ($z = -1.72,\ p > |z| = 0.08$). But the average in Basum was 4.0, the lowest among the three schools, and a Rank-Sum test produced a statistically significant difference between Han and Tibetan teenagers ($z = 3.90,\ p > |z| = 0.00$).

When asked how important it was for them to do well in school, Tibetans had the highest average (4.1), followed by those in Shenzhen (3.9) and Hunan (3.6). Again, the difference between Han and Tibetan teenagers is statistically significant ($z = -4.76,\ p > |z| = 0.00$). But this time, a significant result occurs between Hunan and Shenzhen students ($z = -3.59,\ p > |z| = 0.00$), as it does between Tibetan and Shenzhen students ($z = 2.06,\ p > |z| = 0.04$). This powerfully explains why students in Hunan were least likely to use ICT for academic purposes, for by far more students in Hengshan did not regard it as important to do well in school than those in Basum and Nanshan did, although more in Hengshan hoped to do well than those in Basum did.

	Optimal Coef.	Std. Error
Intercept	1.93	1.01
Hope to do well (`htdwell`)	-0.22	0.09
Negative views of *Wangba* (`cafe`)	0.02	0.10
Ethnicity (`minzu`)	-1.34	0.57
Parental education in years (`pe`)	-0.19	0.10
Interaction (`pande`)	0.11	0.07

Table 9.3: *Optimal coefficients – `minzu` is the numerical version of ethnicity; `pande` is the interaction (product) between parental education in years and numerical version of ethnicity.*

In the study, Tibetans did not just have the highest score in importance (4.1), but they were significantly less likely to report academic underachievement than Han students were. When analysing the data related to self-reported academic ranking in class, I can inversely code “Average” or higher as 0, “Below average” or lower as 1, and then create a binary outcome variable called `undera` to represent academic underachievement. Taking into consideration various correlation statistics pertinent to self-reported academic ranking, I use a number of explanatory variables (see line 390 of `R` codes in Appendix H) in a logit model to predict the outcome. The regression coefficients from the model using list-wise deletion is as reported in Table 9.2.

For the above logit regression model, I shall use i to denote the i^{th} observation. Since the outcome is either 1 or 0, and the probability of reporting a 1 is non-negative and bounded between 0 and 1, the stochastic and systematic components of the model can thus be written as: $Y_i \sim Bernoulli(\pi_i)$ and $\pi_i = (1+e^{-X_i\beta})^{-1}$, where $Y_i \perp Y_j$ for $i \neq j$, assuming all observations are independent. I can then derive the log-likelihood function from the model before implementing it in `R` as follows:

$$
\begin{aligned}
&L(\pi_i|y) \propto \prod_i^N (\pi_i)^{y_i}(1-\pi_i)^{1-y_i},\\
&lnL(\pi_i|y) = \sum_i^N y_i ln(\pi_i) + (1-y_i)ln(1-\pi_i),\\
&lnL(\beta|y) = \sum_i^N -y_i ln(1+e^{-X_i\beta}) + (1-y_i)ln(1-(1+e^{-X_i\beta})^{-1}),\\
&= -\sum_i^N ln(1+e^{(1-2y_i)X_i\beta}).
\end{aligned}
$$

Logit regression coefficients (e.g., the ones reported in Table 9.2) are more difficult to interpret than are those from linear models. In order to see the difference in outcome between Han and Tibetan students more intuitively in the logit model, I first use `R` to optimise the regression coefficients (as reported in Table 9.3) based on the above likelihood function. I then randomly draw 50000 coefficients from multi-variate normal distributions for all covariates, which are governed by the optimised coefficients and the covariance matrix from the maximisation process of the likelihood function. Finally, I compute the first differences in the probability of reporting academic underachievement (π) between Han and Tibetan students by holding constant all other covariates at their means or median values, which ensures the only difference is `minzu`, the numerical version of ethnicity, as shown in Table 9.4. The simulation result shows that Tibetan students are significantly less likely to report underachievement than their Han counterparts are (the mean difference of Tibetan − Han in probability is −0.17, with a 95% confidence interval of [−0.26, −0.04], which does not contain 0 for no difference, as illustrated in Figure 9.5).

	Intercept	`htdwell`	`cafe`	`minzu`	`pe`	`pande`
Han	1	4	2	1	9	9
Tibetan	1	4	2	2	9	9

Table 9.4: *Simulated first differences – see Table 9.3 for a full description of the same variables used in the simulation.*

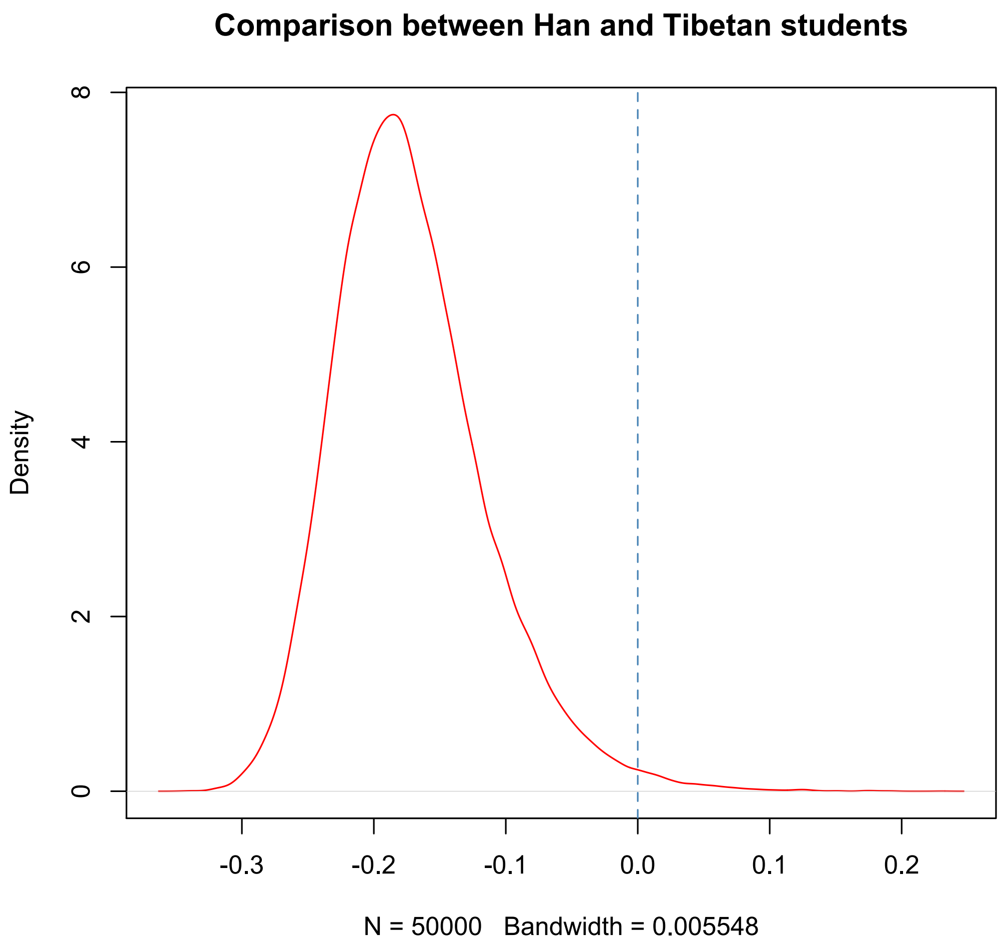


Figure 9.5: *Simulated first differences in the probability of reporting underachievement between Tibetan and Han Chinese students.*

By holding parental education constant at its mean of 9 for both Han and Tibetan students might be problematic in the simulation, for Han parents have on average 10.58 years of education, whereas that of their Tibetan counterparts is 5.48. A more appropriate approach is to compare the differences in the outcome variable between the two groups across all levels of parental education as observed in the study. In order to fully capture the differences, I divide years of parental education into 13 levels, with an increment of 1.5 years from 0 to 18. I then repeat the process as described above about the simulation of first differences. The final result is depicted in Figure 9.6. It shows that the probability of reporting underachievement decreases as parental education increases for all students. When it comes to the difference between Han and Tibetan students, the former are significantly more likely to report academic underachievement than are the latter. However, the differences between the two groups begin to attenuate when parental education reaches 10 years or so, and the 95% confidence intervals for the two groups overlap a lot beyond 12 years of education (high school), although Han students are still more likely to report underachievement than their Tibetan counterparts are. The finding thus illustrates that Han students with the least well-educated parents are the least likely to succeed in their studies.

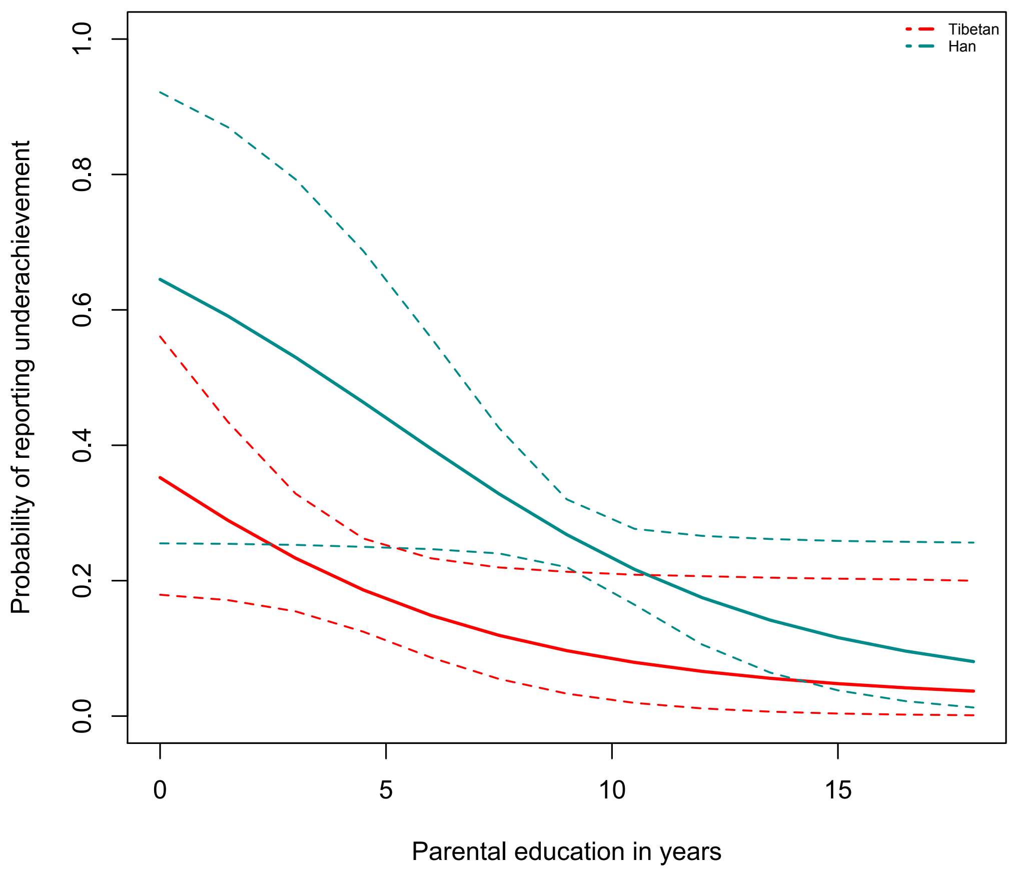


Figure 9.6: *Simulated first differences in the probability of reporting underachievement between Tibetan and Han Chinese students across all levels of parental education.*

It is also worth asking why the aforementioned differences in importance occur between the the groups. Within the scope of the study, it is rather difficult to fully account for the phenomenon. It is perhaps that education is more important for Tibetans in China to enhance life opportunities than it is for mainstream Han students. In other words, there are probably more opportunities for Han students – when they fail in education, they probably have more other options left. Nonetheless, I do not have enough robust evidence to support such an argument.

Although I cannot conclude that Han students have more life opportunities, I do have evidence to show that Han students have more sources of support (2.2) than Tibetans have (1.8) when they encounter difficulties in using ICT. When the sources of support are compared across the schools, as shown in Figure 9.7, Basum remains at the bottom, with Hengshan at 1.94 in the middle and Nanshan leading at 2.5. A closer look at the box plots indicates that the first quartile of Shenzhen (2.00), the mean of Hunan (1.94), and the third quartile of Tibet (2.00) are on almost the same horizontal line, suggesting the distance between two neighbouring schools differ by a quarter on average. This pattern re-emerges in the summary statistics about sources of support, as reported in Table 9.5.

So far, I have examined the distributions of students' academic and non-academic use of ICT, and I know that they are skewed to the right. But I do not know how the distributions look like, neither do I know much about the distribution of students' total ICT activities, which is the combination of the above two types of activities. I would expect the new variable's distribution to have similar characteristics, that is to say, it should be skewed to the right too, for the combination is a linear transformation. Before I plot the three distributions together for comparison, it is worth noting that this new variable does not distinguish academic from non-academic use of ICT, and it simply adds up all the activities one does with ICT, be they academic or not.

	Min.	1^{st} Qu.	Median	Mean	3^{rd} Qu.	Max.
Tibet	0.00	1.00	2.00	1.79	2.00	5.00
Hunan	0.00	1.00	2.00	1.94	3.00	5.00
Shenzhen	0.00	2.00	3.00	2.53	3.00	5.00

Table 9.5: *Reported sources of support by school*

Summary statistics of the new variable reveal that the mean score across the schools

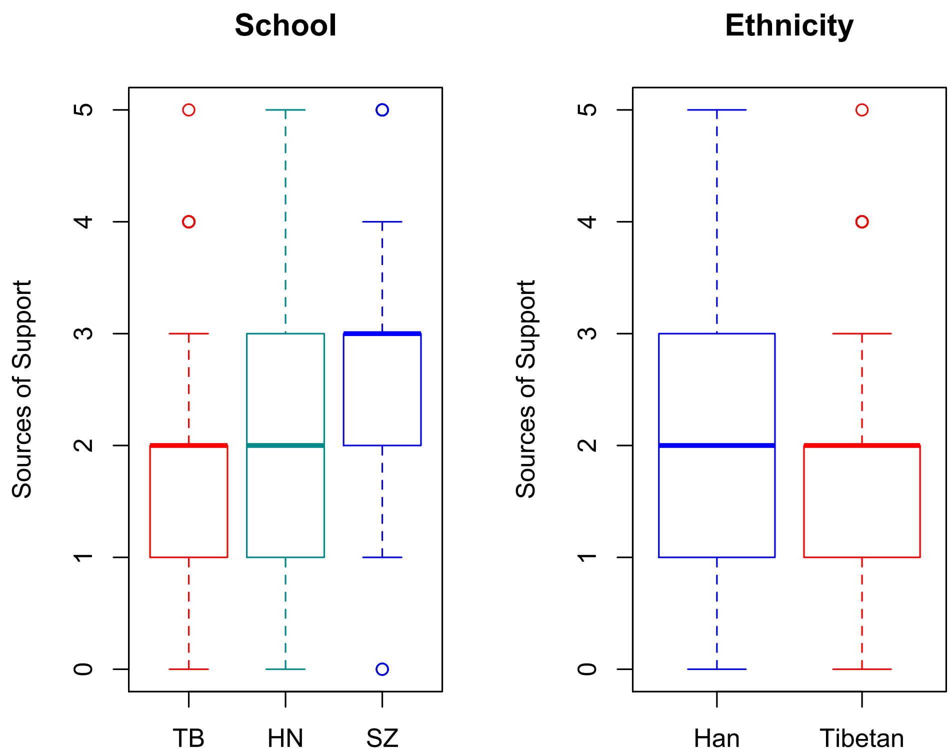


Figure 9.7: *Side-by-side box plots comparing sources of support between ethnic groups and different schools – TB, HN, SZ in the left box stand for Tibet, Hunan, and Shenzhen respectively.*

is 5.45, and its minimum and maximum values are 0 and 18 respectively. As shown in Figure 9.8, the Kernel density plots of the three distributions illustrate that the new variable resembles the distribution of non-academic Internet activities, but the distribution for the academic use of ICT is anything but normal.

Since I have compared both academic and non-academic use of ICT among the schools and between mainstream Han and Tibetan students, I am not going to repeat the comparisons here with the new variable along students' socioeconomic and ethnic profiles. But I will examine the new variable when I am not concerned with the types of activities but primarily interested in how many activities students do with ICT. For instance, I know key class, Han, and Arts students, as well as those with parents having high

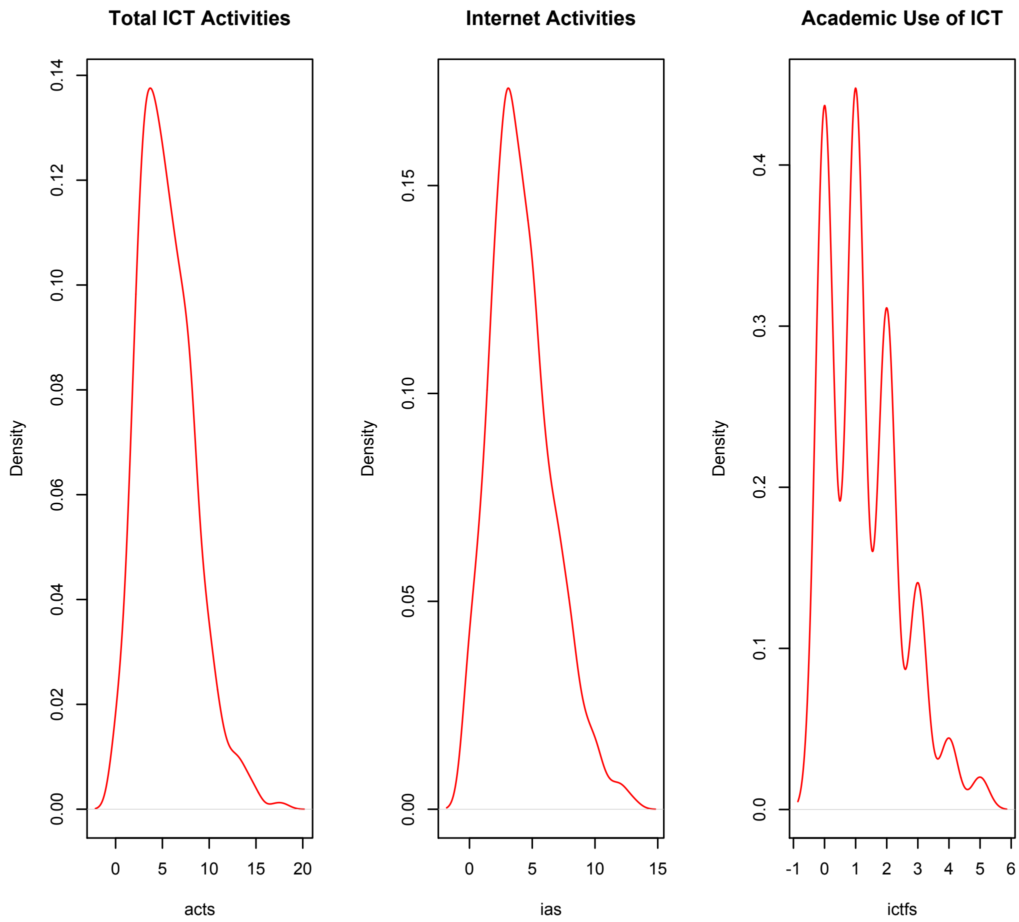


Figure 9.8: *Density plots of different activities with ICT*

school or above education engage with a wider range of activities than do Ordinary class, Tibetan, and Science students, as well as those with parents having lower than high school education. I also notice from the box plots in Figure 9.9 that Shenzhen students do more with ICT than those in Hunan and Tibet do.

However, male and female, Basum and Hengshan students do not differ significantly in their total activities with ICT, suggesting again that the gender gap is narrowing, and that Tibetan as well as rural students in the study are equally disadvantaged in terms of the possible benefits associated with activities in cyberspace. Next, let me examine in detail how track (Arts vs. Science) and attainment status (Key vs. Ordinary) relate to the differences in access and use.

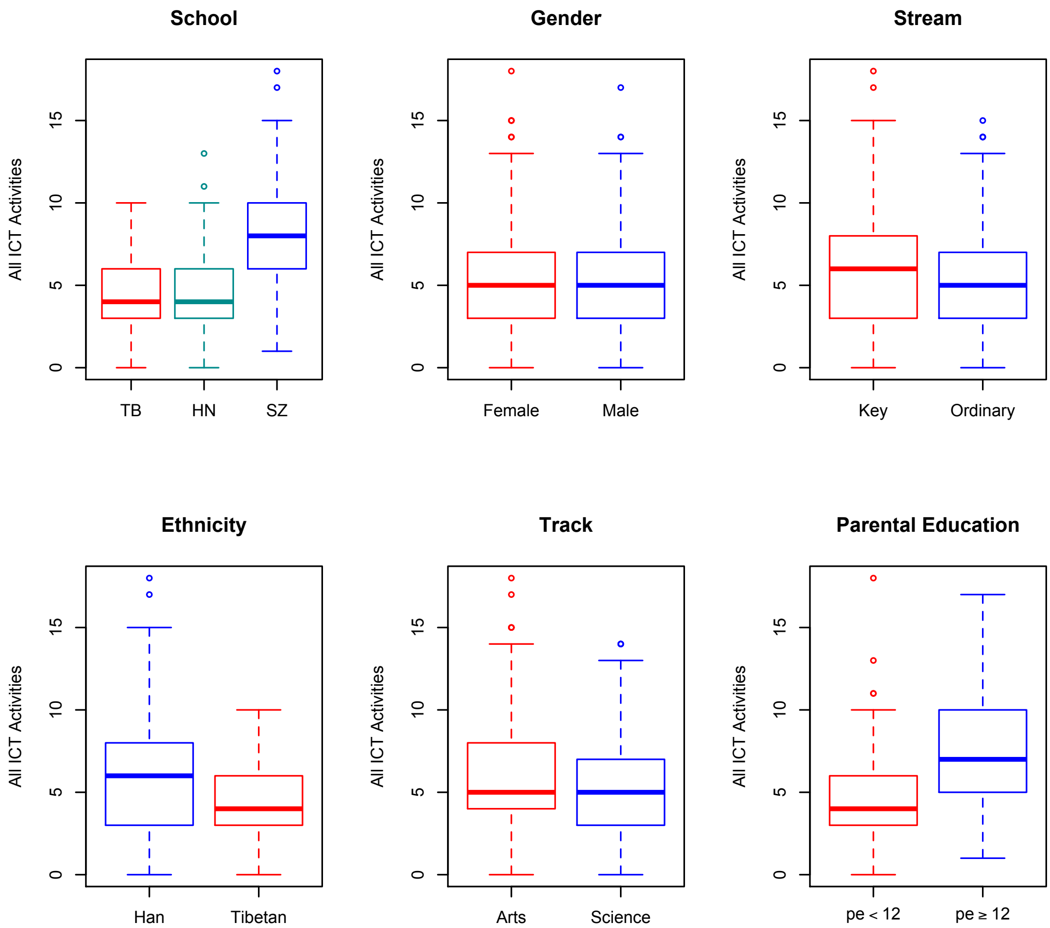


Figure 9.9: *Box plots comparing total number of activities with ICT by different groups – TB, HN, SZ in the top left box stand for Tibet, Hunan, and Shenzhen respectively;* `pe` *in the bottom right box refers to parental education in years, which is made a binary variable, with values smaller than 12 years or not.*

As illustrated in Figure 9.4, the means in overall access to ICT between Arts and Science students are similar (3.76 vs. 3.65 respectively; $t = 0.69$, p-value $= 0.49$). However, there are statistically significant differences between the two groups in all measures of activities with ICT, be they academic ($t = 3.31$, p-value $= 0.00$), non-academic ($t = 2.22$, p-value $= 0.03$; see Figure 9.1), or overall ($t = 3.19$, p-value $= 0.00$), with Arts students leading, on average, in all aspects (1.41 vs. 1.12 for academic activities with ICT; 4.43 vs. 4.01 for non-academic Internet activities; 5.84 vs. 5.13 for total activities with ICT).

When I examine how attainment status correlates with the above outcomes, I can find between Key and Ordinary students similar means in their overall access to ICT (3.82 vs. 3.59 respectively; t = 1.40, p-value = 0.16) and non-academic use of the Internet (4.37 vs. 4.04 respectively; t = 1.73, p-value = 0.08). However, the two groups vary considerably in means for academic use of ICT (1.35 vs. 1.16 respectively; t = 2.14, p-value = 0.03) and overall ICT activities (5.72 vs. 5.2 respectively; t = 2.31, p-value = 0.02), with Key class students leading this time. This is what I would expect, for academically competent students are supposed to focus on their "proper" business of "learning," as reflected in Sections 1.1, 6.1.1, and 7.2 of the qualitative data, "good" students often disdain frequent visits to *wangba* and can usually refrain from unnecessary use of mobile phones.

9.4 Supplementing the visual evidence with test statistics

As we can see from the box plots listed so far, there are significant differences in total activities with ICT between Han and Tibetan, Key and Ordinary class, as well as Science and Arts students. Are these differences due to chance alone? In other words, the results I get may happen to be the attributes of the samples I selected for the study. Do those students not sampled share the same attributes? To what extent can I claim that certain groups of students are advantaged whereas others are disadvantaged in the digital domain? To answer such questions, let me first assume that there are no significant differences between the groups that I have found to be different in their total activities with ICT.

	t-score	p-value
Han vs. Tibetan	7.0873	0.0000
Key vs. Ordinary	2.3057	0.0214
Arts vs. Science	3.1875	0.0015
Female vs. Male	0.6832	0.4947
Hengshan vs. Nanshan	-13.2462	0.0000
Basum vs. Nanshan	-13.5174	0.0000

Table 9.6: *t-tests of total activities with ICT between different groups*

I then run a series of statistical tests to see the real differences in total activities with ICT between groups of interest. All test statistics are reported in Table 9.6. However, it is necessary to explain what those results mean and imply in the context of the study. First, if I assume that Han and Tibetan students are engaging with a roughly equal number of activities with ICT and the difference I found earlier simply occurred by chance alone. From the statistics computed in `STATA` concerning the two groups, I know that Han students have a mean score of 5.9, higher than 4.4 of Tibetan students. Is this difference significant enough? To answer this question, I need to know first whether the two groups have equal or similar variances by running a Robust Equal Variance Test. The result allows me to reject the null hypothesis that the two groups have equal variances ($Pr > F = 0.0000$). Therefore, I should run the two-sample t-test with unequal variances. The result indicates that the probability of getting a t-score at least as extreme as 7.09 is about 1 out of $10,000$. I can thus reject the null that Tibetan and Han students are engaging with a roughly equal number of activities with ICT. In fact, Tibetans are using their ICT for a significantly smaller number of activities. Therefore, the difference is not due to chance alone, and a significant difference *does* exist between the two true population means. Since the sample size in the study is quite large and fairly representative, I can conclude with confidence that Tibetan high school students use ICT for fewer activities than do their Han counterparts.

Next, let me see if such a difference exists between Key and Ordinary class students. First, the Robust Equal Variance Test informs me that the two groups have similar variances ($Pr > F = 0.19$), I should run the t-test with equal variances. If I assume that Key and Ordinary class students engage with an equal number of activities in cyberspace, I need to test this hypothesis against its alternative hypothesis that their true numbers of activities are not equal. The result shows that if no difference exists between the two groups, the probability of obtaining a t-score at least as extreme as 2.31 is about 2 out of 100. This is still very unlikely at the conventional significance level of $\alpha = .05$. I can therefore reject the null hypothesis that there is no difference in true numbers of total activities with ICT between Key and Ordinary class students. In fact, Ordinary class students use their ICT for fewer activities than Key class students do.

Again, similar tests reveal that Arts and Science students have equal variances ($Pr > F = 0.26$) in this item, and the two-sample t-test reports a significant difference between the two groups in their number of total ICT activities ($t = 3.19$, and $p = 0.0015$). Actually, Arts students use ICT for more activities than do their Science counterparts.

Although I have concluded that the gender difference is not significant in the study, it is worth testing the claim. As shown in the Robust Equal Variance Test, the variances in Males and Females are similar ($Pr > F = 0.72$), I therefore run the two-sample t-test with equal variances. Unsurprisingly, the result does not report a significant difference ($t = 0.68$, and $p = 0.49$) between the two groups in total activities with ICT. I am thus confident to conclude that Males and Females use their ICT for similar number of academic and non-academic activities.

The statistics I have computed so far clearly reinforce the visual evidence I found and presented earlier. However, it is drawing my attention that the biggest difference is the one between Tibetan and Han students ($t = 7.09$, and $p = 0.00001$). This result prompts me to ask if the difference between rural and urban schools is bigger than that between Han and Tibetan students. Let me test the assumption that no significant difference exists between Nanshan (an urban school) and Hengshan (a rural school).

First, the Robust Equal Variance Test reports unequal variances in the distributions of total ICT activities between the two schools ($Pr > F = 0.002$), I need to run the t-test with unequal variances. The test statistics reveal that the difference between the rural and urban schools is even bigger ($t = -13.25$, and $p = 0.00001$) than that between Han and Tibetan students. In fact, Hengshan students use ICT for significantly fewer activities than their urban counterparts do in Nanshan. From the box plots I plotted earlier in Figure 9.9, I can see that no significant difference exists between Basum and Hengshan, how about the difference between Basum and Nanshan? Is it bigger than that between Hengshan and Nanshan as reported above? Let me run another round of tests to see the differences.

From the Robust Equal Variance Test between Basum and Nanshan, I know that the variances in the two schools are unequal ($Pr > F = 0.0002$). The two-sample t-test produces a set of statistics ($t = -13.52$, and $p = 0.00001$) that are almost identical to those from the test between Hengshan and Nanshan. I can therefore conclude with confidence that Tibetan and rural students are equally disadvantaged in terms of the potential benefits associated with their use of ICT in and out of schools.

	t-score	p-value
Han vs. Tibetan	7.1320	0.0000
Key vs. Ordinary	2.2588	0.1054
Arts vs. Science	3.1870	0.0206
Female vs. Male	0.6604	0.4377
Hengshan vs. Nanshan	-13.3181	0.0000
Basum vs. Nanshan	-13.6088	0.0000

Table 9.7: *The same t-tests iterated 1000 times*

9.4.1 Differences based on 1000 bootstrapped datasets

I have concluded thus far that significant differences in total ICT activities exist between all but the groups defined by gender and attainment status. However, it is worth noting that, by chance alone, some tests will report significant results when I run many (see Sakoda, Cohen, & Geoffrey, 1954). In that case, on what grounds can I rule out the probability that no results reported in Table 9.6 actually occurred by chance?

Since it is now impossible for me to go back and survey more students from more schools for the same study, one way to boost my confidence in the conclusions I made is to bootstrap my actual sample many, say 1000, times – to re-sample 1000 times with equal size and replacement from the sample I actually observed in `R`.* This process therefore generates 1000 datasets as if I did the same fieldwork 1000 times. With each data set, I run exactly the same t-tests as I did earlier. I then store the test statistics for each pair of groups, which leaves me with 1000 pairs of t-scores and p-values. With the simulated results, I now have more confidence in the belief that the means of those t-scores and p-values are most likely to represent the true differences in the population.

Upon comparing the results reported in Tables 9.6 and 9.7, I notice that only one pair are not consistently significant in both sample and simulated datasets, and they are Key and Ordinary class students. This means that the significant result for this pair I obtained earlier might be due to chance alone. With other simulated results confirming what I found for other groups, I am even more confident than I was that no significant difference in total ICT activities exists between males and females, and that significant ones do exist between groups defined by other variables as shown in Table 9.7.

* To ensure I obtain the same results in future replications, the seed I set in `R` for all simulations I run in the study is 1405973792, my QQ number.

9.5 An ideal model to predict the outcome

9.5.1 Outcome definition and regressor selection

viscafe −0.29	freecafe −0.21	handsets 0.08	phbill 0.03	ictp 0.07	freeph 0.03
pe 0.25	icts 0.20	icth 0.28	ictsch 0.07	acts 0.91	ictfs 0.18
support 0.14	rank −0.01	imptdwell 0.01	understd 0.04	cdwell 0.02	htdwell 0.05

Table 9.8: *Covariates correlating with the number of Internet activities in varying degrees – please see Appendix D.1 for a complete description of the covariates appearing in the table.*

Since the study is primarily concerned with the differences in access to and use of ICT within and between the three schools, it is expected that the broader sociocultural contexts of the schools and the socioeconomic profiles of the students would somehow correlate with certain outcomes of interest. While student ethnic background and school location are indicative of the macro-contexts, parental education is utilised to measure the micro-profiles of individuals in the study.

As for the outcome variable, I choose the number of non-academic Internet activities. This variable is better than academic use of ICT and total ICT activities partly because the distribution of academic activities is not even approximating normality, as shown in Figure 9.8. Although the distribution of total ICT activities resembles that of non-academic Internet activities, it is created by the linear combination of academic and non-academic use of ICT, where the latter is also troubled with the question of "what constitutes 'academic use' of ICT in the study?" As explained in Section 9.3, it is "academic" only in that it is related to school work, however students actually use them. Moreover, the three schools are not really incorporating ICT into their ways of teaching in consistent ways, for instance, Basum in Tibet did not even have an official website.*

Figure 9.1 examined the relationship between the number of Internet activities and categorical variables such as gender and ethnicity. To understand how the interval level outcome variable correlates with other continuous variables, I need to run a series of

* They decided to shut it down after their site was hacked.

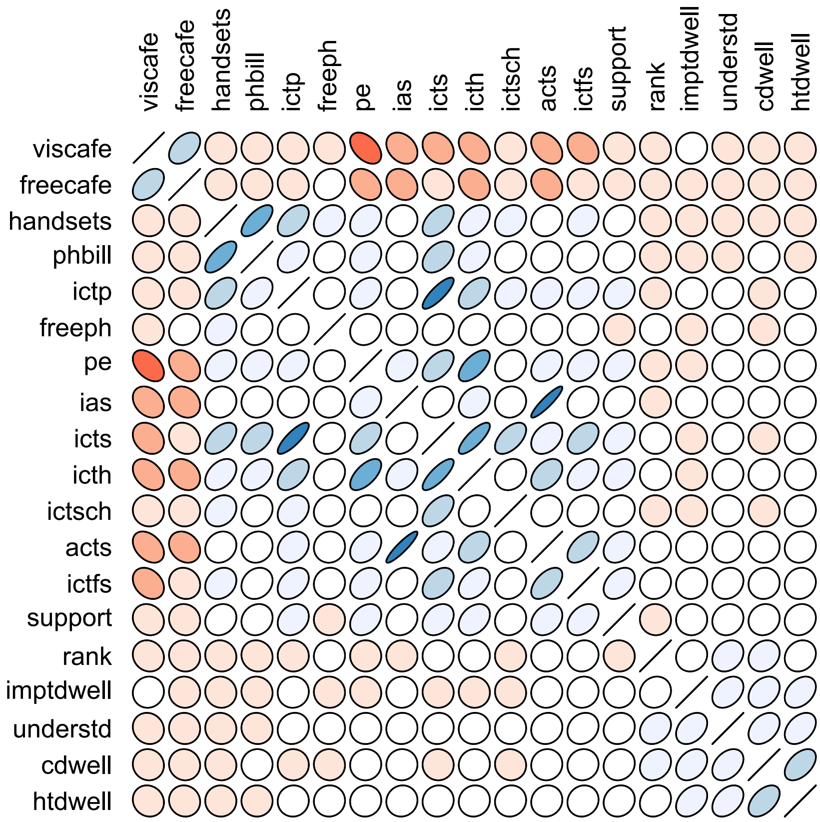


Figure 9.10: *Covariates correlating with the number of Internet activities in varied patterns – please see Appendix D.1 for a complete description of all the covariates appearing in the matrix.*

Spearman* correlation tests in R. To better illustrate the relations in question, I then draw an Ellipse Plot to represent the resulting correlation matrix.

As shown in Figure 9.10, the outcome variable, the number of Internet activities, correlates quite well with how often students visit *wangba*, how free they can visit *wangba*,

* It does not assume variables are interval and normally distributed; however, it does require that they are ordinal.

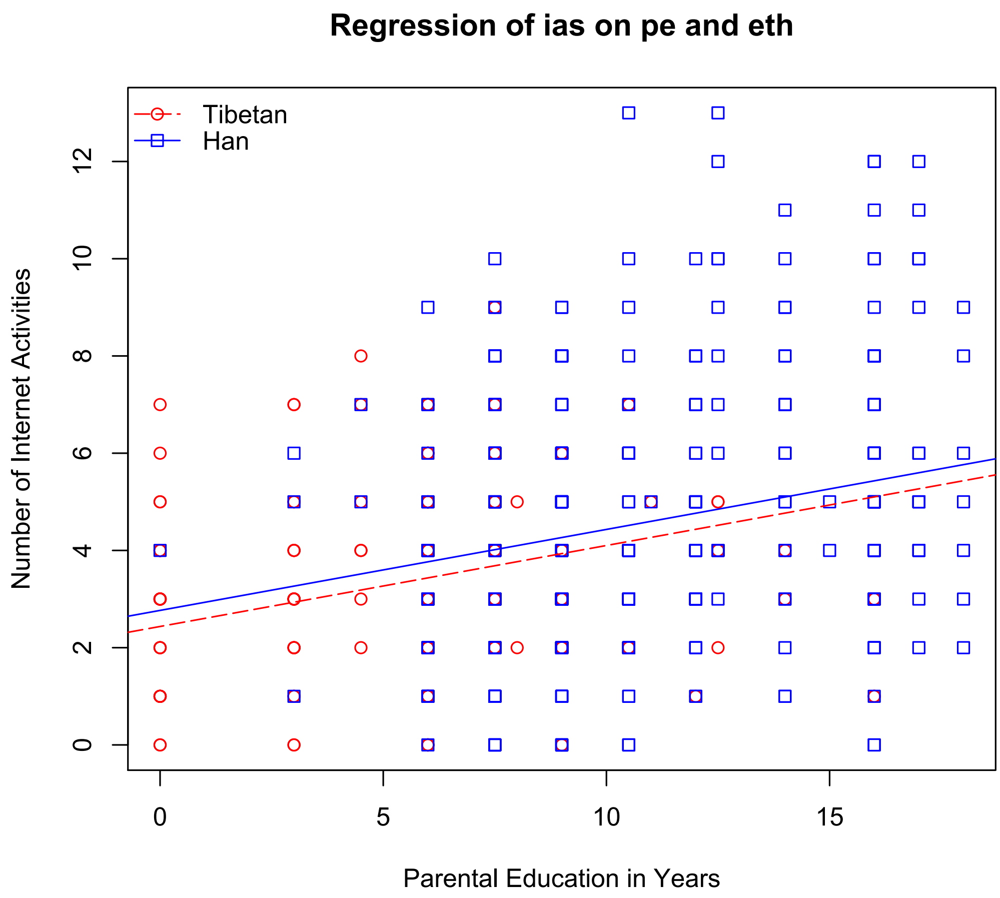


Figure 9.11: *Using parental education (`pe`) and ethnicity (`eth`) to linearly predict reported number of Internet activities in an additive model, which results in two parallel regression lines, one for Han (solid blue), and the other (dashed red) for Tibetan students.*

parental education in years, overall access to ICT, and home access to ICT. It correlates even better with total ICT activities and perfectly well with itself. How often students visit *wangba* and how free they can visit *wangba* are two strongly correlated variables, as are overall and home access to ICT, so I can just add one of the two pairs to a linear model as predictors of the outcome. Adding total ICT activities has the problem of collinearity. As the darkness of the colours represents varying degrees of correlation, what I really want is those ellipses with some colour, either in blue (positive correlation) or red (negative correlation). I do not need circles either, for they represent no or very weak correlations. Nevertheless, the correlation matrix exhibits the same information

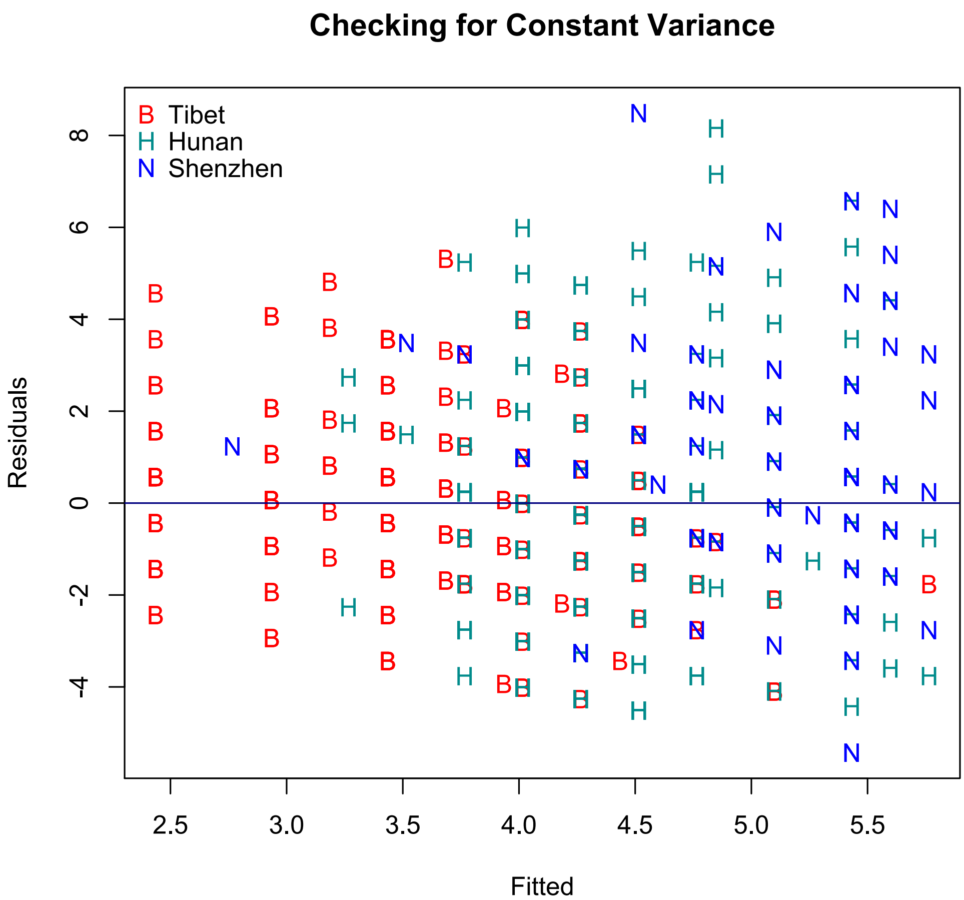


Figure 9.12: *Variances of the additive model*

as those correlation coefficients do in Table 9.8. That said, they are equally indicative of which explanatory variables I should use for a linear regression model.

9.5.2 Testing the additive model

Upon examining the correlation matrix in Table 9.8, I know that how often students visit *wangba*, parental education in years, and home access to ICT can predict the number of Internet activities reasonably well. Meanwhile, Figure 9.1 reminds me that Internet activities also differ in significant ways between several groups defined by categorical variables such as ethnicity. Since I am concerned with the differences *between* and *within* the schools, a good model should take into consideration all the points raised above. By repeating the process discussed in Section 5.5.2 about model selection, I first render

Model 9.1 an efficient enough one to predict the number of Internet activities:

$$ias \sim pe + eth \tag{9.1}$$

That is to say, the number of Internet activities can be efficiently explained by parental education and ethnic background. According to the summary statistics of the regression model in Table 9.9, being ethnic Tibetan is not statistically associated with the outcome variable ($t = -1.26$, p-value $= 0.21$), whereas the association between the outcome variable and being mainstream Han is significant at $\alpha = .001$, so is the relationship between the number of Internet activities and parental education (significant at $\alpha = .001$).

This model assumes that the difference in outcome between Han and Tibetan students is constant for each level of parental education, with Han students using ICT for 0.33 more activities on average. Figure 9.11 captures the feature quite well, as we can see, the two regression lines for Han and Tibetan students are parallel to each other, but the vertical distance between the higher blue line for Han and lower red line for Tibetan is constant. While this additive model accounts for the difference in outcome associated with ethnicity and illustrates that the number of Internet activities has an increasing linear relationship with parental education for both groups, it is inadequate to explain the subtle deviations of the regression lines from the observed patterns in the data, for a closer examination of Figure 9.11 reveals that the red line has been lifted upwards while the blue one shifted downwards, which do not fully reflect how the data are really distributed.

	Estimate	Std. Error	t-value	$Pr(>\|t\|)$
Intercept (Being Han)	2.77	0.32	8.68	0.00
Parental education	0.17	0.03	5.93	0.00
Being Tibetan	-0.33	0.26	-1.26	0.21

Table 9.9: *Regression coefficients of the additive model*

To more thoroughly understand how well Model 9.1 fits the data, I should also check, as I did in Section 5.5.3, if the assumptions underlying the linear regression model have been met. First, the residuals from the regression model seem to be spinning out in Figure 9.12 – as the expected values get bigger, so do the variances. This violation is confirmed by the test statistics of the constant variance test (F = 11.79, p-value = 0.001). Since the null is constant variance, I do have enough evidence to reject it; therefore, the assumption is not met.

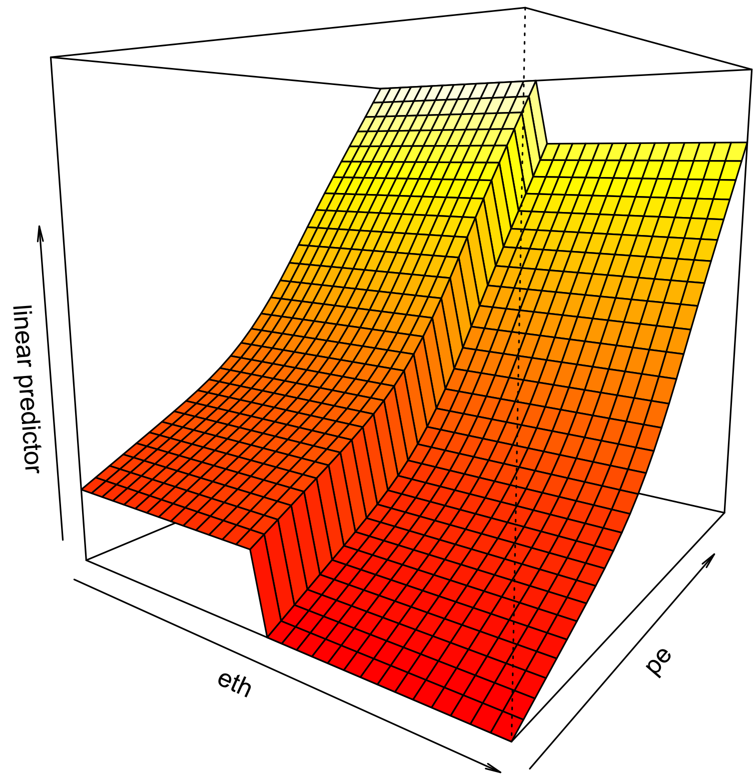


Figure 9.13: *Linearity of the additive model –* `pe` *is parental education in years,* `eth` *is ethnicity,* `linear predictor` *is the predicted value of the outcome variable, namely, the number of non-academic Internet activities (*`ias`*).*

Now I need to check for normality and linearity. The Shapiro-Wilk Normality Test produces a p-value of 1.08×10^{-6}, suggesting the normality assumption has been violated. As for linearity, the 3-D smooth plot of the residuals, as shown in Figure 9.13, depicts the relationship between the outcome and its predictors in the model quite well. As we can see, the outcome does have an increasing relationship with parental education, and the Han group has a higher level. But the surface of the two levels are not flat. It seems that parental education has a stronger correlation with the number of Internet activities as its values increase. Therefore, a more versatile model should be identified.

9.5.3 With an interaction, the model fits the data better

	Estimate	Std. Error	t-value	$Pr(>\|t\|)$
Intercept (Being Han)	2.20	0.37	5.99	0.00
Parental education	0.22	0.03	6.70	0.00
Being Tibetan	0.99	0.50	1.97	0.05
`pe:ethTibetan`	-0.19	0.06	-3.08	0.00

Table 9.10: *Regression coefficients of the interactive model – `pe:ethTibetan` is the interaction between parental education and being Tibetan.*

As discussed in Section 9.5.2, the additive model has the limitation of artificially inflating the magnitude of correlation between the number of Internet activities and being Tibetan while deflating the one between the outcome and being mainstream Han. It also assumes the difference in outcome between Han and Tibetan students is the same across all levels of parental education. But in fact, as shown in Figure 9.13, the degree of correlation between parental education and the number of Internet activities is not constant – higher levels of parental education are more strongly associated with the outcome than are lower ones. It means both parental education and ethnicity have a bearing on the number of Internet activities at the same time. In other words, Model 9.1 should include an interactive term of the two predictors, which makes Model 9.2:

$$ias \sim pe + eth + pe \times eth \tag{9.2}$$

Let me explain how the interactive model performs by interpreting the regression coefficients reported in Table 9.10. This time, all terms are significantly correlated with the outcome variable, and the overall model is linearly adequate to fit the data ($F = 24.79$, on 3 and 579 degrees of freedom; p-value $= 4.19 \times 10^{-15}$). The intercept is 2.20, which is the expected number of Internet activities for Han students whose parents have no formal education. Relative to Han students, Tibetans with parents having a similar educational background actually use the Internet for almost one more activity on average. However, as parental education increases, Tibetans begin to lag behind, for the strength of correlation between the outcome and being Han, as indicated by the slope of the blue line in Figure 9.15, is much bigger than that between the outcome and being Tibetan, as indicated by the slope of the red line. Figure 9.15 also shows the vertical distance between the two regression lines across all levels of parental education is no longer constant. It first decreases until around six years of parental education, then increases as parental education increases. This change implies being Han has a stronger correlation with the outcome at either end of parental education, whereas the magnitude of correlation between the outcome and being Tibetan is relatively stable.

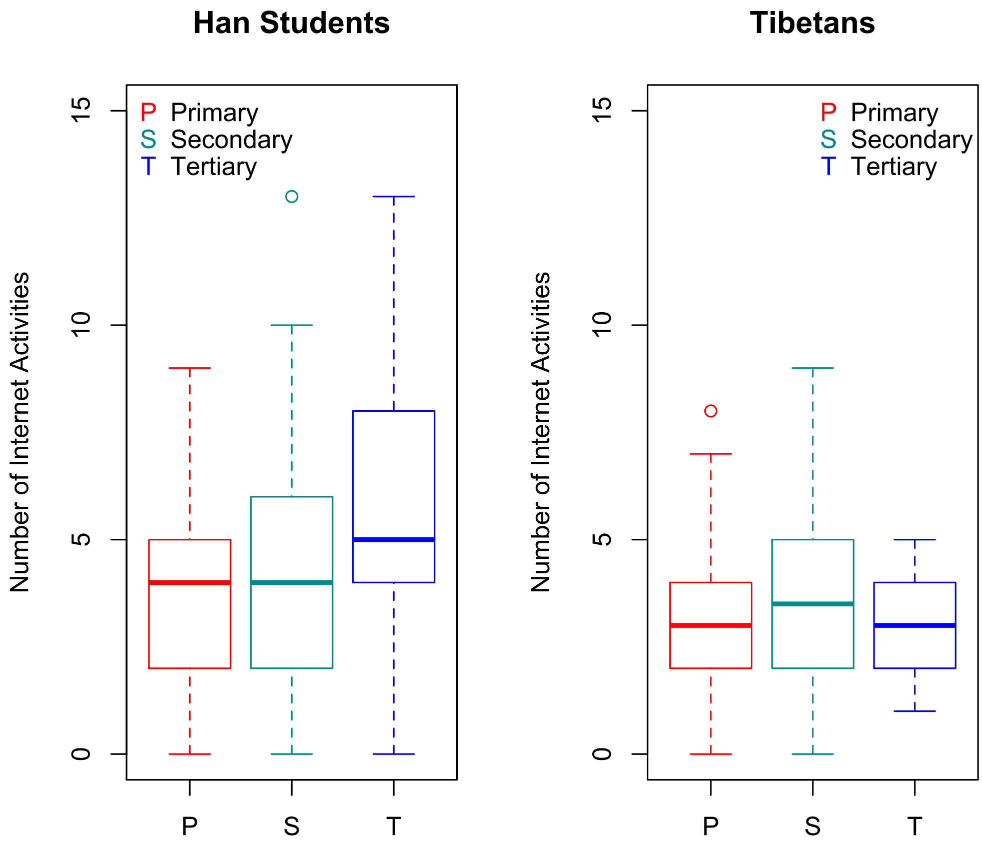


Figure 9.14: *Parental education and outcome by ethnicity – Side-by-side box plots comparing the strength of correlation between parental education level and the number of Internet activities. As we can see, higher education has a by far stronger correlation with the outcome in question for Han students than it has for Tibetans.*

Also reported in Table 9.10, the expected difference in outcome between two mainstream Han students with one year difference in parental education is 0.22; but for Tibetans, the average difference is only $0.22 - 0.19 = 0.03$, suggesting the return to parental education – provided children's Internet activities are indicative of the quantity of interest – is by far smaller for Tibetans than it is for the mainstream Han, as visually illustrated in Figure 9.14. This further reveals that Tibetans are disadvantaged, but the most disadvantaged are Han students with parents having no more than six years of education, leaving urban Han youths the most privileged in terms of ICT. Figure 9.15 depicts the above relations quite well. The above results are based on the observed dataset with list-wise deletion in analysis, but they are consistent across all datasets with imputed missing values, as shown in Table 9.11.

	Mean Imp.			Reg. Imp.			`Amelia` ($m = 10$)		
	$\hat{\beta}$	se	p	$\hat{\beta}$	se	p	$\hat{\beta}$	se	p
`Intercept`	2.36	0.35	.00	2.07	0.35	.00	2.27	0.36	.00
`pe`	0.21	0.03	.00	0.23	0.03	.00	0.22	0.03	.00
`ethTibetan`	0.88	0.49	.07	1.04	0.48	.03	0.82	0.48	.09
`pe:ethTibetan`	-0.21	0.06	.00	-0.20	0.06	.00	-0.18	0.06	.00

Table 9.11: *Regression coefficients of the interactive model based on datasets imputed from three different imputation methods, namely, mean imputation, regression imputation, and multiple (10) imputation in `Amelia` II – `Intercept` refers to Han students, `pe` is parental education, `ethTibetan` stands for Tibetan students, and `pe:ethTibetan` is the interaction between parental education and being Tibetan.*

To find more robust evidence for the conclusions made above, I can also simulate in `Zelig` 1000 times the first differences in the outcome variable of Model 9.2 between Han and Tibetan students by holding constant all relevant variables in Figure 5.6 at their means or median values. The result produced in `R` is 0.85, suggesting Han students on average engage with the Internet for 0.85 more purposes than do their Tibetan counterparts, given they all come from similar socioeconomic backgrounds. But when I control for ethnicity and compare the outcome within Han and Tibetan students who differ only in parental education (between 0 and 18 years), the simulated first differences are 0.64 and 3.90 for Tibetan and Han students respectively, indicating the divide within mainstream Han students is over six times bigger than it is within Tibetans and four times bigger than that between Han and Tibetan students. Considering the maximum level of observed parental education in Tibet is 16, I shall re-run the simulations between 0 and 12 years of parental education within Tibetan and Han students. This time, the means of those differences-in-means are 0.43 and 2.60 for Tibetan and Han students respectively, and the divide within the mainstream Han is still six times bigger than that within Tibetans. Nonetheless, it is worth bearing in mind that being digitally (dis)advantaged does not mean (dis)advantage in other aspects of life, which are beyond the scope of the research.

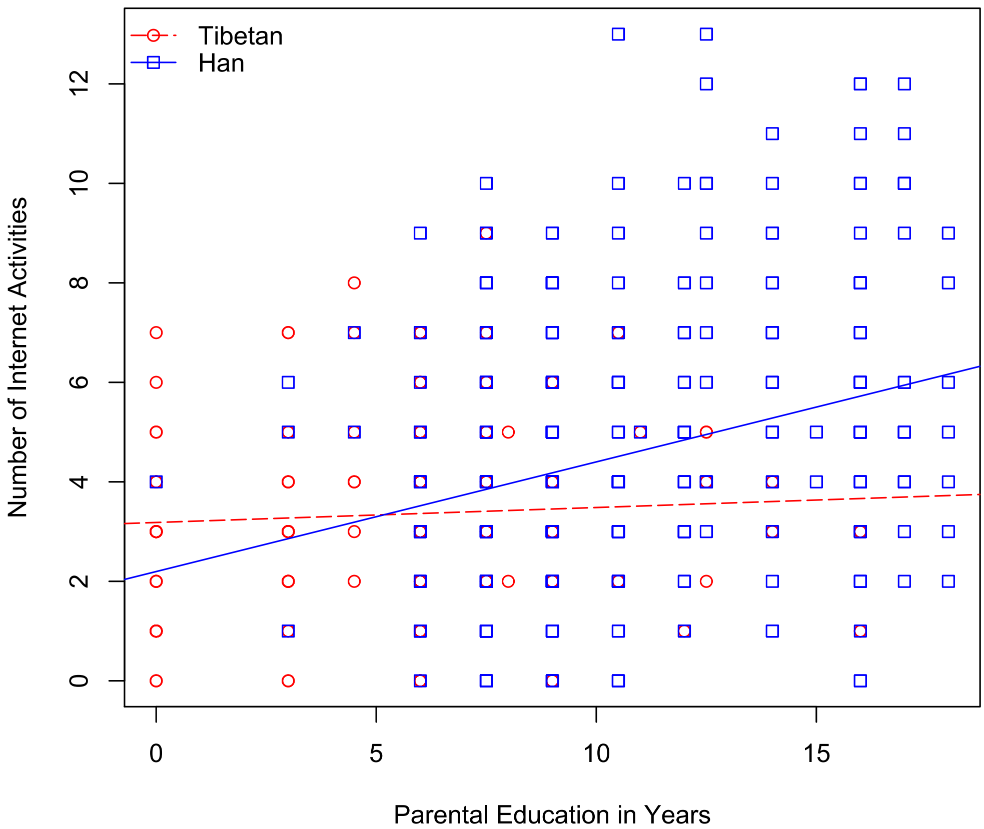


Figure 9.15: *Using parental education (`pe`), ethnicity (`eth`), and their interaction to linearly predict reported number of Internet activities in an interactive model, which results in two intersecting regression lines, one for Han (solid blue), and the other (dashed red) for Tibetan students.*

9.5.4 Testing the interactive model

As I did in Section 9.5.2, I should also check if the assumptions of the interactive model have been satisfied. As shown in Figure 9.16, the variance seems to be constant for residuals from Model 9.2. However, the test results of residuals vs. fitted values report otherwise, with an F-score of 11.13 on 1 and 581 degrees of freedom, and an associated p-value of 0.0009, suggesting the constant variance assumption has been violated at

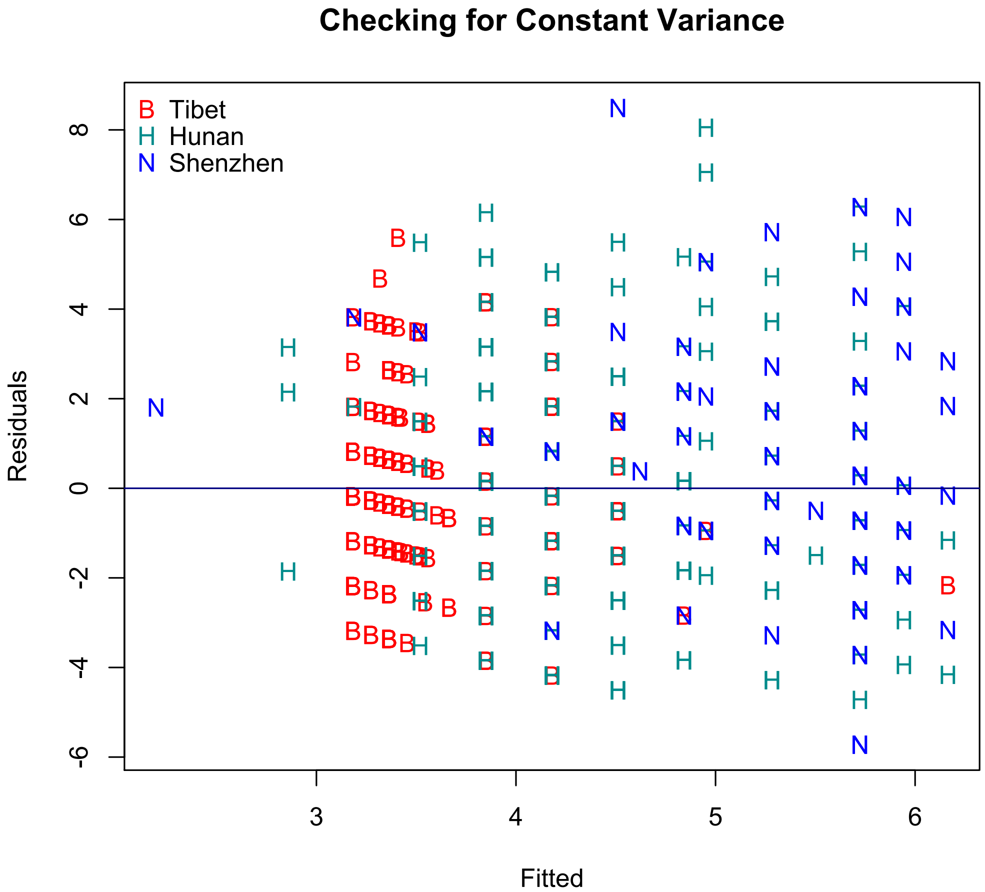


Figure 9.16: *Variances of the interactive model*

$\alpha = .05$. As for the assumption of normally distributed residuals, the Shapiro-Wilk normality test also reports a violation ($W = 0.98$, p-value $= 1.09 \times 10^{-6}$). However, the partial residual plot indicates that the linearity assumption has been satisfied, with the p-values for both tests of the whole model and of the continuous variable `pe` (parental education) being non-significant at 0.5 and 0.6 respectively. These results are consistent with the visual evidence shown in Figure 9.17.

9.5.5 Why is the interactive model still unbiased?

Despite the above violations, the point estimates of the interactive model are still unbiased. This is the case partly because of the possibility for me to relax, as discussed in Section 5.5.3, some of the assumptions for linear models due to a relatively large sample

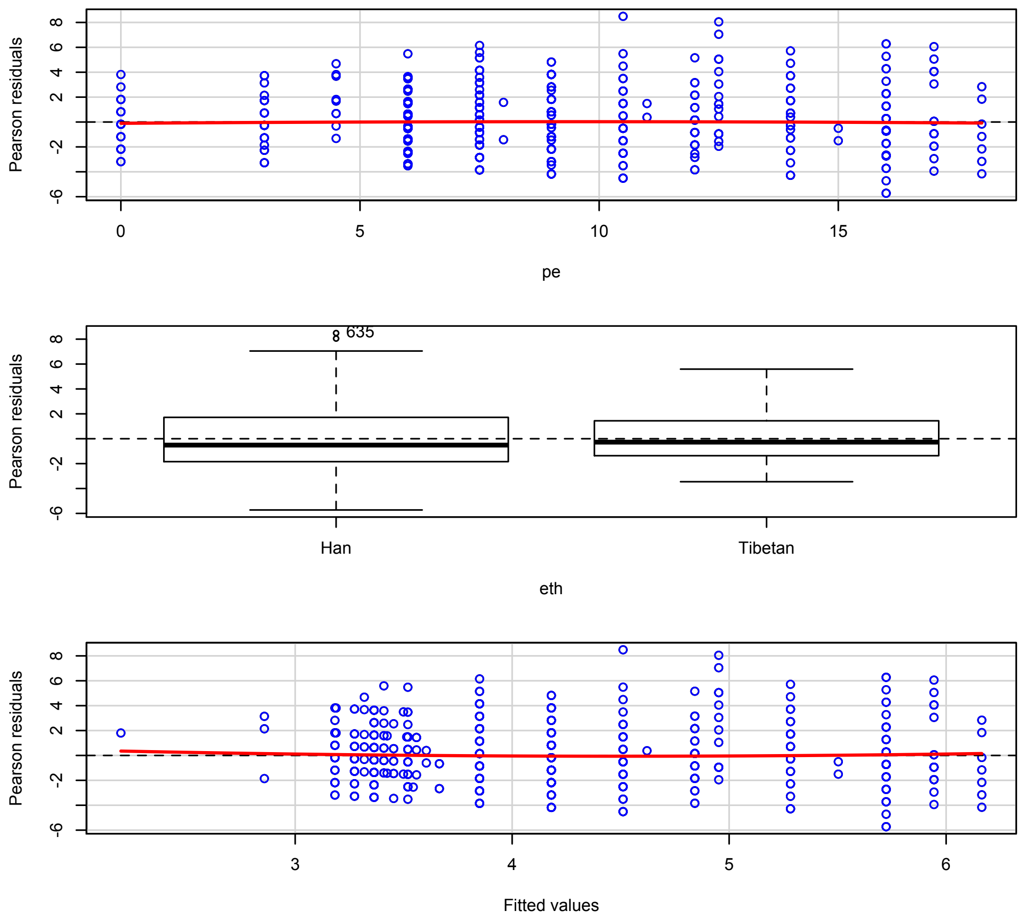


Figure 9.17: *Linearity of the interactive model – `pe` stands for parental education, `eth` is ethnicity.*

size. But more compellingly, I can utilise simulations through bootstrapping, as detailed in Section 9.4.1, to demonstrate that the claim made above is sound. Moreover, it is necessary to do this when the visual evidence and test statistics presented in Section 9.5.4 diverged.

Like the process shown in Section 9.4.1, the following simulations will use the same seed of 1405973792 and the size of each re-sample will still be equal to that of the real sample in the study. Unlike the procedure described in the above-mentioned section, the simulations that follow will try different numbers of iterations. In other words, instead of using 1000 straight away, the re-sampling here will start from 15 iterations,

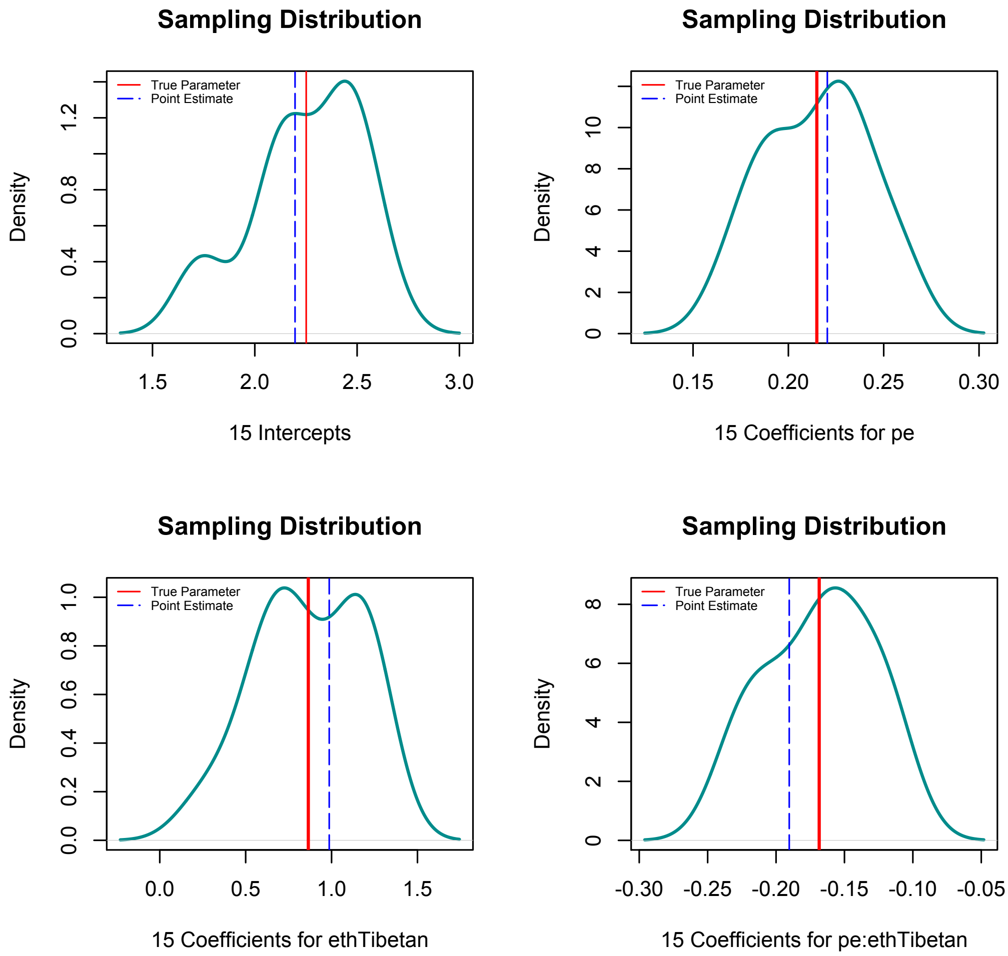


Figure 9.18: *The regression coefficients are derived from the interactive linear model (9.2) being applied to each of the 15 bootstrapped datasets. The four sets of coefficients thus have their own unique distributions with their means as the true coefficients (solid red vertical lines). For a detailed description of the coefficients, please see Table 9.10.*

then proceed to 30, and finally set at 1000. The outputs from such an approach thus allow me to see the effects of different numbers of iterations, which in turn demonstrate how the point estimates get closer and closer to the true parameters in the population as the number of iterations increases.

Figure 9.18 is based on 15 iterations of Model 9.2. For each iteration, I first apply Model 9.2 to the simulated dataset, I then store the four regression coefficients before plotting

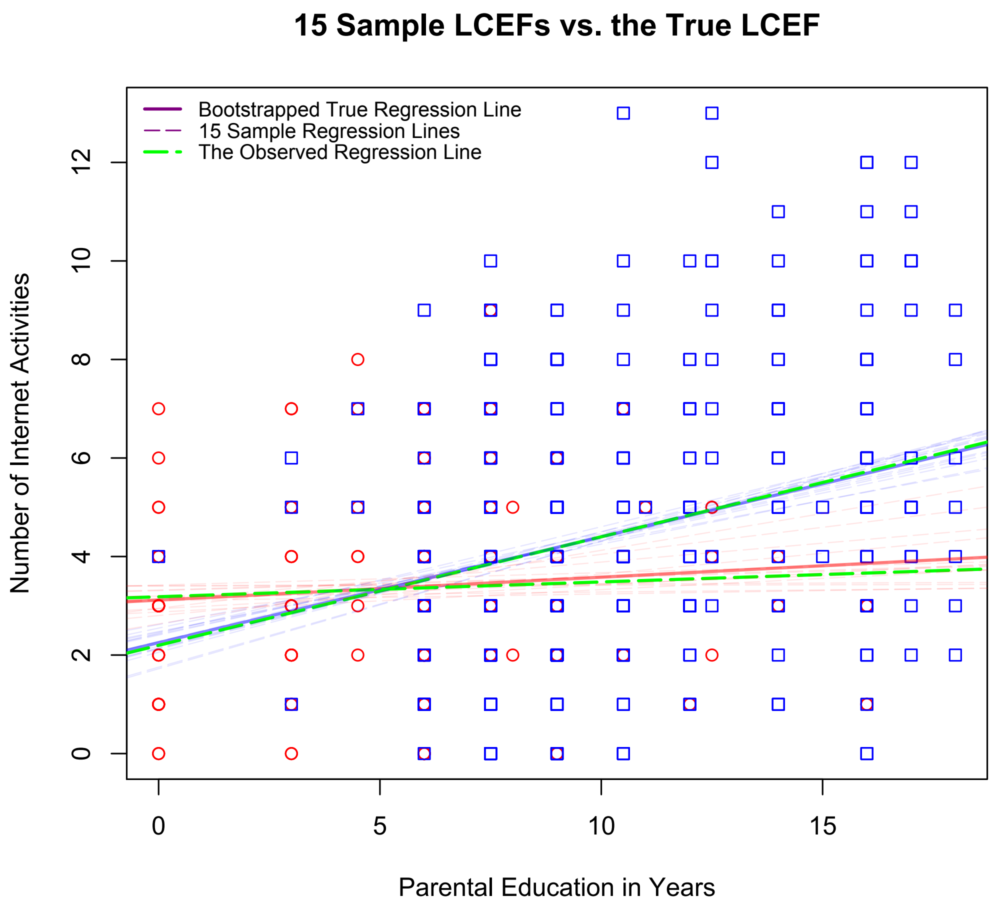


Figure 9.19: *The regression lines are generated from the interactive linear model (9.2) being applied to each of the 15 bootstrapped datasets. The 15 pairs of regression lines (blue ones for Han and red ones for Tibetan students) thus have their own unique patterns. Each line is called a Linear Conditional Expectation Function (LCEF), which compares with the true bootstrapped regression line (True LCEF) for each group of students (Han vs. Tibetan).*

the sampling distributions of those regression coefficients. Finally, I compare the mean of each sampling distribution with the corresponding coefficient I obtained in Model 9.2 based on the real sample of the study. As shown in Figure 9.18, there is some distance between each pair of red solid line and blue dashed line when the iteration number is 15. I can also compare the regression lines (in dashed green) from Model 9.2 based on the observed data with those from the above simulated data. As displayed in Figure 9.19, there are also small deviations of the green lines from the red (for Tibetans) and blue (for Han students) solid lines based on 15 iterations.

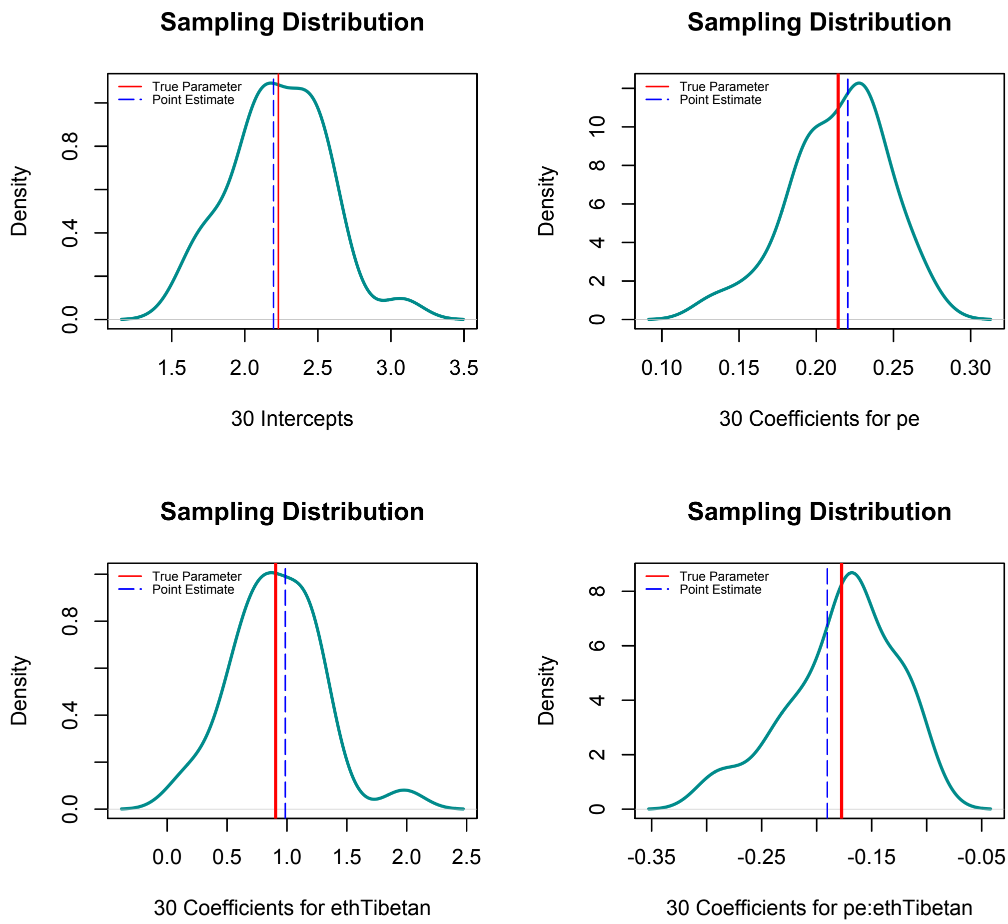


Figure 9.20: *The regression coefficients are derived from the interactive linear model (9.2) being applied to each of the 30 bootstrapped datasets. The four sets of coefficients thus have their own unique distributions with their means as the true coefficients (solid red vertical lines). For a detailed description of the coefficients, please see Table 9.10.*

Next, I increase the number of iterations to 30, and compare how the sampling distributions and regression lines change. As we can observe in Figure 9.21, the regression lines almost converge with the simulated true lines, although some distance still exists between the lines in the sampling distributions of Figure 9.20. This probably explains why many suggest a minimum sample size of 30 in various studies.

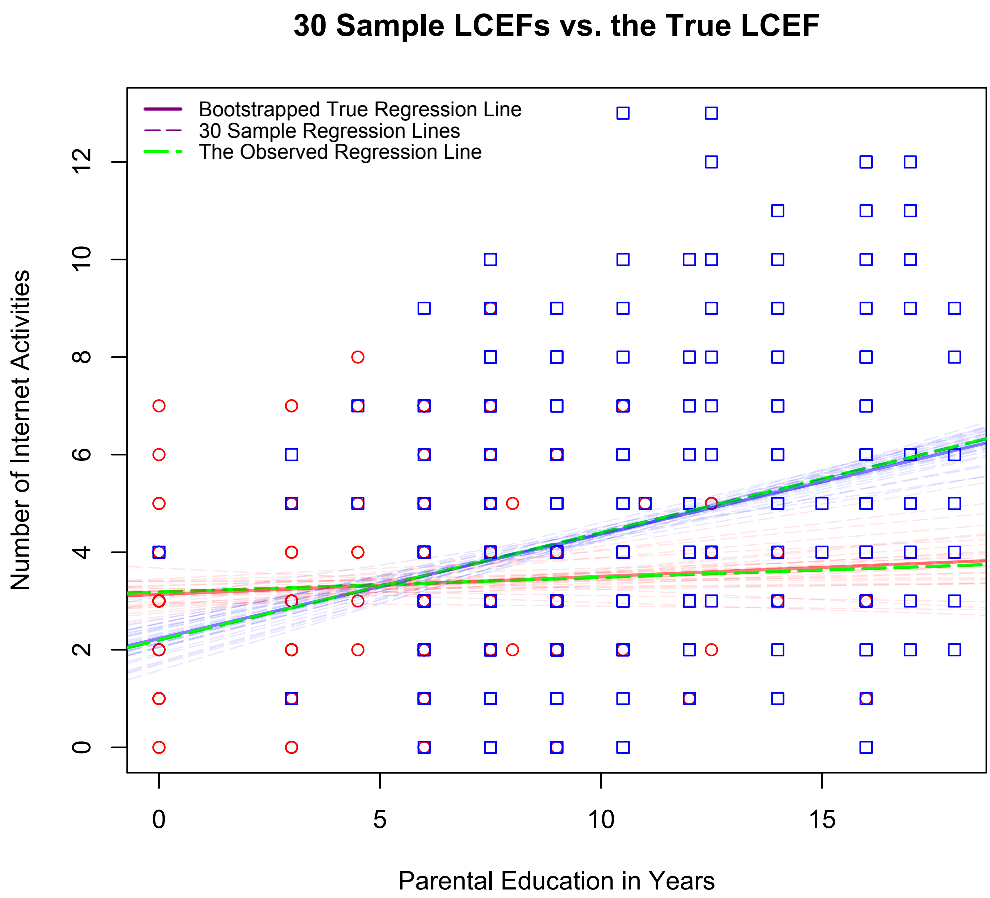


Figure 9.21: *The regression lines are generated from the interactive linear model (9.2) being applied to each of the 30 bootstrapped datasets. The 30 pairs of regression lines (blue ones for Han and red ones for Tibetan students) thus have their own unique patterns. Each line is called a Linear Conditional Expectation Function (LCEF), which compares with the true bootstrapped regression line (True LCEF) for each group of students (Han vs. Tibetan).*

However, as I do 1000 iterations, the aforementioned distances all disappear, and the sampling distributions of those coefficients all become normal, regardless of how those coefficients are really distributed in the data. These features are captured in Figures 9.22 and 9.23. That said, the violations identified in Section 9.5.4 *can* be reasonably ignored, which means Model 9.2 is an efficient one, although it may not be the best one.

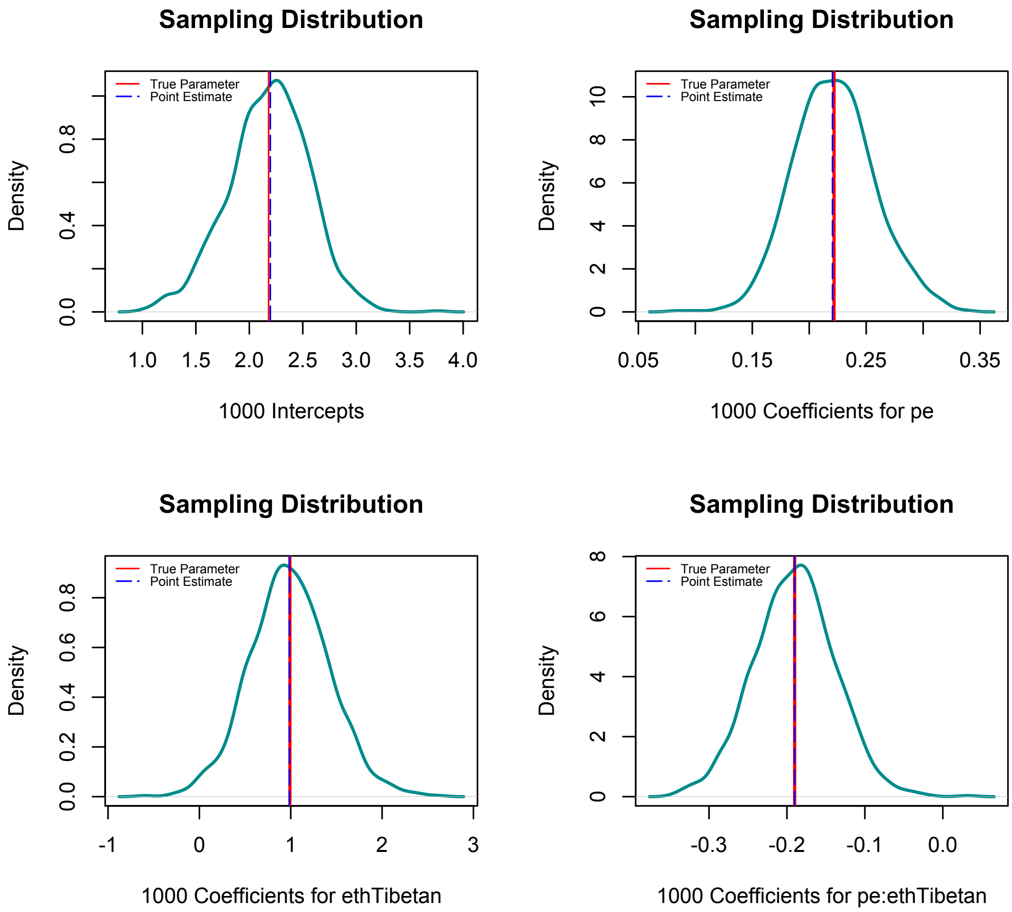


Figure 9.22: *The regression coefficients are derived from the interactive linear model (9.2) being applied to each of the 1000 bootstrapped datasets. The four sets of coefficients thus have their own unique distributions with their means as the true coefficients (solid red vertical lines). For a detailed description of the coefficients, please see Table 9.10.*

9.6 Variables left out of the model may count equally well

Since the model I have established involves only two predictors, it is necessary to examine some of the variables that were left out of the model. As Faraway (2004, p. 122) pointed out, the model building process I employed in Section 5.5.2 risks ignoring predictors that are significant but not selected. As qualitative findings reported earlier in the thesis, *wangba* in Hunan and Tibet are crucial for many of the students there, it is therefore worth a closer statistical examination.

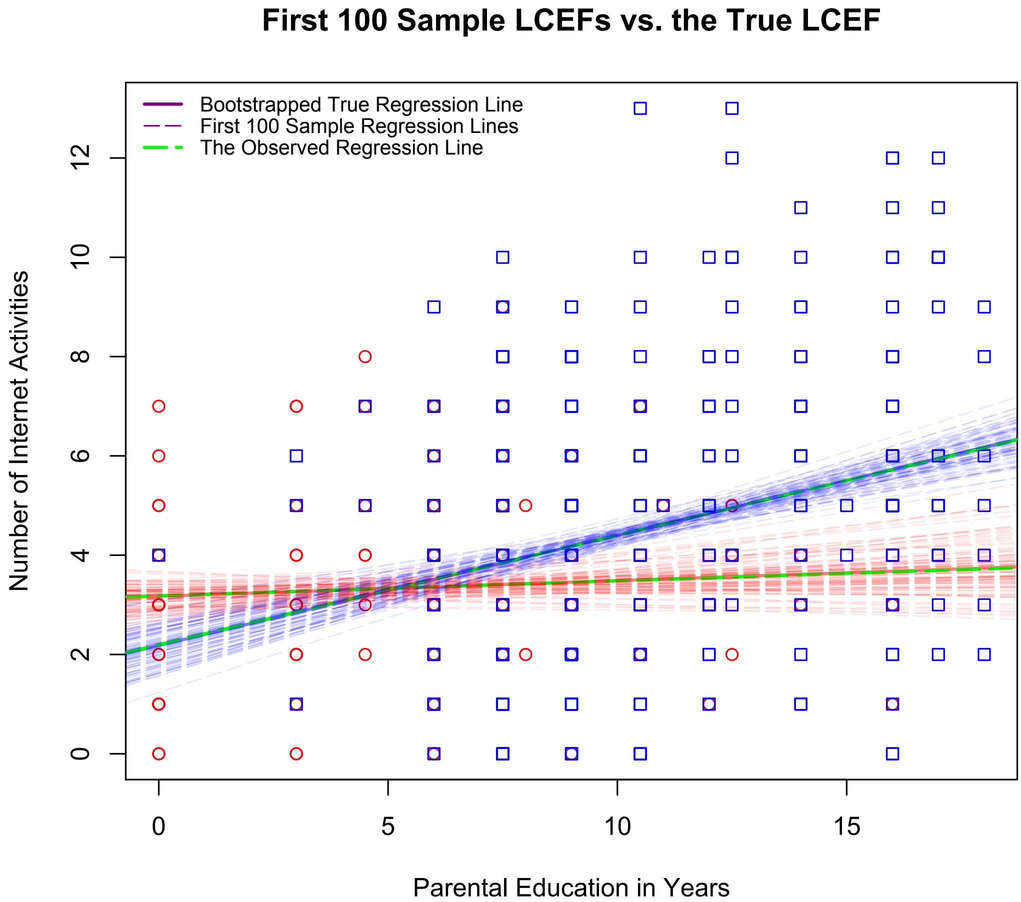


Figure 9.23: *The regression lines are generated from the interactive linear model (9.2) being applied to each of the 1000 bootstrapped datasets. The 1000 pairs of regression lines (blue ones for Han and red ones for Tibetan students) thus have their own unique patterns (for a better visual presentation, only the first 100 pairs are displayed in the chart). Each line is called a Linear Conditional Expectation Function (LCEF), which compares with the true bootstrapped regression line (True LCEF) for each group of students (Han vs. Tibetan).*

9.6.1 *Wangba* as a significant means for shared access

In the survey, students were asked how often they visited *wangba*. There are five answers to this question, the first is "Never visited one before," to which a value of 0 was assigned in analysis. The second category is "I prefer not to say," to which a score of 1 was attached. Since all three schools ban students' visit to *wangba* during weekdays, it is reasonable that students might be reluctant to disclose the true information. Had a value of 0 been given to this category, the data might misrepresent the true value for those who actually frequented *wangba* but were unwilling to reveal the information. It is therefore reasonable to allocate one score to the category, a mark not too high to overestimate the overall mean of a school, nor too low to underestimate the true mean, given the size of the sample in the study. The other three categories, namely, "Weekends and holidays," "Often, even during term time," and "Cannot cope without it" have a value of 2, 3, and 4 respectively.

Summary statistics in `STATA` for this variable report that Nanshan students have a mean of 0.4, suggesting most of them either never visited *wangba*, or chose "Prefer not to say." Since Nanshan students had the highest mean for home access (2.7 vs. 1.3 for Hunan and 1.0 for Tibet), it is not surprising that they visited *wangba* less than their counterparts did in the other two schools. While Basum students had the lowest level of home access, they frequented *wangba* most (mean = 1.8). Hengshan students again stood in the middle (mean = 1.6).

Although I can tell the difference-in-means for the variable how often students visit *wangba* (1.2) between Shenzhen and Hunan and the one (1.4) between Shenzhen and Tibet, I do not know if the one (0.2) between Tibet and Hunan is statistically significant at the conventional significance level of $\alpha = .05$. However, I can run a Rank-Sum test to see if the assumption of chance were true. The results show that the probability of finding a difference at least as big as the one observed in my sample is about 1.5 out of 100 times, provided that Hunan students visited *wangba* as often as Tibetans did. This difference is statistically significant at the conventional level. Therefore, I have enough evidence to conclude that Basum students in Tibet visited *wangba* significantly more often than their Hengshan counterparts did in Hunan.

As reported in Table 1.1, Nanshan students did not visit *wangba* as often as those in Hengshan and Basum did. In fact, students in Hunan visited *wangba* over four times as much as their Shenzhen counterparts did (1.65 versus 0.41 in means), and Tibetans visited *wangba* even more often (mean = 1.83). How does this difference affect students' attitudes towards and knowledge of *wangba* and the Internet in general then?

First, a Spearman correlation test of how often students visit *wangba* and their negative views of *Wangba* reports a negative ($\rho = -0.12$) and significant (p-value = 0.00) correlation, implying that the more students visit *wangba*, the less likely they would report that *wangba* are detrimental to them.

	ρ_{sam}	p_{sam}	p_{sim}
`viscafe` vs. `cafe`	-0.1194	0.0019**	0.0368*
`icth` vs. `cafe`	0.0757	0.0473*	0.1556
`ictfs` vs. `cafe`	0.0421	0.2710	0.3444
`ias` vs. `cafe`	0.0520	0.1738	0.2702
`freecafe` vs. `cafe`	-0.1223	0.0017**	0.0283*
`ias` vs. `games`	-0.0883	0.0216*	0.1107
`games` vs. `cafe`	0.2000	0.0000***	0.0002***
`ictparents` vs. `rank`	-0.0381	0.3562	0.3765
`ictparents` vs. `pe`	0.0812	0.0530	0.1604
`ictfriends` vs. `phbill`	0.1703	0.0000***	0.0028**
`ictfriends` vs. `handsets`	0.1879	0.0000***	0.0010**
`ictfriends` vs. `icts`	0.1692	0.0000***	0.0016**
`ictfriends` vs. `acts`	0.0926	0.0160*	0.0855
`ictfriends` vs. `pe`	0.1435	0.0006***	0.0120*

Table 9.12: *Spearman correlation tests based on sample and simulated datasets — ρ_{sam} is the correlation coefficients based on the sample, p_{sam} reports the significance levels of the sample correlation tests based on the observed sample data, p_{sim} reports the significance levels of the simulated correlation tests based on simulated datasets. See Appendix D.1 for a complete description of the covariates tested and reported in the table.*
*Significance levels: * $\alpha = .05$, ** $\alpha = .01$, *** $\alpha = .001$.*

Second, the correlation between home access to ICT and negative views of *Wangba* is positive and significant ($\rho = 0.08$, p-value $= 0.047$), suggesting students with better home access are more likely to view *wangba* as detrimental to them than are those who visit them often (they are less likely to have home access to ICT). This statement is, however, based on a correlation which is marginally significant in the real data. But the correlation is non-significant in the simulated datasets, as reported in Table 9.12.

Third, when I examine how different types of ICT use correlate with negative views of *Wangba*, the results show that both academic ($\rho = 0.04$, p-value $= 0.27$) and non-academic ($\rho = 0.05$, p-value $= 0.17$) use of ICT are independent from negative views of *Wangba*, and the results are consistent across the datasets, implying that students harbour similar attitudes towards *wangba*, regardless of the types of use students more often engage with.

However, school policy regarding students' visit to *wangba* (`freecafe`) negatively correlates with students' negative views of *Wangba* across the datasets ($\rho = -0.12$, p-value $= 0.00$), meaning that the more freedom students have in their visits to *wangba*, the less likely they report *wangba* are detrimental to them. In other words, students who never visited *wangba* are more likely to report negative attitudes towards them – they probably subscribe to dominant media reports about *wangba*, or simply report how they think others (adults and peers) would view *wangba*.

Another possible interpretation for such a negative correlation could be that students described as being "addicted" to *wangba* might have lost the capability to realise that visiting *wangba* often could be detrimental to them, just as computer gaming addicts enjoy games so much that they can hardly refrain from playing; and the more they play, the less likely they consider computer games as detrimental to their academic performances, or the more likely that they will give up any hope in performing any better in school.

In fact, correlation tests show that non-academic use of ICT (the number of Internet activities) is negatively correlated with attitudes towards computer games in the sample ($\rho = -0.09$, p-value $= 0.02$), suggesting that the more students use ICT for non-academic purposes, the less likely they harbour negative opinions about computer games. That said, students' attitudes towards *wangba* and games are similar. In fact, the two variables are positively and significantly correlated across the real and simulated datasets ($\rho = 0.2$, p-value $= 0.00$), implying that computer games and *wangba* are almost equally regarded by the students in the study.

Since all schools in the study have in place some *wangba* policy and it affects students in varying ways and to varying degrees, it is of great importance to see how effective the policy really is in promoting academic achievement among the students. In order to detect the effect of the policy, I need to evaluate it in a way that allows me to make some causal inference. In the survey, students were asked about the freedom they enjoyed in visiting *wangba*. I can treat this as a treatment variable, where those who report "Not restrictive at all" or "No access or no opinion" are regarded as a control group, and those who select "Fairly restrictive" or "Very restrictive" are considered as in treatment. The outcome is again a binary variable called `achieve`, where "Above average" or higher in self-reported academic ranking is coded as 1, "Average" or lower as 0. To see the difference in the probability of reporting high achievement between the two groups of students, I can once more use the logit model introduced earlier (see Section 9.3.3).

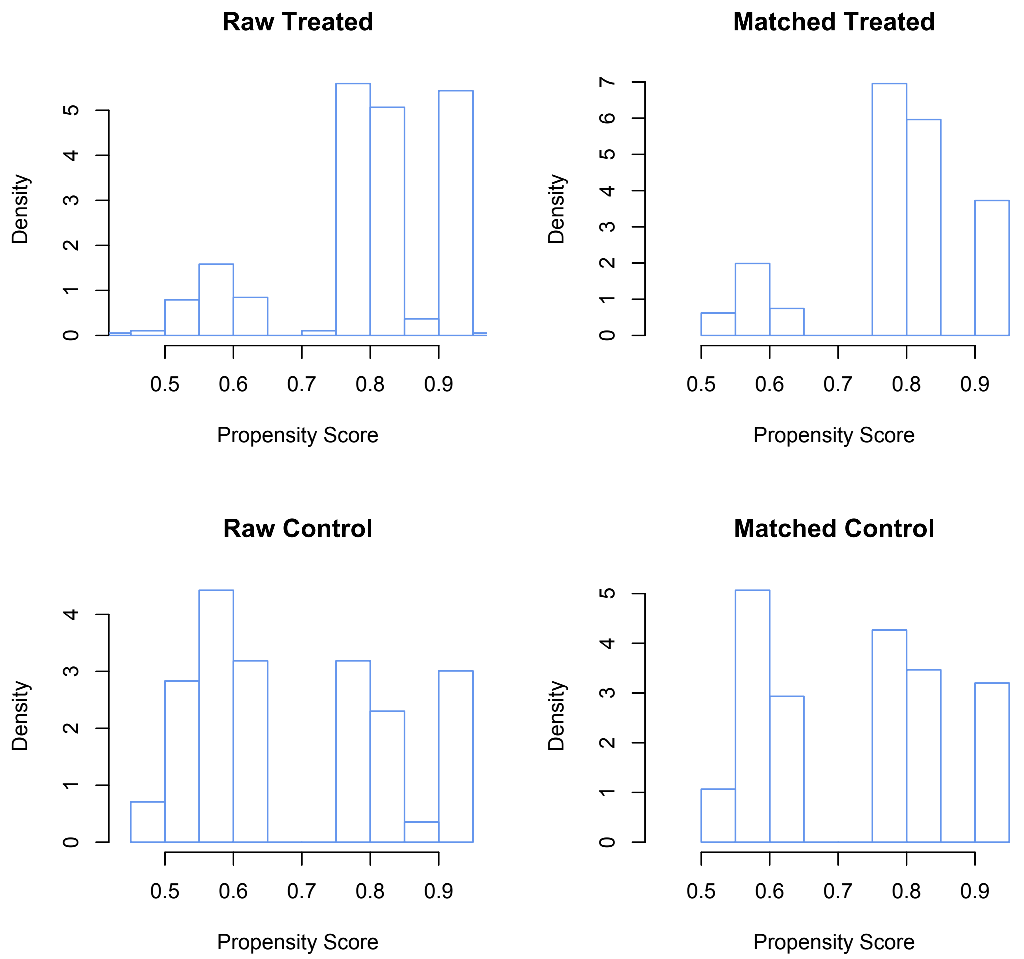


Figure 9.24: *The effect of matching using Coarsened Exact Matching*

Let me first simulate in R the first differences between control and treatment groups by holding constant all relevant covariates (see line 503 of R codes in Appendix H) at their median values. As a result, the mean of 50000 simulated differences (treatment − control) in the probability of reporting high achievement is 0.01, with a 95% confidence interval of $[-0.10, 0.12]$, which crosses the no difference vertical line of zero, suggesting that *wangba* policy in School Hengshan (median value) has no effect on its students' probability of reporting high academic achievement.

The causal inference made above is based on simulations, with which many people might feel uncomfortable, for they argue that the simulated differences are not real. In order to make an equally valid causal inference without relying upon such simulations, I can employ Coarsened Exact Matching (CEM, see Ho, Imai, King, & Stuart, 2011, p. 12) to compare the mean difference in outcomes between the two groups who are in the same school, come from similar socioeconomic background, are equally motivated to do well, and engage with ICT for about the same range of purposes. Before I match students in `R` according to the above specifications, the covariates are very imbalanced between treatment and control ($L1 = 0.966$, with only 2.6% of local common support). After matching using the CEM algorithm, I end up with 75 matched observations for the control group, and 161 for treatment (to see the effect of matching, please compare the histograms vertically in Figure 9.24). In total, there are 236 students satisfying the conditions specified above (see Figure 9.25), a sub-sample big enough, in my view, to establish a causal link.

With the matched dataset, I can fit the logit model in `Zelig` to see if the policy has any effect on the probability of students reporting high achievement in Hengshan, given covariates `htdwell` (hope to do well), `acts` (total ICT activities), and `pe` (parental education) take on their means. The procedure returns 0.47 and 0.53 as the probabilities of reporting 1 and 0 respectively. The overall effect, as shown in Figure 9.26, is not significant, meaning students in the two groups are about equally likely to report high achievement, and the result is independent of the policy under concern.

When I repeat the process in Nanshan and Basum, I find consistent results – the policy does not make students more likely to report high achievement. In Basum, the mean first difference is 0.04, with a 95% confidence interval of $[-0.09, 0.16]$, which contains 0 for no difference. In Nanshan, the mean first difference is 0.05 and its 95% confidence interval is $[-0.09, 0.19]$, which again crosses the zero vertical line. Since the outcome variable has 94 missing values, I then use `Amelia` to impute 10 complete datasets, which have exactly the same observed values but differ in missing ones. For each dataset, I undertake the same matching procedure before running the logit model to see the effect of the policy. Finally, I obtain the value for the Sample Average Treatment effect on the Treated (SATT), which has a point estimate of -0.08, with a 95% confidence interval of $[-0.30, 0.13]$, and a p-value at 1.54, suggesting once more no significant effect of the policy. For the number of matched cases in treatment and control for each multiply imputed dataset, please see Table 9.13.

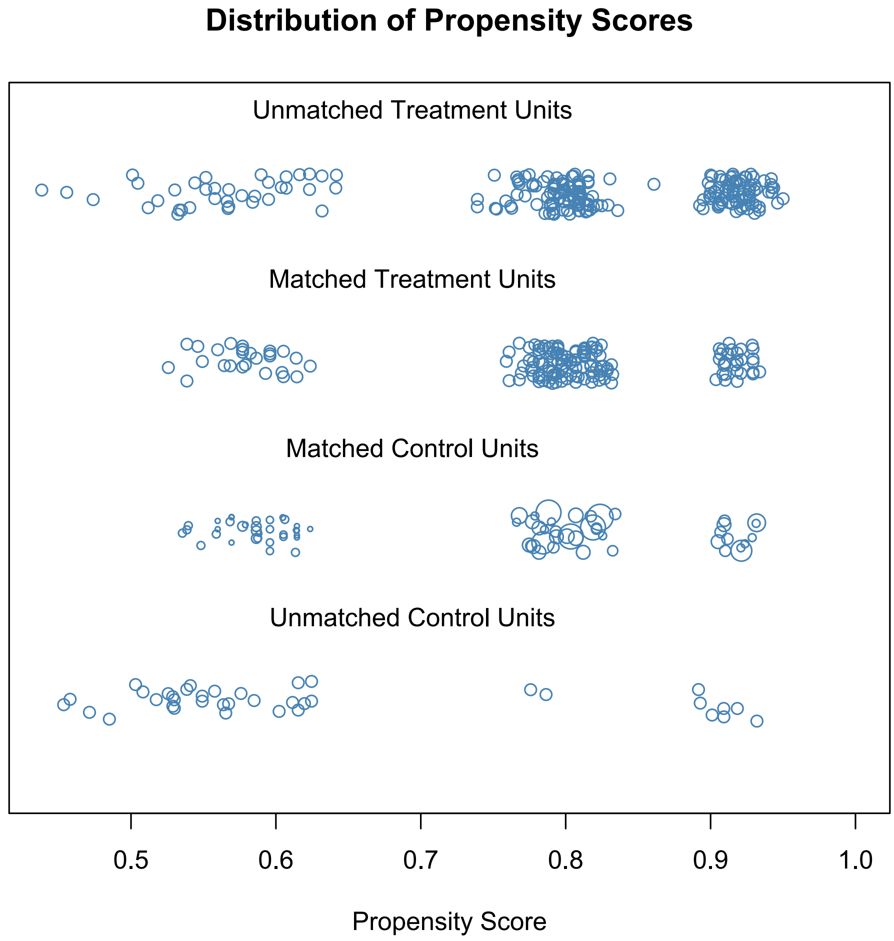


Figure 9.25: *Treated units matched with similar controlled cases*

As I did in Section 9.3.3, I can also see if parental education has any effect on the outcome after matching by dividing the continuous pre-treatment variable into 13 levels of 1.5 years for each. If the matching mechanism is effective, the outcome should be irrelevant to any pre-treatment variable, even though the treatment itself is highly associated with certain covariates such as `diqu`, the numerical transformation of school, where by far more students in Nanshan are treated as control because *wangba* are not as closely related to students' daily lives there as they are in the other two schools. As shown in Figure 9.27, both the mean and 95% confidence intervals for treatment and control almost overlap, indicating not only that the policy has almost no effect on the probability of reporting high achievement, but also that the matching mechanism

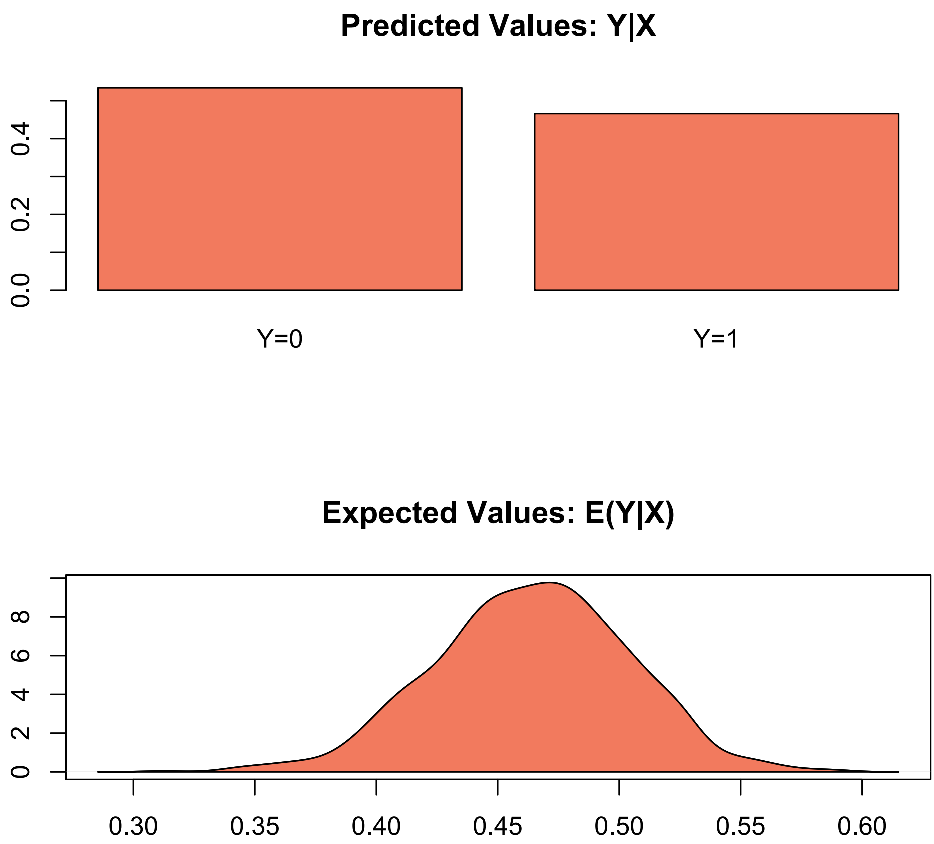


Figure 9.26: *Difference in outcome between treatment and control after matching*

as described earlier is effective — the outcome is independent of the pre-treatment covariate, namely, parental education in years.

9.6.2 Re-evaluating technology in learning

For now, I know that students differ considerably among the three schools in their access to and use of ICT. But "so what?" – how do those differences relate to, say, students' academic performances, one key issue that concerns many? To better understand the relationship, I need to run a few Spearman correlation tests for the ordinal level variables in question.

According to `STATA` output, the Spearman correlation test between students' self-reported

	Control	Treatment
Dataset i	54	73
Dataset ii	47	62
Dataset iii	47	61
Dataset iv	52	84
Dataset v	51	67
Dataset vi	49	64
Dataset vii	54	74
Dataset viii	46	68
Dataset ix	52	67
Dataset x	47	66

Table 9.13: *Matched number of cases in each of the 10 datasets*

academic ranking and their academic use of ICT is positive and significant ($\rho = 0.11$, p-value $= 0.01$), suggesting that the more one uses ICT for academic purposes, the more likely that the person considers herself academically capable relative to others in her class. Although the correlation is rather weak, it does indicate that the two variables are dependent.

However, when I examine the relationship between self-reported academic ranking and students' overall activities with ICT, the correlation becomes much weaker and non-significant ($\rho = 0.02$, p-value $= 0.62$), suggesting that self-reported academic ranking is independent of total ICT activities. This is not surprising, for `acts` (total ICT activities) consists of both non-academic activities online (the number of Internet activities) and academic use of ICT and the correlation between the number of Internet activities and self-reported academic ranking is non-significant ($\rho = -0.02$, p-value $= 0.58$).

A further correlation test between parental education and self-reported academic ranking ($\rho = -0.02$, p-value $= 0.67$) reveals that self-reported academic ranking correlates with academic use even stronger than it does with parental education. This is plausible given that parents in the study have only 9.19 years of education on average (slightly above junior secondary) – many parents may not know much about studies in high school, and their academic influence on their children's school performance may not be as significant as that of ICT if students use them to learn.

To better understand the relationship between the variables under concern, I ran a few more correlation tests. For instance, none of the three levels of access to ICT is

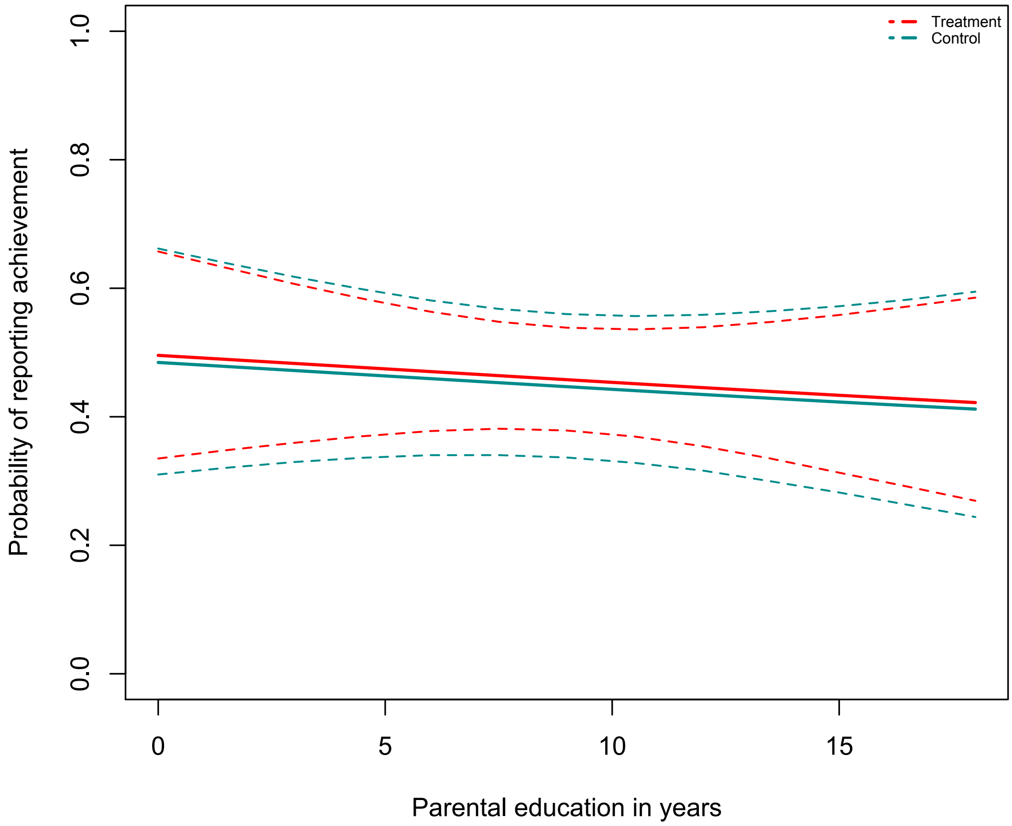


Figure 9.27: *The effect of school wangba policy on the probability of students reporting high academic achievement is almost the same for treatment and control; using Coarsened Exact Matching, we can also see that the outcome under concern is less relevant to parental education than it was in the probability of students reporting underachievement in Figure 9.6.*

significantly correlated with self-reported academic ranking, for test results show that home ($\rho = 0.04$, p-value $= 0.35$), personal ($\rho = -0.01$, p-value $= 0.87$), and school ($\rho = -0.02$, p-value $= 0.67$) access are all non-significantly associated with academic ranking, nor is it with overall access ($\rho = 0.01$, p-value $= 0.78$). These statistics imply that what really matters is perhaps what students *do* with ICT rather than what they *have*.

However, the attitudes students take towards and the efforts they make in their studies matter more than do ICT. For instance, the extent to which students believe that they can do well in school if they work hard is significantly correlated with self-reported academic ranking ($\rho = 0.20$, p-value $= 0.00$), implying that those who believe they can do well in school are more likely to view themselves as highly capable in class. Moreover, self-reported academic ranking correlates significantly with the degree of importance one attaches to her study ($\rho = 0.13$, p-value $= 0.00$), how much one hopes to do well in school ($\rho = 0.16$, p-value $= 0.00$), and the efforts one makes to understand something difficult ($\rho = 0.26$, p-value $= 0.00$).

But I am primarily concerned with how academic related variables correlate with ICT related variables. Once more, academic use of ICT and one's can-do-well attitude are significantly associated ($\rho = 0.08$, p-value $= 0.04$), so is it with the efforts one makes in order to understand something challenging ($\rho = 0.17$, p-value $= 0.00$). However, believing that one can do well is not significantly associated with non-academic activities online ($\rho = 0.02$, p-value $= 0.65$), nor is it with one's overall access to ICT ($\rho = 0.03$, p-value $= 0.45$).

Interestingly, the number of Internet activities significantly correlates with how much one hopes to do well ($\rho = 0.08$, p-value $= 0.04$). Perhaps the more time one spends with ICT for non-academic purposes, the more one hopes to do well in school, indicating that high school students are constantly reminded of how important it is for them to do well in school, particularly when they are not doing "proper things" with ICT. Hope-to-do-well also occurs more often with more overall access to ICT ($\rho = 0.12$, p-value $= 0.00$), but more access does not necessarily translate into more efforts made to understand difficult concepts ($\rho = 0.07$, p-value $= 0.08$), neither does it make students accord greater importance to their studies ($\rho = 0.01$, p-value $= 0.7$).

9.6.3 Less trustworthy or more vulnerable?

Having examined the relationship between ICT and learning, I shall look at the ramifications of technology access and use in adolescent life experiences. For reasons already discussed in Section 9.4.1, the results derived from the correlation tests based on the observed sample in the sections that follow should ideally come with paired simulated tests. Otherwise, significant results may occur due to chance alone. If the simulated results and the ones derived from the real sample, as reported in Tables 9.12 and 9.14, are consistent, then I have more confidence than otherwise in the conclusions that follow from either significant or non-significant results.

As before, the results reported in column p_{sim} of the three tables are the average p-values of 1000 iterations. The test statistics and their corresponding p-values derived from the real sample are presented to the left of the simulated p-values. If I have paired significant or non-significant p-values for p_{sam} and p_{sim}, then the evidence I have for a particular test is robust.

	W_{sam}	p_{sam}	p_{sim}
`infonline` vs. `gender`	60044	0.2236	0.3266
`infonline` vs. `stream`	60342	0.1297	0.2505
`infonline` vs. `track`	60907	0.0559	0.1590
`infonline` in Hunan and Shenzhen	21059	0.0000***	0.0012**
`infonline` vs. `eth`	51863	0.0018**	0.0276*
`infonline` in Hunan and Tibet	26954	0.2241	0.3189
`privacy` vs. `eth`	49130	0.0035**	0.0342*
`privacy` in Hunan and Tibet	25809	0.3246	0.3687

Table 9.14: *Wilcoxon Rank-Sum tests based on sample and simulated datasets – W_{sam} is the correlation coefficients based on the sample, p_{sam} reports the significance levels of the sample correlation tests based on the observed sample data, p_{sim} reports the significance levels of the simulated correlation tests based on simulated datasets. See Appendix D.1 for a complete description of the covariates tested and reported in the table. Significance levels: * $\alpha = .05$, ** $\alpha = .01$, *** $\alpha = .001$.*

Let me first analyse how students differ in their attitudes towards the information they find online. To measure this variable, students were asked how much they trusted the information they encountered in cyberspace. As the data reveal, Han students trust the information more ($mean = 2.31$) than Tibetan students do ($mean = 2.01$), although both groups largely disagree with the statement that online information can be trusted, for their means are between 2 and 3, which represent "Largely disagree" and "Largely agree" respectively. What's worth reporting here is that, as shown in Table 9.14, the difference between the two groups is significant at $\alpha = .01$ level in the observed dataset and $\alpha = .05$ in the simulated ones, suggesting that Han students are more trusting than are Tibetans in cyberspace. However, this statement does not imply that trusting people are more trustworthy – it could also suggest that the information presented to Tibetans might be less trustworthy in the first place. In any case, the difference calls for more evidence and a better explanation.

Further Wilcoxon Rank-Sum tests report that, as shown in Table 9.14, significant differences do *not* exist between Male vs. Female ($p_{sam} = 0.22$), Key vs. Ordinary ($p_{sam} = 0.13$), and Arts vs. Science students ($p_{sam} = 0.06$) in their trust of online information. However, they *do* exist between Hunan vs. Shenzhen ($p_{sam} = 0.00001$) and Tibetan vs. Han students ($p_{sam} = 0.0018$) across both real and simulated datasets. Since the difference between students in Hunan and Tibet is not significantly big ($p_{sam} = 0.22$) across the datasets, I can conclude with confidence that students in both Hunan and Tibet trust online information less than do their counterparts in Shenzhen, although Tibetan students are least likely to trust online information in the study.

Making statements about who is more trusting or trustworthy is always risky. To find more robust evidence, I shall analyse the data about online trust in another way. As I did in Section 9.3.3, I inversely code "Largely agree" or "Strongly agree" as 0 and "Largely disagree" or "Strongly disagree" as 1. I call this binary outcome variable `nontrust` and use the same logit model to predict the probability of reporting non-trust. But this time, I use 20 predictors (see line 465 of `R` codes in Appendix H) to simulate 50000 first differences in the outcome between Han and Tibetan students. Again, all other covariates are held constant at their median values, and the only variation appears in `minzu` (the numerical transformation of ethnicity), which changes from 1 for Han students to 2 for Tibetans. The simulation result shows that Tibetan students are no more likely than their Han counterparts are to report non-trust of online information, for the mean difference of Tibetan − Han in the probability of reporting non-trust is -0.02, with a 95% confidence interval of $[-0.26, 0.19]$, which contains 0 for no difference. The density plot of the 50000 simulated first differences in Figure 9.28 illustrates the point well.

The comparisons made above tend to support my second suggestion about the difference in adolescent trust of online information, that is, the information less-trusting students encounter online might have taught them to be more cautious. In other words, students in rural and ethnic minority areas are more vulnerable to undesirable or mal-information. This is also true for those whose parents are less well-educated, for a Spearman correlation test reports that students with parents better-educated tend to trust online information more than those with less well-educated parents do ($\rho = 0.1$, p-value $= 0.007$). Therefore, socioeconomically disadvantaged students are more vulnerable to online risks; or one may argue, they are just less trusting people. Anyway, it requires further examination to see which statement is better grounded.

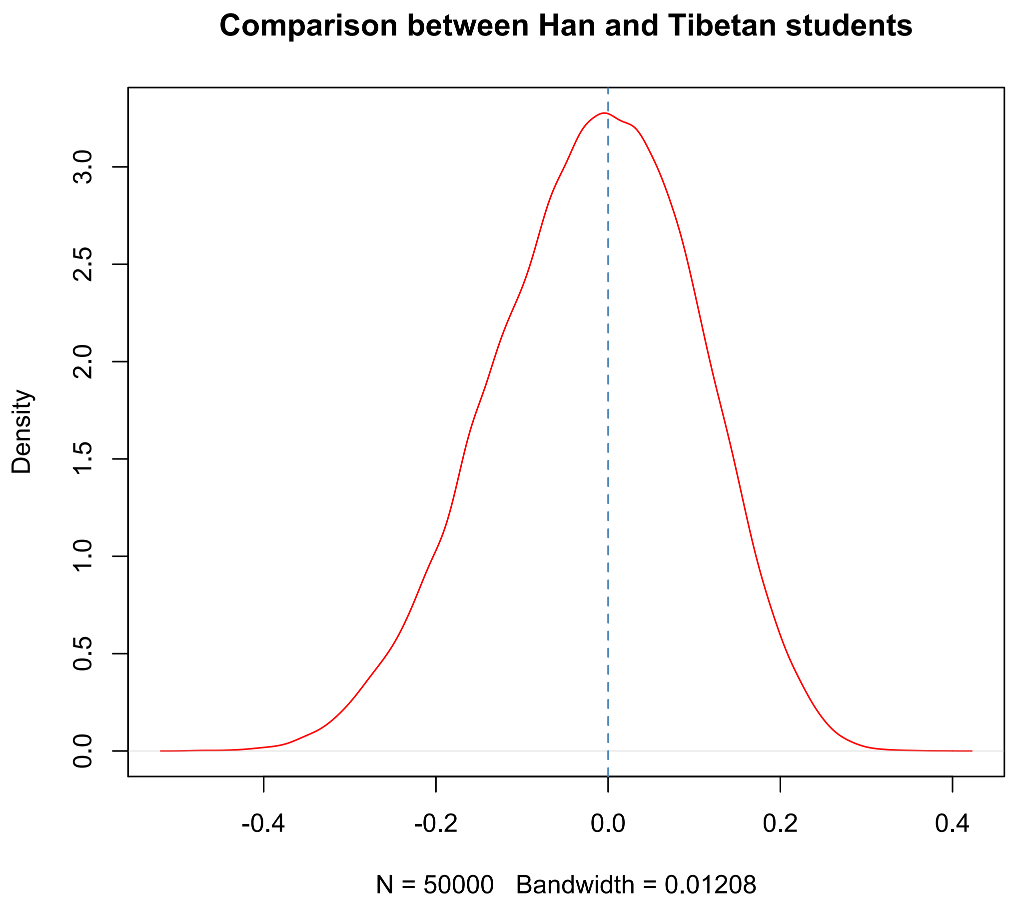


Figure 9.28: *Simulated first differences in the probability of reporting non-trust between Tibetan and Han Chinese students.*

To see if socioeconomically less privileged students are less cautious online – if so, it thus supports my first statement that they are more vulnerable, I can test if there are significant differences between the two groups in their concerns about online privacy. First, a Rank-Sum test between Han and Tibetan students regarding privacy concerns reports that Tibetans are significantly less likely to express greater concerns over privacy (p-value = 0.0035) in both real and simulated datasets, suggesting that Han students are more aware of the issue, although they trust online information more than Tibetans do.

Put in another way, Tibetans do not trust online information as much as their Han counterparts do, neither are they equally concerned about online privacy; Han students trust online information more than Tibetans do, but they are more bothered with online privacy. This difference might result from the fact that they have different levels of access to ICT, meaning the more students use ICT, the more concerns they have; and the more they rely upon ICT, the more they trust online information unconsciously. This point finds resonance in the qualitative data. For instance, the blogs *Yanhai* and *Yajun* have developed over the years deeply concern them, yet they carry on using them for they represent their pasts or what Turkle (2008b) called "inner lives that are charged with personal meanings" (p. 2).

To see whether the difference is largely due to ethnicity or socioeconomic background, I need to run a Rank-Sum test about privacy concerns between Hengshan and Basum students who are both socioeconomically disadvantaged. The results show that no significant difference exists between them (p-value = 0.32), suggesting that Tibetan and Hunan students are about equally less concerned about their online privacy than are students in Shenzhen. Therefore, the difference in privacy concerns is more attributable to socioeconomic factors than it is to ethnic profiles, for students in Hunan are by far less likely to express privacy concerns than are their counterparts in Shenzhen (p-value = 0.00001), yet they are both Han students.

The conclusion made above also finds supportive evidence in the correlation test between the number of handsets ever used and privacy concerns ($\rho = 0.11$, p-value = 0.004), for the former is indicative of students' socioeconomic status.[*] However, it is worth noting here that parental education itself does not correlate significantly with privacy concerns ($\rho = 0.07$, p-value = 0.08), but the number of handsets students ever used does.

Why? The answer lies in the fact that many families do not encourage students to use a mobile phone in school, even though they can well afford it. Nevertheless, for those who do allow their children to use ICT, the number of handsets ever used can be a good indicator of socioeconomic status, for better-off families are more likely to try more and more expensive handsets. Unsurprisingly, `handsets` (handsets ever owned) correlates significantly with privacy concerns here while parental education as a better indicator of socioeconomic status in most cases does not. But the most convincing explanation is that students with mobile phones, as evidenced in the qualitative findings,

[*] The correlation between handsets ever used and parental education has a positive coefficient of 0.23, and a p-value of 0.00001.

are deeply concerned about, or in some cases strongly object to, others (particularly adults) browsing their private data such as text messages stored in their mobile handsets.

9.6.4 ICT in adolescent relations with significant others

Having examined the attitudes students harbour towards the Internet and their varying degrees of trust in online information, I now need to check how ICT use relates to their relationships with parents and friends. When asked to rate the statement that ICT have a negative impact on parent-child relationship, the average score across the schools is 1.6, which is between "Strongly disagree" and "Largely disagree," implying that the vast majority do not think ICT have had any negative impact on their relationship with parents. However, the difference between Han ($mean = 1.70$) and Tibetan ($mean = 1.35$) students is statistically significant (p-value $= 0.0001$), suggesting that by far more Han students thought their use of ICT had affected their relationship with their parents.

Is the difference due to students' ethnocultural profiles? To answer the question, I need to test if the differences in parent-child relationship between the three schools are significant. Further Rank-Sum tests report that the difference between students in Hunan and Shenzhen (all Han students) is non-significant (p-value $= 0.17$), yet the one between students in Tibet and Hunan is (p-value $= 0.00001$), so is it between those in Tibet and Shenzhen (p-value $= 0.01$). The comparisons thus reveal that Tibetans are by far less likely to report ICT's negative impact on parent-child relationship than are Han students in both Hunan and Shenzhen.

Moreover, the comparisons suggest that Hunan students are most likely to agree with the statement about negative impact of ICT on parent-child relationship. Taking into consideration the conflicts Hengshan students narrated in the qualitative data, I am confident to conclude that the difference is attributable to students' ethnocultural profiles, which implies that Han parents are more likely to intervene than are Tibetan parents in their children's engagement with ICT.

Although I reported earlier a closing gender gap in ICT, females and males *do* differ significantly in the above variable. In fact, females are by far less likely than are males to report a negative impact of ICT use on parent-child relationship (p-value $= 0.001$), suggesting that parents intervene more in their boys' interaction with ICT than they do in their girls'. In addition, a significant difference also exists between Arts and Science students in their likelihood of reporting a negative impact (p-value $= 0.03$).

However, there is no significant difference between Key and Ordinary class students (p-value $= 0.82$), neither does a significant correlation exist between this variable and self-reported academic ranking ($\rho = -0.04$, p-value $= 0.36$), suggesting that students, regardless of their academic standing, are equally likely to report a negative impact. As reported in Table 9.12, a Spearman correlation test between this variable and parental education also indicates that the two variables are independent ($\rho = 0.08$, p-value $= 0.05$), implying that better educated parents and less well-educated ones are equally likely to intervene in their children's use of ICT. This result is consistent across all datasets.

Finally, I shall see what roles mobile phones have to play in adolescent friendship. Summary statistics report that students largely agree ($mean = 2.9$) that mobile phones can help them maintain a closer relationship with their friends. As revealed in Table 9.12, students attach greater importance to their mobile phones in building and maintaining friendship, particularly when they spend more on monthly phone bills ($\rho = 0.17$, p-value $= 0.00001$) and have used more handsets ($\rho = 0.19$, p-value $= 0.00001$).

This is not surprising, for the more students use their mobile phone, the more likely they use it to contact their friends, and the more important they believe a phone is. This significant correlation extends to their total access to ICT ($\rho = 0.17$, p-value $= 0.00001$) and total number of activities they do with ICT ($\rho = 0.1$, p-value $= 0.02$). Moreover, parental education also correlates well with this variable ($\rho = 0.14$, p-value $= 0.0004$) across all the datasets, implying that students with better educated parents attach greater importance to their mobile phones in establishing and maintaining friendship. This probably results from the fact that the value of one's ICT increases only when more people around the person are also using the technology. In other words, socially advantaged students befriend with people of similar backgrounds in cyberspace, for they happen to have similar levels of access to ICT, as one student expressed in the qualitative data, a person without a phone or refusing to use a phone in the information age would be regarded as abnormal by those who have or use it a lot.

9.7 Conclusion

The quantitative findings as presented in this chapter unveil the structural differences within and between the schools in several ways, and more often than not, the findings from different ways of analysis converge, which thus provides robust evidence for sound arguments regarding the inequalities in question. First, by comparing the differences-in-means of students' Internet activities, we know that Basum students in Tibet engage with the Internet for the lowest number of activities, Nanshan students in Shenzhen with the highest, with Hengshan in Hunan to the middle. This inequality in cyberspace corresponds to the uneven macro-level economic development of the three regions studied, which has Shenzhen as the most developed city and Tibet the least prosperous, leaving Hunan somewhere between. However, students' academic use of ICT does not faithfully follow the patterns in economic development. While Hengshan students have more overall access to ICT than their Basum counterparts have, the latter use ICT for academic purposes significantly more than the former do, with those in Nanshan still leading the trend. This partial reverse in academic use of ICT is expressive of the specific ways learning and teaching are organised in the schools. In Hengshan, *wangba* are viewed in the most disparaging light, although school policies regarding *wangba* are not effective in promoting the probability of students reporting academic achievement across the schools. But the best explanation for Hengshan students' lowest academic engagement with ICT is that the students view doing well in school the least important. Whereas in Basum, students regard doing well the most important, although they have the lowest score in hoping-to-do-well.

Another way of revealing structural inequalities in ICT is through regression analysis. The best linear model used to predict the outcome is an interactive one with ethnicity, parental education in years, and their interaction on the right hand side. The results of the regression model illustrate that Han students with parents having no more than six years of education engage with the Internet for the lowest number of activities. However, the most digitally advantaged students are also Han, namely, teenagers with better-educated parents. This means that the return to parental education is greater for Han students than it is for Tibetans. This finding is further confirmed by the simulated first differences in the outcome between the two groups, which not only show the gap in outcome within the mainstream Han students is bigger than either the divide within Tibetan students or that between Han and Tibetan students, but also demonstrate the former is about six and at least three times bigger than the latter two respectively.

Second, while students' academic success highly correlates with parental education in years, Tibetan students are also significantly less likely to report underachievement in school, which further confirms that Han students with least-educated parents are the most disadvantaged. Nevertheless, it is vital to bear in mind that digital (dis)advantage does not mean (dis)advantage in other aspects of life, which are beyond the scope of the study. Regarding ICT in learning, the crucial message is that what really matters in self-reported academic ranking is what students actually *do* with ICT, rather than what they actually *have*. But what matters most is the attitudes students take to their studies, for ranking highly correlates with not just how much one believes she can do well in school, but also with how much she hopes to do well, the level of importance one attaches to education, and the efforts one makes to understand challenging concepts.

As for ICT in students' daily lives, one key finding surrounds the differences in students' non-trust of online information. This time, the ways of analysis matter, for their results diverge. While the straightforward two-group (Han vs. Tibetan) t-test results in Tibetan students being significantly less trusting of online information, a series of three-group t-tests and a logit model tell different stories – the multiple tests reveal that non-trust is actually more due to socioeconomic *vulnerability* rather than *ethnicity*, but the simulated first differences based on a logit model show no significant differences in the probability of reporting non-trust between Han and Tibetan students. However, it is necessary to note that the logit model condenses the outcome into a binary variable, whereas the former two methods using t-tests are based on the raw data collected for the item.

In terms of ICT for close relationships, the study finds that Han students' engagement with ICT has had more negative impacts on parent-child relationships than that of Tibetan students has. This is due to the fact that Han parents intervene more in their children's involvement with technology than their Tibetan counterparts do. While the gender gaps in access and use have largely narrowed, parents do intervene more in their sons' interactions with ICT than they do in their daughters'. Finally, students with higher access to ICT and use them for more purposes tend to have better-educated parents, and consider mobile phones to be more important in establishing and maintaining friendships than do those who have lower access and use and come from less well-educated parents.

Chapter 10

Divides that Divide

10.1 Inequalities: from the real to the virtual

In this chapter, I shall synthesise the findings from quantitative and qualitative strands to answer the research questions raised in page 80. Since the first question the study set out to answer is about the level and nature of adolescent engagement with and attitudes towards ICT, and the focus of analysis concerns the differences along key categorical variables such as school class, attainment status, socioeconomic and ethnocultural profiles, what I need to abstract here is thus the inequalities/differences that matter.

The quantitative findings in Chapter 9 showed that adolescent access to and use of ICT are not random, and they significantly correlate with where they are (which school), where they come from (family background as measured by parental education), where they stand in school (Arts vs. Science and Key vs. Ordinary), sometimes with self-reported academic ranking, but rarely with sex (Male vs. Female). To be more specific, Nanshan students have the highest level of access to ICT and support, use technology for the widest range of purposes, and are most likely to treat ICT as "life" and "thought" companions for psychosocial, emotional, and intellectual gains. But in Hengshan and Basum, many teenagers of similar age are still familiarising themselves with keyboard skills in *wangba*, which Nanshan students are least likely to visit but most likely to disdain. Even within schools, Arts students use ICT for significantly more activities than Science students do, although the two groups have similar levels of access to ICT. A significant difference also exists between Key and Ordinary class students in their use of ICT, with the former leading in academic but not in non-academic use of technology. The gaps along ethnocultural and socioeconomic lines are even more striking, which the following paragraphs will show.

Regarding ethnicity and the differences in access and use, one dominant theme is that Tibetan students are disadvantaged relative to the mainstream Han in both overall access to ICT ($t = 10.84$, p-value $= 0.00$) and total activities with ICT ($t = 7.09$, p-value $= 0.00$), so are rural Han students in Hunan relative to their counterparts in Shenzhen (overall access to ICT, $t = -14.53$, p-value $= 0.00$; total activities with ICT, $t = -13.25$, p-value $= 0.00$). Therefore, the digital marginalisation as identified above is *not* entirely due to ethnicity. However, when I compare the outcomes between Basum and Hengshan, I find that Tibetan teenagers have a by far lower level of overall access ($t = -4.39$, p-value $= 0.00$), but the two groups do not differ significantly in the number of total activities with ICT ($t = -0.98$, p-value $= 0.33$). This pattern reappears in the level of support they have when they encounter difficulties in using ICT ($t = -1.75$, p-value $= 0.08$).

This rather interesting finding results at least in part from the popularity of *wangba* as an important means for shared access in Tibet. In fact, as reported in Table 1.1, Basum students frequent *wangba* significantly more than those in either of the other two groups do (relative to those in Hengshan, $t = 2.78$, p-value $= 0.01$). To better understand the above pattern as observed in the quantitative data, it is necessary to take into consideration the varied attitudes students and adults hold towards ICT in specific regions. Otherwise, it is difficult to fully appreciate how *wangba* become a social phenomenon and are viewed as a necessity or indulgence in Tibet (and in Hunan to a lesser degree), but not the same for Nanshan students.

Since Hengshan students have significantly more access to ICT than do those in Basum and the two groups hold similar attitudes towards *wangba* ($t = -0.95$, p-value $= 0.34$), the significant difference in *wangba* visits and non-significant difference in total activities with ICT between the two groups are due to the fact that adults in Hunan are more likely to intervene than are their Tibetan counterparts in adolescent interactions with ICT (see page 242), and to certain "preferential policies" such as lower scores required of Tibetans for higher education, which are reflected in the number of weekends students have to enjoy – Basum teenagers have one off almost every week, whereas those in Hengshan have two days off every two weeks, meaning less time for technology.

As I examine the relations between students' sociodemographic profiles and certain outcomes in question, it is worth noting that they do not occur in isolation to one another. Instead, they function at the same time. For instance, when I use ethnicity and parental education to account for the variation in the number of activities students do with the Internet (see Model 9.10), I can see more aspects of the inequality under concern. As illustrated in Figures 9.14, 9.15, and 9.13, Tibetan students in the study are digitally disadvantaged, but Han teenagers with parents having fewer than six years of education are in an even worse situation; while Tibetans are entitled to certain benefits (e.g., monthly stipend from the state and the exemption of tuition fees for rural and nomadic students), the return to parental education, as measured in the number of activities students do with the Internet, is by far smaller for Tibetans than it is for the mainstream Han, which substantially privileges those Han students with parents educated at tertiary level.

It is therefore tempting to conclude that the inequalities in access and use simply result from uneven economic development of the three regions (see Figures 9.2 and 9.3) and/or skewed income distribution for families (compare access by parental education in Figure 9.4 as well as activities by parental education in Figure 9.9). While the reasoning finds strong evidence in the patterns of access, it does not have consistent support from the distributions in use. As reported earlier, Hengshan and Basum students have a significant difference in access, but not in use – if the economic rule holds, Hengshan students should have engaged with ICT for a wider range of purposes than Basum teenagers do.

Also in Section 9.3, I reported a reverse trend in academic use of ICT between Hengshan and Basum students – the former had more overall access, but used ICT for academic purposes significantly less than did the latter. In fact, Han students are significantly more likely to report underachievement in school, which I do not have data to account for. However, for the reverse trend in academic use of ICT, I reasoned that the economic principle ceased to function because of the following factors. First, Basum students come from by far more socioeconomically stratified backgrounds (see a discussion in Section 3.2.4) than their Hengshan counterparts do (more outliers mean more skewed distributions in access and use). Second, while slightly more Hengshan students reported no experience in *wangba*, Basum teenagers visited *wangba* significantly more often than did their Hengshan counterparts. Third, Basum was less restrictive than Hengshan in their students' use of ICT. Finally, although Hengshan students hoped to do well in school more than Basum students did, they attached by far less importance to doing well in school than the latter did. Therefore, it is not unwise to argue that the inequality in access registers inequalities in economic development and income, but the diversity in use articulates different ways of living and learning.

10.2 Technology in the mind

Figure 10.1: *A nomad herding his yaks with snow-capped mountains rippling away.*

The second question of the study interrogates the subjective aspects of youth interaction with ICT, and the data gathered for this question are primarily qualitative. As presented in Chapters 6, 7, and 8, the analyses in the qualitative strand are "case-" and "experience-orientated" (Onwuegbuzie et al., 2009). Unlike the "variable-orientated" analyses of responses from the correlational survey, this strand adds blood and flesh to the quantitative findings by illuminating how the meanings of ICT shift from what Turkle (2011) described as "better-than-nothing" for some, to "something" for others, and in certain cases, to "better-than-anything."

By presenting the digital gadgets students have in an emotional, cognitive, and social light, I demonstrated how the values of ICT change from what Ling (2012) called something "good-to-have" for some, to a "necessary evil" for others; from Turkle (2007)'s being "good-to-think-with" for some, to "goods-to-think-with" for others. In other words, as anthropologist Veronica Strang (2006) did in her analyses of water, I examine ICT as both technological and sociocultural objects, which respond to changing and dynamic socioeconomic, ethnocultural, familial, and educational circumstances. As a result, I bring together the ideas of ICT as "life companions," the familiar devices of convenience, necessity, or indulgence; and of ICT as "thought companions" (Turkle, 2007, p. 5), which is perhaps less familiar to many.

As numerous accounts revealed in the qualitative strand, students' physical, emotional, and intellectual interactions with ICT render them mesmeric yet fearful, necessary yet disquieting. Youths across the schools praised how much their ICT could do *for* them. For instance, Bella and *Xiumeng* in Shenzhen could report their wellbeing and whereabout when they went out, and *Bianba* could dial for help while walking to and from her school in the high Tibetan Plateau, the Roof of the World (for a view, see Figure 10.1). However, they also expressed deep concerns about what technology could do *to* them, such as mobile radiation to their body and the harm electronic reading could do to their eyesight (see pages 134, 144, and 160). Therefore, students, and people generally perhaps, welcome and treasure what technology can do *for* them at the cost of what they can do *to* them.

Teenagers suffuse their cyberspace with emotional values. For some, a mobile phone is an object of desire, for it marks the beginning of a relationship. *Jingwen*'s secret mobile phone meant a great deal to her, but she could not use it at home because of her mother. Just as she kept her handset secret at home, she did what she could to conceal her relationship with a handsome boy in school. Yet the "placeless space" (Sandvig, 2013, p. 101) created by her phone was full of "amatory possibilities" (S. Higgins, personal communication, May 6th, 2013). The bond between *Yanzi* and her boyfriend was strengthened via their mobile phones too, particularly at the early stage of their relationship. When they chatted late into night, they were exchanging not just texts; through their mobile phones, they saw themselves as entering each other's soul and holding each other's heart in their palms.

For others, a mobile phone is an object of loss, for it signifies the end of a romantic relationship. *Pin*'s mobile phone reminded him so powerfully of his time with his ex-girlfriend that he kept her text messages for a long time, and every time he came across her name stored in his handset, he saw a shadow of her "flicker past," just as Annalee Newitz' laptop refreshed her memory of the love she had with a hacker (2007, p. 90).

But the loss in other aspects of adolescent life can sometimes find "emotional repair" (Strohecker, 2007, p. 27) in cyberspace too. *Yajun* found immeasurable solace in her mobile communications with her mother, to whom she could throw all the frustrations she had in her failed exams.

According to Turkle (2007), both things and people are treated as objects in psychoanalysis. When one loses something important or someone she loves, she may be able to find that object again in herself (p. 9). *Yanhai*'s roommate seemed to have lost her bond with her family. But she, as *Yanhai* related in page 150, appeared to be successful in finding the lost affection she so needed *within* herself and *inside* her virtual space. As Freud poetically wrote: "the shadow of the object fell upon the ego" (cited in Turkle, 2007, p. 9), which means, in Turkle's words: "When objects are lost, subjects are found" (p. 9).

The meanings teenagers encode in their ICT also express patterns of continuity and change, which permeate their engagement with technology. Yet, they are not always as clear as the ones exhibited in the above-mentioned romantic relationships. Like the meanings in Strang (2006)'s water, the values teenagers "pour" into their devices are sometimes invisible. For instance, it often takes students some time without a phone to realise how important it is to their lives. Indeed, objects like a phone can be so "taken for granted" (Ling, 2012) that their values only surface when they "swirl" in the powerful undercurrents of negotiation, surveillance, and control. When they are less visible, they simply "seep" into the decisions made about access and use (cf. Strang, 2006, p. 245), even for those who keep ICT at bay and concentrate on their preparations for the *Gaokao* – they avoid using them today in order to fall in love with them tomorrow, for they are constantly told and (made to) believe that they would have better opportunities to engage with technology once they get into university.

The feelings teenagers have for the ICT they call their own are inseparable from the thoughts they develop in their relationships with those "evocative objects" (Turkle, 2007). By first recording and constructing their lives in their cyberspace, *Yanhai* and *Yajun* often felt at one with their blogs while reading, sharing, and acting upon what they had built. In that respect, the virtual catalyses the growth or construction of the real – when students learn to live with, or in, their digital space, as Buckingham (2008, pp. 4 - 6) and boyd (2008, pp. 128 - 129) contended, they are actually shaping and re-shaping themselves into being. When ICT provide a placeless place for adolescent emotion and intellect to cohabit and interact, they become "objects of passion and reason" – the former is often viewed as being illogical, emotional, and non-scientific; whereas the latter normally associated with science and knowledge, for abstract reasoning, as Turkle (2007) argued, has long been recognised as a "canonical and superior" way of knowing (p. 6). At that point, ICT cease to be objects of simple instrumental value, they become what Turkle (2007) called "thought companions" (p. 9). In other words, teenagers do not just love the technology they have or have with, they also think with the technology they love or love playing with.

Given ICT are being increasingly integrated into adolescent daily lives, and they are objects of opportunity and risk, good and bad, discipline and desire, freedom and control, the quarrels between adults and adolescents will continue to take place. The accounts provided by the informants across the three schools have demonstrated that the negotiation and management of technology access and use are expressive of social, familial, economic, and political relationships between groups, generations, and regions in contemporary China. The patterns of access and use as well as the meanings and values with which students invest ICT are indicative of status and power. However, the specific beliefs about and attitudes towards ICT are embedded in the ways students have been raised and taught. For instance, "good" schools are supposed to be strict and "good" students are supposed to stay away from *wangba*.

As such, technological development in the study articulates social structures and transformations well, just as the management of water does in England (Strang, 2006, p. 246). However, beneath the fast changing technology, as discussed in Section 3.2, certain continuity persists in the deeper educational[*] and socioeconomic[†] currents of contemporary Chinese society, and it is likely to remain in the near future. That is to say, parents and teachers will always want and need to control their children and students, who will always want to express themselves through their use of ICT. And any lack of access to technology is always likely to be associated with disadvantage and exclusion, just as water is in Strang (2006)'s analysis (pp. 247 - 248).

The conclusions made above are perhaps too pessimistic for ICT to play any role in social and human dimensions of development. For adolescents, digital technology does

[*] For example, the *Gaokao* and the ways in which high school students learn and parents and teachers intervene.

[†] For instance, the *Hukou* and the patterns educational inequalities and inequities take in urban vs. rural and Han vs. Tibetan areas of China.

provide an empowering platform where they can better understand the society within which they situate and even re-define what it is possible for themselves (Benkler, 2006, p. 139). Although students investigated in the study used ICT largely for leisure activity rather than schoolwork, it might be costly to ignore the fringe benefits of "improper" learning with ICT. Apart from the knowledge gained about society, playing with the digital tools endows teenagers with cognitive (Turkle, 2008a) and emotional (Turkle, 2007) benefits, which have roles to play in adolescent development and subjective wellbeing. For instance, writing (e.g., blog entries in the study) and talking (e.g., sharing moments of rapture over phone calls with significant others) about emotional experiences were found to have considerable and consistent contributions for health and wellbeing across diverse groups of people (Pennebaker, 1997).

Therefore, schools and families at the meso-level should tap into the potentials ICT have to proffer by providing guidance for the young rather than keeping technology at bay. Given the perceived risks associated with technology access and use, for instance, schools can, as Professor Christopher Jones (personal communication, July 1st, 2013) suggested, ask students to put their switched-off phones in a specified place before a class begins. Instead of "inserting" computers that often "die easily" into schools, schools can concentrate their scarce resources on fewer but better machines and well-designed IT curricula that help students search and critique online information and avoid plagiarism. In socioeconomically well off schools, students should be taught to, say, program and analyse data today – to focus on specific skills deemed essential for the information society, even one skill at a time that is truly transformative in nature and makes what Sennett (2008) called "the intimate connection between hand and head" (p. 9).

10.3 Implications: from the virtual to the real

The third question of the study is about the dynamics between adolescent interactions with ICT, academic matters, and their daily life routines. While the data for the first question are largely quantitative, and those for the second primarily qualitative, this question connects the first two questions and integrates both qualitative and quantitative findings. If the first question concerns the social shaping of technology (see page 26), then the third is mainly about social and educational consequences of access and use, which relate to the theories about the roles technology has to play in human and social development (see Sections 2.4, 2.5, and 2.6). The second question, however, is pertinent to the theory of technology as texts with meanings (see Section 2.3).

Let me first theorise ICT in learning. In Section 9.3.3, I found that Han students hoped to do well in school significantly more than their Tibetan counterparts did, but the latter regarded it significantly more important to do well in school. Among the three schools, Hengshan students had the lowest score in importance and were least likely to use ICT for academic purposes; Basum students did not hope to do well as much as their Hengshan and Nanshan counterparts did, but doing well meant the most to them. If we can treat hoping-to-do-well as an indicator of motivation, then Nanshan students were the most motivated.

The findings outlined above thus have the following implications. Although Tibetans reported attaching a greater value to education than their Han counterparts did, they were the least motivated group among the three schools; while rural youths in Hengshan were more motivated to do well than Basum teenagers were, they viewed doing well as the least important among the three schools. This suggests that Basum teachers should make what they teach and the ways they teach more appealing while School Hengshan might make schooling more aspiring. Regarding urban schools like Nanshan, I do not have enough relevant data to make a similar conclusion, for the nature of the study is concerned about "what is most in need of change," as Kay Milton at Queen's University of Belfast said, "the best social scientific research" shall point to "what is most wrong" (comment on the back cover of Strang, 2006).

As reported in Section 9.6.2, the attitudes students held towards their studies and the efforts they made to understand difficult concepts significantly correlated with their self-reported academic ranking in a positive way. But access to technology alone had no significant associations with the concerned outcome of ranking. Since students' academic ranking correlated significantly with their academic use of ICT (but not with non-academic use of the Internet), a correlation even stronger than that between the outcome and parental education, what lies at the heart of the issue is this: the *attitudes* students take to their studies matter more than what they *do* with ICT, which matters more than what technology they *have*. Here comes the implication of such a finding: to improve the outcome in question, schools may need to change what students *do* with ICT; but to change what they do, it is perhaps vital to first change what they *think*, as Le Grand (1982) argued: "to understand what people believe is crucial to understand the way they behave; and to change the way they behave, it is crucial to change what they believe" (p. 150).

Regarding school ICT, one consistent theme emerging from the three schools is that school computers, though legitimate in existence, had little, if at all, sociocognitive gain in adolescent development. The pure provision of computers across the schools was apparently less meaningful and beneficial than were home computers (largely in Shenzhen) and *wangba* (though illegitimate to those under 18, mainly in Hunan and Tibet) to the very same students they promised to help. In fact, a quasi-experimental approach to the correlational data reveals that *wangba* policies in the schools had no effect on the probability of students reporting "Above average" or "Top 10%" in class.

Although high schools have IT courses in the first two years, students' knowledge about computers and computing varies significantly within and between schools in the study. This gap is likely to have grave repercussions for learning beyond high school, for universities today are increasingly migrating their teaching and administration to cyberspace. For example, *Yajun* revealed that once she enters higher education, she relies on her computer almost every day. Unlike her high school in Shenzhen, there is much more to explore for herself in her university. She uses her computer to preview and review, to complete assignments and make presentations, and to relax and entertain herself. In high school, she used her mobile phone to a significant degree, but now her computer is her companion.

For those students who either have little knowledge about computers or are still learning how to type, what challenges they would have to face once they go to college or enter workplace, particularly when they need to study or work along with those from schools like Shenzhen? It is likely that the digital gaps will translate into divides of various forms and further divide the society and workforce beyond secondary education. In fact, students in Hengshan and Basum already expressed such a concern, as reported in pages 2, 3, and 171.

Even in high school, the differences in use and access have different consequences for different students. As evidenced in qualitative findings (see pages 131, 164, 167, 168, 177, and 178), it seems to be consistent across the three schools that students use search engines to find sample essays online when they have composition assignments. However, in the selection of search engines, Shenzhen students tend to use Google more than those in Hunan and Tibet do. Bella for instance compared results from Google and Baidu before deciding on which sources to rely upon. To her, Google generates more comprehensive and graphics rich resources, which she preferred. When the results were not consistent across different search engines, she said she would think about it. Eason also used search engines to find answer keys to exercises. But he emphasised that they were considered as references only. *Tongzi*'s justification for using search engines to find answers stemmed from the fact that it was faster than seeking help from teachers. When he solved problems in past exam papers, answers were often a few key strokes away using his home computer. However, he was afraid of taking that advantage the Web had to offer via his phone in school, for it was risky to use his phone on campus, even when he used it for "proper" learning.

However, fewer students in Hengshan and Basum revealed that they used those essays for consultative purposes – many in the schools did not see any problem in copying essays from the Internet. It also seems that plagiarism in the Internet era is not yet considered a threat to academic integrity in the high schools studied. Therefore, students' use of the Internet reflects certain aspects of learning – students are not required to differentiate their own voices and ideas from those they consult online. In fact, in many ways, they are assessed on how well they memorise the information in text books, at least it is so according to students' own understanding of what learning should be like. Students in the three schools all reported that they had spent too much time in memorising key exam points in those compulsory subjects.

While Nanshan students knew a great deal about weibo and actually blogged often, many students in Basum, particularly those from nomadic and rural backgrounds, had barely heard of them. As fewer students used weibo or blog, fewer recognised the educational value of using it as a thought companion. Even those who were aware of the trend saw no point of playing with it (let alone the possibility of thinking with it), for the persons close to them were not using it.

For example, *Dunzhulaba* noted that QQ is popular among secondary school students and Renren among university students. Actually, QQ as an instant messaging and social networking software package has been integrated into his daily life and he can find on QQ most of his former and current classmates and friends. Whereas Renren as an equivalent of Facebook in China is too new to be relevant to his daily life – he has only heard of the site because his sister uses it to connect with her college friends in inland China. *Dunzhulaba* opened an account on Renren, but he rarely visits it unless he needs to follow his sister's status while she is away from home – his own friends are on QQ, not Renren. This finding thus confirms Qiu (2013)'s observation that QQ is very stable among its "working-class users" while "upper- and middle-class Internet users moving constantly among Xiaonei (aka Renren), Kaixin, Fanfou, and Sina Weibo" (p. 122).

Therefore, qualitative differences exist in how students use and perhaps abuse ICT, even the same technology. For instance, some can capitalise on the Internet for intellectual growth; others treat it as the last resort to cope with deadlines. From the virtual to the real, the differences in use express or even exaggerate existing social and educational gaps. However, it is worth noting that such differences in use occur without any school interventions – teachers of the schools did not teach how to search and analyse essays online; otherwise, *Guoyu* might not have justified his plagiarism on his teacher's ignorance of the digital resources freely available to him. Should the schools offer a course about how to capitalise on the resources online, how would those gaps in use and achievement emerge and interact then? This question may deserve a place in schools' what-to-do lists.

As for ICT in adolescent daily life, I examined issues surrounding online trust, privacy, and offline relations mediated by technology. As reported in Section 9.6.3, I found that Tibetans in the study were less trusting of the information they encountered online than their Han counterparts were. But when I compared the correlation between urban vs. rural groups, the result showed that Hengshan students were equally less trusting than were Nanshan students, suggesting that the difference was not (entirely) related to *ethnicity*, but *vulnerability*. When I simulated the first differences in non-trust of online information between Tibetan and Han students using a logit regression model, the result showed no statistically significant difference between the two groups either. I therefore argued that the two less trusting groups were not less trustworthy, because the information they encountered online might not be trustworthy in the first place, which had taught them to be more cautious.

The evidence I utilised to make the above argument was that both Hengshan and Basum students were less concerned about online privacy than were Nanshan students. While Nanshan students expressed greater concern over online privacy, they surprisingly trusted online information more. To account for the counter-intuitive result, I contended that the more personal data they put online and the more they used certain sites, the more they trusted them, or the more they trusted them unconsciously as the sites became more familiar to them or they felt more at one with the sites. Furthermore, I highlighted that socioeconomically disadvantaged groups are more vulnerable, for the "low-end" or what Qiu (2009) called "working-class" ICT they use put them in a lower market position, where quality is often an issue, as partly revealed in the qualitative data about mobile phone brands students used in Tibet (see page 184).

Earlier qualitative examinations of mobile phone use among students showed how important the device was for students of different geographic locations. In Hunan, mobile phones connected students with their parents working in other provinces as migrant workers; in Shenzhen, they were used as venting machines, and played significant roles in forging romantic bonds; in Basum, they also served as Chinese dictionaries and safety devices in the high plateau. Unsurprisingly, when asked to rate the negative impact of ICT use on parent-child relationship, most students chose "Strongly disagree" or "Largely disagree." However, there was a significant difference between Han and Tibetan youths, suggesting that Tibetans were less likely to report a negative impact. Since no significant difference was found between Hengshan and Nanshan students, the difference was thus related to students' ethnocultural profiles.

As illuminated in the conflicts between adults and adolescents in the two Han schools, negotiations in access and use often resulted in quarrels with parents, and the squabbles in Hunan were the most noteworthy. But in Basum, students rarely reported such a problem. A similar pattern occurred between female and male students in the study, implying that parents intervened more in their sons' use of ICT than they did in their daughters'. These findings are about the consequences of use. But in pages 146 and 243, I also reported the consequences of non-use – students without mobile phones were likely to be viewed as "eccentric" by their peers or excluded from certain social lives, and socially advantaged students tended to have more friends of similar backgrounds. Therefore, it is perhaps not wrong to argue that you are who you are with in cyberspace.

10.4 Limitations and discussions

In answering the three questions, the study utilised both quantitative and qualitative data, which showed strengths in addressing the questions concerning both structural differences and individual level dynamics. Without the correlational survey, it would be difficult to expose, say, the patterns of inequality between urban vs. rural and Han vs. Tibetan students, neither would it be easy to detect the subtle difference in the marginalisation of Tibetans and rural Han students with less well-educated parents.

Without the insightful interviewing of students with different levels of access and use in each school, the meanings and values adults and students associate with the ICT in question are likely to be missed. For instance, the survey was able to find out how many students did not report using mobile phones in each school, but the qualitative data could reveal how students without mobile phones were viewed and possibly excluded by their peers who had. While the inequality as reported in numbers showed the *scale* of the problem and it might strike our eyes, the exclusion of one group by another as presented in narratives unearthed the *depth* of the problem and it was likely to touch our hearts.

However, the two types of data may branch out in different directions, and when that occurs, it is very challenging to synthesise or even make sense of the findings. For instance, when Nanshan students reported the highest level of trust in online information, they also expressed the deepest level of concern over online privacy in both strands, which made one puzzle: why were they more trusting when they were more concerned? That was counter-intuitive, and the possible way out, given the imperfect data on hand, was to look at the qualitative findings about blogging and the anxiety students expressed about the possible loss of the content they had created in cyberspace. But that was only one way out, there might be other, or even better, explanations, which were rather difficult to identify.

While the study benefited from mixed methods, so did it from the comparing and contrasting of multiple cases. Like most comparative studies, it began with superficial levels of similarities and differences. But those points were not what I really care about digital inequality, for any two items on earth, as Professor Steven Wandler (personal communication, Spring, 2012) talked about academic writing, could be said to be similar in one way yet different in another. What I am really interested in is whether I can learn anything new about, say, School Basum in light of the findings from Hengshan and Nanshan. In other words, what really interests me is what new knowledge the comparing and contrasting can teach about the phenomenon in question (see Appendix B for more on this topic).

For example, I might conclude that Tibetans are less trusting of online information if I had only two groups of Han and Tibetan students, and perhaps go one step further to make an argument about the difference that they are less trusting in cyberspace because they are a suppressed people in the real. But when there was a third group in the study, I was in a better position to examine if the argument was sound. It turned out that the significant difference in the item was not (at least entirely) related to ethnicity, for Hengshan students had a similar score in trust. However, the third group cannot just be any group, as Arthur Spirling (personal communication, Fall, 2012) argued, we could make almost any conclusion we pleased if we were free to choose any case we liked. In this study, as introduced in Section 9.1, the "most-similar" principle applied. That is to say, the three schools were similar in many aspects (see the controlled variables in Section 9.1), but differed in a few key explanatory variables of interest that could be used to explain the difference in outcome. Although the difference between Han and Tibetan students in their trust of online information was statistically significant when I first analysed the data using a correlation test, the significance attenuated when I used a logit regression model to simulate the first differences in non-trust between the two ethnic groups. I presented the results from both methods in the thesis to demonstrate that quantitative methods are not always value-free and they involve as much human decision as qualitative methods do.

Meaningful comparisons should result in meaningful arguments. But conclusions based on meaningful arguments are likely to be disquieting, for meaningful arguments, as Wandler (personal communication, Spring, 2012) argued, almost always respond to questions that have no straightforward answers, or with answers that reasonable people often have different opinions about. Therefore, it is no easy job to make those who share different views to question themselves and agree with you that the views they normally hold might be wrong after they read your arguments. Back to this study, while I have confidence in the evidence I gathered, the argument I have made inevitably involves a certain level of personal judgement, which almost always has its limitations to normative scientists.

Moreover, the quantitative strand is largely a correlational study, it is therefore unwise to establish causal links such as social status *leads* to certain level and nature of access and use, or certain types of use has *caused* the problems we do not want to see. However, it is clear that access and use are socially shaped, and they do have social and educational consequences. After all, what the public want to hear is almost always causal – we want to know if *wangba* have *made* "good" students "bad," or mobile phone use has *disturbed* "proper" learning. If there were no causal relationships at all, why should schools ban mobile phone use or *wangba* in the first place? By preventing students from interacting with ICT, adults do not just assume causal links *may* exist, they actually assert they *do* exist. Therefore, I synthesise the answers in a way that sounds like causal and linear (e.g., from the real to the virtual and then the virtual to the real), despite the correlational nature of the data.

However, I argue that using the above two-directional relationships to describe and explain the phenomena under concern is justifiable, for I did control certain variables in the study. I even employed a quasi-experimental approach to see the effect of school *wangba* policies on the probability of students reporting high academic ranking in class. I also accept one striking limitation to such an approach – while I was able to match students in the control group with similar students in the treatment group, the students successfully matched were only similar in a few observed covariates. Without random assignment of the treatment, I could not control the effect of unobserved covariates or what Karlan and Appel (2011) called "outside influence" ("Randomized Control Trials," para. 6) on the outcome under concern between the two groups.

That said, there is always a balance to strike between answering an optimal question and achieving a maximum level of precision in experimental designs. By assigning students to treatment and control according to their reported level of freedom in visiting *wangba*, I am confident that I was detecting the effect of the treatment, rather than the effect of assigning individuals to treatment. However, the bias from such a procedure might be greater than otherwise, for specific groups of students might be more likely than others to report the strictness of school policy on their visits to *wangba*.

I agree that I cannot make causal claims unless I can control all relevant confounding variables, but hardly any real world social science research can identify and then control all possible confounders. That being the case, why is my overlook of certain hidden variables worse then? Given the three-case comparisons made between Han vs. Tibetan and urban vs. rural in many aspects of access, use, and consequence, the evidence I have gathered are thus robust, and the two-way relationships can be said to be quasi-causal, which I hope will satisfy what the public want to hear and at the same time withstand potential critiques from pure experimentalists.

Finally, there is the issue of applying Western theories to Non-Western contexts. My earlier engagement with theoretical frameworks such as the generational divide employed Western concepts to frame the digital divide problem in a Chinese context. Those terms included "Baby Boomers" and "Net Generation," which are likely to be problematic to those who are seeking to develop Chinese theories of digital inequality and explain the issue under concern in Chinese terms. One might argue that the approach I have adopted to investigate the phenomenon in question is largely an application of Western theories in Chinese schools. Judged against the theoretical approaches outlined in Barney and Zhang (2009), what I did would be primarily testing, revising, or developing theories of Chinese inequalities in the digital era, which obviously originated from the West and served to "exemplify some received [Western] theory or theories" (p. 18) regarding digital technology and generational differences.

That potential line of critique certainly merits some serious reflection, for any mindless "borrow with the intent to improve" (Whetten, 2009, p. 36) inevitably assumes that concepts and theories developed in Western contexts are better, if not the best, ways of understanding and explaining Chinese phenomena (see a similar discussion in Barney & Zhang, 2009, p. 21). The problem becomes more alarming when Western theories fail to apply in Chinese contexts (sometimes they do not even apply in Western countries), in that case, not letting go of a Western theory is no different from the analogy that Barney and Zhang (2009) so tellingly made: an individual who has lost his key down a street only looks for it around lamp posts because he believes that is where "light" is (p. 23).

Does the theory of generational divide apply in my peculiar study? Am I only looking for an answer or explanation under the Western light? I think I can convincingly refute those claims by answering the above two questions. While I accept that the term "Baby Boomers" is Western, the main differences between parents and their adolescent children in the digital domain are consistent in European-American and Chinese contexts. Back in the 1990s, Yau and Smetana (1996) found that apparent similarities existed in parent-adolescent conflicts between Asian and Western families (p. 1273). As China becomes more and more like America in many aspects of life (see a discussion in Leonard, 2008, pp. 12 - 13), as ICT penetrate deeper and deeper into Chinese societies, the similarities* surrounding the differences and conflicts between adolescents and adults in the digital arena are likely to be greater and greater. So my answer to the first question is yes.

* For instance, teenagers often demand greater autonomy than their parents are happy to grant, see Yau and Smetana (1996, p. 1262).

As for the second question, I think incompatibility of Western theories and concepts is most likely to occur in measurement (see a good example in Bond, 1998). In this study, I did not adopt a ready-to-use survey in a wholesale fashion to measure digital divides in China. Instead, I designed and re-designed the survey to answer my specific research questions. Although certain areas of interest were influenced by Western literature, I did incorporate some preliminary findings from the field to shape the questions raised, for instance, class track information, attainment status, and even parental education. Furthermore, the qualitative strand departed even further from the Western "light," for example, in my use of Chinese terms to explain Chinese Internet cafés. Nevertheless, I am in sharp disagreement with the view that one must use Chinese terms and theories to explain Chinese phenomena. As long as a "light" is illuminating, in my view, we shall have no reason of shutting our eyes, for what we are all after is the "key." Resisting Western theories for the sake of resistance is, as Said (1983) put, "an inevitable part of acceptance" (p. 227).

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Appendix A

A Recollection of the Fieldwork

Figure A.1: *A snow-covered pass over 5000 metres high*

Tibet is indeed a remote and relatively inaccessible land. Even in 2011, from Guangzhou to Lhasa, the train journey took me three days and two nights. Of course, one can easily fly there today from a province closer to the Roof of the World, but I was advised to get there by train, partly because that allows my body to slowly adjust to the high altitude. But mainly because travelling in probably the world's highest running train in itself is an extraordinary experience.

High altitude sickness is the fear of many new visitors to Tibet. The ascending to an altitude of around 3700 metres in Lhasa has different consequences for different people. When I first arrived in Lhasa, I didn't lose any appetite, but suffered from a headache on the first night and the following day. That was the second time the same sort of headache hit me. When I realised there was something unusual that night, my first reaction was to ask myself if I had any port that day, because I got exactly the same pain once after drinking too much of it. I certainly didn't have any that day, so I knew it was high altitude sickness.

As I became aware of the sickness, I stayed in my hotel room. Because of the warning against a shower on the first day in Lhasa, I only went to open my toothpaste tube, which was inflated and the paste, without any effect of human force, automatically came out like a magic. The water in the hotel was not hot enough, so I was a bit scared to hear a cold in the high altitude could cause pulmonary or cerebral oedema and the story (joke) that a plastic pipe had to be put into a guest's throat so that water could be pumped out from his lungs (see Le Sueur, 2001, p. 60). I do not know how high altitude sickness relates to one's physical fitness, but it is likely that the very action of worrying about it could bring about enough headache. As Le Sueur (2001) described in his book, much of the symptoms might be self-inflicted (p. 135). When I got busier, I almost forgot about it.

But I was made more fearful when my friend warned me that I could be arrested as a spy by the Chinese authority. My research is not at all subversive in nature, but when you communicate with people and tell them that you are doing some research about education in Tibet, they wittingly or unwittingly drag you into certain topics that you have no interest in whatsoever. I had already been declined access three times prior to my arrival in Lhasa. I did not want to return with nothing from the trip. Without any doubt, I did not want to find myself in trouble with authorities of any type and level. And Of course, I did not want to die, peacefully in my hotel room, and then be sky-buried in the land of snow.

Right at the time when all those weird thoughts were cropping up on my mind, somebody knocked on my door. When I opened it, two policemen appeared in front of me. They asked for my ID, which was checked by the police before, but never in a hotel room. My head began to spin, and I wondered, what did I do wrong today? Are they really watching over me? Do they really know who I am, where I come from, what I am here for, where I am going, who I am with, and what I am doing with who I am with? I could feel my heartbeat racing and breath shortening.

Figure A.2: *Along the Yaluzangbu: blue water tracing through the white sand*

It was no small shock to me, but soon I realised it was simply a routine for them, for they knocked on other doors and did exactly the same thing over and over again – it was essential for almost any Chinese travelling in Tibet and my card was checked many times during the stay. That night was truly sleepless and breathless. When I did fall asleep, I dreamed of my supervisor, Professor Steven Higgins, blown out of a tube like the toothpaste, and myself chasing after him in a hope to catch him, but the thin air soon left me puffing and panting after a few meters of running. The following morning when I checked my email, I saw his message detailing me how to avoid high altitude sickness, for his sister is a doctor in the UK and he himself climbed high altitude mountains before.

Appendix B

A Note on Writing

Figure B.1: *Watch the plant grow as I watch the thesis grow*

It was a great idea to watch a plant grow,
as I watch my thesis grow,
as I watch myself age.
I water the flower as I revise what I write,
it suddenly gives life to what you are doing,
particularly to what you are doing on the screen.
It makes you feel the words are alive!

By and large, I enjoyed the writing process; although at various points, it was grist for the mill in a therapeutic way. Here I shall share many of the problems I have been struggling with and reflecting upon. But first of all, I would like to thank Professors Steven Higgins (Durham) and Steven Wandler (Harvard) for their help in making me a better academic writer. Many of the points I present here are inspired by them during my conversations with them.

While writing can be done effectively in various ways and to various ends, good academic writing does not happen overnight. Instead, it is a process that takes time, and above all, academic writing is an act of thinking. It makes the connection between hand and head, as in good craftsmanship where the making process reflects the thinking process, the writing process should mirror the scholarly process itself.

As I touched upon in Section 10.4, good academic writing engages with meaningful arguments, which are almost always rooted in analysis and evidence. In writing this thesis, I know that any issue related to Tibet in China could be made an issue. So I was very careful in presenting my own arguments about the differences between mainstream Han and Tibetan students. I kept asking myself whether I could find evidence to back up what I had to say. When I did find some evidence, I detailed the procedures by which I came across the answers. When different methods led to different conclusions, I provided both and let readers make their own judgements, and more importantly, I managed to draw readers' attention to the point that "scientific evidence" actually involves a lot of human decisions.

For instance, in comparing the differences in reporting non-trust of online information, the difference-in-means test and logit regression model resulted in diverging results – the former found a statistically significant difference between Han and Tibetan students, whereas the latter did not. So it is important to leave some room here for readers to make their own interpretations by pointing out the weaknesses associated with the two methods – the former assumes a constant distance between any two neighbouring options such as "Strongly disagree" and "Largely disagree;" whereas the latter loses information by making the responses a binary variable of either trust or not.

In addition, meaningful arguments should respond to positions that reasonable and intelligent people actually hold – they are no "straw man" that one can easily knock down. In other words, they are meaningful only if readers think their views on a particular topic could be altered upon reading your arguments grounded on good evidence, which are often falsifiable, generalisable, and replicable; or at least, if you can provide them with new reasons to question their existing viewpoints. It thus implies that a meaningful argument must have a meaningful counter-argument. If your argument is an oversimplification or outright distortion of opposing views, then we can ignore it in the first place. As in real life events, we often raise ourselves by raising our opponents.

Meaningful arguments involve meaningful analyses. As in the analysis of texts, it is important to understand what your data (here I mean statistical data) are saying and why. But it is equally important to figure out what your data are not saying and why not, and perhaps even more so to find out how your data are making their points (Hacker & Sommers, 2012, p. 77). Put in another way, unless we summarise less and analyse more, we can hardly teach our audiences anything new about an existing topic (text or argument), or a new way to understand the topic. So in my view, it is often your interpretation, not your description, of the data (both qualitative and quantitative) you are dealing with that really counts. This is real analysis, or at least the beginning of real analysis.

Regarding the presentation of statistical findings, one common practice we often see is the use of facts as arguments. As in literature review, writers often summarise key ideas they encounter in books and/or journal papers, and use them *as* arguments. While summary is crucial in any academic endeavour, it is risky to over-summarise and lose one's own voice in the writing process. That is to say, regardless of the nature of the data one has, it is vital to *participate* in the ongoing conversation or to *converse* with the data. Otherwise, one risks *subordinating* herself to the sources on hand.

For example, when I present certain summary statistics about access to and use of ICT in different schools, it is not enough to tell how different they are (summary). It is important to explain why they differ in those ways (analysis), and even more important to highlight the implications of those differences, namely, the answers to the *so what* question (argument) as a contribution to knowledge! Otherwise, I would have assumed that the data could speak for themselves, just as I would have assumed that the direct quotation of Freud in page 251 ("the shadow of the object fell upon the ego") could speak for itself had I not explained what it really meant in Turkle's words.

The same logic applies to the comparing and contrasting of ideas, data, and texts. As I mentioned in Section 10.4, it is so very lame to just tell my audience that Schools Hengshan and Basum are similar in some ways but different in other aspects (all things are!). According to Professor Wandler (personal communication, Spring, 2012), this is "the non-argument argument" of my findings resulting from the comparisons. So the key here, as Wandler suggested, is to expose interesting points, or metaphorically speaking, to "generate *heat* through the friction," or to reveal deeper and sometimes disquieting truths about access and use in the schools under investigation – elements that only emerge after the comparing and contrasting process. That is to say, the process *does* tell us how similar the schools are or are not. But it also tells us why people should care (so what?) by presenting something *new* the process *teaches* us. It also follows that empirical contribution to knowledge is not merely about *doing* something new, it is also about *teaching* something new.

Ultimately, all the contributions mentioned above should boil down to the overall argument of the study, which is the crystallisation of all the key findings from both qualitative and quantitative strands – the *thesis*. While the research questions present problems and puzzles for the study to address, the thesis requires me to answer those questions or even take a "position" (Hacker & Sommers, 2012, p. 18) on the debate about digital inequality in China. For instance, I argued that the most digitally marginalised teenagers are actually mainstream Han Chinese students with parents having no more than six years of education.

Moreover, the thesis also responds to the aforementioned *so what* question. It shows why answering those questions is important. In the study, addressing the digital inequality can, for example, help disadvantaged youths reap the level of psychosocial, intellectual, and emotional gains associated with adolescent engagement with ICT as observed in Shenzhen. Answering the questions thus *teaches* us new ways of assessing and managing youth interaction with ICT, which can provide young people with entry points to "larger, transformative experiences of understanding, sociality, and confidence, often at the point of being shared" (Turkle, 2008a, p. 37). For instance, the Internet has enabled the students in the study to better understand issues such as corruption and inequality in Chinese society.

Appendix C

Informed Consent

Prior to each interview, the permission to audiotape the conversation between me and students was obtained. This form was only presented to the students involved in the qualitative strand face to face with me. Before I turn on my iPhone as a recording device, I orally translated the content to the students before asking for their signatures. This was to make sure that students knew the purpose of the research project and that their privacy would be protected by anonymity of their own and their school names. This process was therefore implemented twice, one before all the students completed the survey in their classroom, and the other before interviewing if they took part in that stage.

According to my preliminary fieldwork experience, it is important to ask informants to sign in both Chinese and *pinyin*, the romanisation of Chinese characters for pronunciation. Otherwise, it could be difficult to recognise certain characters by some students. It is also vital to say the name of each informant (perhaps time and place of the interview as well) to the recorder so that later matching of audio and text files becomes much easier, particularly when there are many informants in a study. I would recommend this even in the presence of an interviewee information form, which might be lost or damaged during fieldwork.

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Informed Consent Form

This research, entitled 'A Sequential Mixed Methods Approach to the Study of Digital Divides in China: Evidence from Two Senior Secondary Schools", is a study that aims to find out how Information and Communication Technologies (ICTs) like mobile phone, computer, and the Internet are being taken up by students like you at senior secondary level in China. Apart from investigating the influences these technologies might have on students' academic performance and life experiences, I am also going to examine the differences between and within urban vs. rural as well as Tibetan vs. Han Chinese students, in terms of your access to and effective use of new technologies. This research hopes to shed some light on what we can do to harness the benefits that new technologies can afford and to address the differences between the groups, so as to bring about an ICT-enhanced and more equitable education in high schools. This research is undertaken by ZhiMin Xiao, a Durham Doctoral Fellow at the School of Education, Durham University.

Please read the following text carefully:

I have read and understood the information on this study and have had the opportunity to ask questions and get satisfactory answers about the research.

I understand that I can withdraw from the research project without any consequences at any time simply by informing the researcher of my decision. I understand who will have access to identifying information provided and what will happen to the data at the end of this project.

I understand that this project has been reviewed by, and received ethics clearance through, the School of Education, Durham University.

I thereby agree to participate in this study.

Name in *Hanzi*: Name in *Pinyin*:

Date: Signature:

Appendix D

The Survey

This survey was designed at the very early stage of my doctorate. Although I revised it over ten times by asking friends and students to read it and then give me their feedback, I could have done it differently and avoided certain problems I later identified during analyses. But I would particularly like to thank Li Ling, Yvonne Zhang, Nik Kraus, Dr. Wan-ying Tay, Dr. Li Wu, Dr. Jangho Lee, and Professor Feng Anwei for their valuable comments on my earlier drafts. Thanks also go to Dr. Rebecca Eynon for allowing me to use for this study two of her survey items published in her conference paper (2010, p. 853).

The first problem occurs in Question 13, where “Only weekends or holidays” can be nested in “Often, even during term time.” The second area for improvement is the wording of a few statements in Question 20. For instance, the first statement has some extreme words like “significantly detrimental,” which is likely to affect how students respond to it. Its Chinese translation sounds even severer. Question 7 about parental occupation has too much missing data. I later decided to abandon the responses collected for this item altogether as an indicator of socioeconomic status. A better way of measuring it could be relative wealth. For instance, I could have asked students: In your village or community, do you think your family is wealthier than, similar to, or poorer than most. Bearing in mind these shortcomings, I placed more weight on data gathered for questions that are easy to understand and involve only “factual” information such as the number of purposes they engage with the Internet for.

Digital Divides in China

Hello! My name is ZhiMin Xiao. I am a Ph.D. student at the School of Education, Durham University. Thank you for taking the time to learn more about the "digital divide" project. The aim of this research is to find out how Information and Communication Technologies (ICTs) such as mobile phones, computers, and the Internet are being taken up by students like you at senior secondary level in China. Apart from investigating the influences that these technologies might have on students' academic performance and life experience, I am also going to examine the differences in terms of access to and effective use of new technologies between and within urban v.s. rural, as well as Tibetan v.s. Han Chinese students. In doing so, this research hopes to shed light on what can be done to more effectively harness the benefits that such new technologies can afford and at the same time to address the differences between the aforementioned groups, thus bringing about a more equitable ICT-enhanced education in Chinese high schools.

Completing this survey will take you about 10 to 15 minutes. The collected data will be analysed and applied in my Ph.D. thesis. By participating in the study, you will be more aware of the advantages and disadvantages of using ICTs in education and daily life. Please feel free to ask any questions you might have about the study before you decide whether or not to participate. Should you decide to take part and help, please be aware that you may withdraw from the study at any point without any penalty. All information that you provide as part of this study will be both strictly confidential and anonymous – you will not be identifiable in the final report of this research and the data stored securely. Only my supervisor Professor Steve Higgins and I myself will have access to this data.

If you have decided to participate, please type in your name and today's date in the space below to agree to proceed. If you prefer to complete the survey anonymously, please sign below with your school's name. However, if you would like to participate in a face-to-face interview with me after the survey, please sign your real name. In addition, all questions with an asterisk (*) are compulsory and must be answered in order to assure that the information you provide can be used. If you have any further inquiries about the research, please feel free to contact me at zhimin.xiao@durham.ac.uk Thank you!

你好！我叫肖志敏，现为英国杜伦大学教育学院在读博士生。感谢你抽出宝贵的时间来更深入地了解此项关于数字差距的研究课题。此研究的目的是探寻信息与通讯技术（在此课题中特指电脑、手机、和互联网）在中国高中生中的普及和使用情况，以及它们对学生的学习和生活所产生的影响。除此之外，我还会比较城、乡以及汉、藏两族学生在接触和有效使用以上通讯技术上的差异。通过此项研究，我希望了解如何更好地利用新信息技术来提升教学质量并探索出帮助缩小数字差距所需的相关知识。

完成这个问卷大概需要10到15分钟。你提供的数据将会在我的博士论文中进行分析和讨论。通过参与这项调查，你会了解到更多关于信息技术对教育所产生的积极和不良影响。请注意，在问卷填写的过程中，你可以因任何理由放弃完成此问卷。对你所提供的信息我会加以保密；在写作时，未经你许可，我不会透露你的真实姓名。所有原始数据只有我以及我的指导教授 Steve Higgins 有权查看。

如果你已决定参与，请在下面签上你的姓名并填写今天的日期。如果你决定以匿名的方式回答问题，请在下面空白处填写你的学校名称。但如果你想在填完问卷之后跟我面谈的话，我建议你签上自己的真实姓名。此外，所有带星号的问题为必答问题。如果你还有疑问，请与我联系，我的邮箱地址是：zhimin.xiao@durham.ac.uk QQ: 1405973792 手机: 18620231473

*** 1. Please type your name and today's date below to proceed 丨在回答问卷问题之前，请填上你的姓名和今天的日期**

Your name in Hanzi and Pinyin (e.g. 张三 / Zhang San) 丨你姓名的汉字及拼音 （比如：张三 / Zhang San）

Today's Date (dd/mm/yyyy) 丨今天的日期 (日/月/年)

*** 2. Gender 丨性别**

Male 丨男

Female 丨女

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*** 3. Year of birth 丨你是哪年出生的？**

- 1992
- 1993
- 1994
- 1995
- 1996
- I prefer not to say 丨我不想说

Other (please specify) 丨其它（请说明）

*** 4. Ethnicity 丨民族**

- Tibetan 丨藏
- Han 丨汉
- Other 丨其它

*** 5. Are you on an arts or science track 丨你读文科还是理科?**

- Arts 丨文科
- Science 丨理科
- Neither 丨没有分科

*** 6. Is your class high attaining relative to others in your school 丨你们班是重点班吗?**

- Yes 丨是
- No 丨不是

Other (please specify) 丨其它 (请说明)

*** 7. What do your parents do for living? (If you prefer not to reveal this information, please type "N/A") 丨你父母是做什么的？ (如果你不想透露此信息，请填"N/A")**

Mother 丨母亲:

Father 丨父亲:

*** 8. Your parents' highest academic qualification 丨你父母的最高学历**

	Mother 丨母亲	Father 丨父亲
No formal education at all 丨没有受过正规教育		
Primary school 丨小学		
Junior secondary school 丨初中		
Senior secondary school 丨高中		
Higher education with or without a first degree 丨大学(大专或本科)		
Graduate or higher degree 丨研究生或更高学位		
I prefer not to say 丨我不想提供此信息		

*** 9. Where do you mainly live during school terms 丨上学期间你主要住在什么地方？**

- At home 丨家里
- In school dormitory 丨学校宿舍
- Elsewhere 丨其它地方

*** 10. Academically speaking, where do you stand in your class (overall performance) 丨你的学习表现在班上的大概排名**

- Top 10% 丨前10%
- Above average 丨中上
- Average 丨中等
- Below average 丨中下
- Bottom 10% 丨最后10%
- I prefer not to say 丨我不想说

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*** 11. Please rate the following statements (the higher the score, the more it represents you) | 请为以下表述评分（分值越高就越体现你的状态）**

	1	2	3	4	5
(1) I hope to do well in school this year	我希望今年学得很好					
(2) I believe that I can do well if I try hard	我相信，如果我努力，我可以学得很好					
(3) It is important to me that I do well in school	成绩好对我来说很重要					
(4) When I am taught something that doesn't make sense to me, I spend time trying to understand it	当老师教的内容很难懂时，我会花时间去弄懂它					

*** 12. Your level of access to ICTs (multiple options possible) | 你对这些技术的使用情况（可多选）**

	None	没有任何一项	Computer	电脑	Mobile Phone	手机	Internet	互联网
(1) Which items do you have personalised access to	哪些设备可供你个人使用？				
(2) Which items do you have access to at home	你在家里可以使用哪些设备？				
(3) Which items can you use at school	你在学校可以使用哪些设备？				

*** 13. Your visit to Internet cafés | 你去网吧的情况**

- Never before | 从没去过
- Only weekends or holidays | 只有周末或放假的时候去
- Often, even during term time | 学期的时候也经常去
- I can't cope without Internet cafés | 没网吧的话这日子没法过了
- I prefer not to say | 我不想告诉你

*** 14. How many mobile phones have you had for your own use | 你已用过几部属于自己的手机？**

- 0 | 没用过
- 1-3 | 1—3部
- 4-6 | 4—6部
- Above 7 | 7部以上

*** 15. On average, how much per month do you spend on mobile phone bills | 你平均每月花多少钱在手机费上？**

- 0 | 零
- Below 30 Yuan | 30元以下
- 30—90 Yuan | 30—90元
- 90-150 Yuan | 90—150元
- 150—250 Yuan | 150—250元
- Above 250 Yuan | 250元以上

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*** 16. Usually, what do you use the Internet for (multiple options possible)丨你一般用互联网做什么（可多选）？**

- Online banking丨网络银行
- Visiting social networking sites such as Renren丨访问人人等社交网站
- Chatting online丨聊天
- Downloading videos or music丨下载视频或音乐
- Receiving and sending emails丨收发电邮
- Playing online games丨玩网络游戏
- Keeping up with news丨看新闻
- Looking for job opportunities丨找工作
- Meeting international friends丨会国际友人
- Running a business丨做买卖
- Editing or sharing photos丨编辑或分享照片
- Reading novels online丨读网络小说
- Researching products I'd like to buy丨查询购物信息
- Writing my own blog丨写日志

Other (please specify)丨其它（请说明）

*** 17. How do you use ICTs for your study (multiple options possible)丨在学习上，你是如何使用这些设备的（可多选）？**

- Writing homework on computer丨用电脑写作业
- Making a slide presentation such as PowerPoint丨准备电子演说文档，如微软的PowerPoint
- Searching online for information related to my study丨在网络上查找与学习有关的信息
- Logging on to school website to get information about school work丨登录学校网站查询与学习有关的信息
- Communicating with friends about school work丨跟朋友交流与学习有关的信息
- Usually, I don't use ICTs for school work丨我一般不因为学习而使用这些设备

Other (please specify)丨其它（请说明）

*** 18. When you encounter difficulties while using ICTs, where do you get help (multiple options possible)丨当你在使用这些技术的过程中遇到困难时，你可以从哪里得到帮助（可多选）？**

- I try to figure it out for myself丨我尝试自己去弄懂它
- Friends丨朋友
- Teachers丨老师
- Parents丨父母
- I look on the Internet丨我上网找解决办法
- Nobody available to help丨没有人可以帮我

Other (please specify) 丨其它 (请说明)

Digital Divides in China

* **19. How restrictive are the conditions you face (e.g. those from either your parents or teachers) in using the following ICTs｜你在使用以下信息技术时面临多大来自比如父母或老师的限制？**

	No access or no opinion 没有接触或没有看法	Very restrictive 很受限制	Fairly restrictive 有一定限制	Not restrictive at all 一点限制也没有
Internet café｜网吧				
Mobile Phone｜手机				

* **20. To what extent do you agree with the following statements｜你在多大程度上同意以下看法？**

	Strongly disagree｜很反对	Largely disagree｜基本反对	Largely agree｜基本赞成	Strongly agree｜很赞成	No opinion 没意见
(1) Internet cafés are significantly detrimental to students like me｜网吧对我这样的学生来说是极其有害的					
(2) Computer games have severely affected my academic performance｜电子游戏严重地影响了我的学习					
(3) My use of ICTs has a negative impact on my relationship with my parents｜使用这些设备破坏了我与父母之间的关系					
(4) Most information I find online can be trusted｜大部分网络上的信息是值得信赖的					
(5) I am very concerned about my privacy online｜我很担心我的网络隐私					
(6) With a mobile phone of my own, I can build a closer relationship with my friends｜自己有手机可以更好地建立友情					

21. If you would like to take part in a follow-up interview, please leave your contact details below. I will be in touch with you shortly｜如果你愿意跟我面谈，请留下你的联系方法，我会尽快与你联系。

QQ

Phone No.｜电话号码

Email｜电邮

Other｜其它

This is the end of the survey. Your answers to the questions have been received with appreciation｜你已经回答了该问卷的所有问题，非常感谢你的时间！

D.1 Key variables

1. `gender` Male or Female
2. `age` Age in 2011, transformed from year of birth
3. `school` The three schools
4. `diqu` Numerical version of `school`
5. `eth` Ethnicity, Tibetan or Han
6. `minzu` Numerical version of `eth`
7. `track` Arts or Science track
8. `wenli` Numerical version of `track`
9. `stream` Key or Ordinary, class attainment status
10. `zdpt` Numerical version of `stream`
11. `htdwell` Hope to do well in school
12. `cdwell` The belief that one can do well in school if she works hard enough
13. `imptdwell` Self-perceived importance of doing well in school
14. `understd` Efforts made to understand something difficult in learning
15. `viscafe` Frequency of visits to *wangba*
16. `handsets` Number of mobile phone handsets ever owned
17. `phbill` Monthly mobile phone bill
18. `freecafe` Freedom one enjoys in visiting *wangba*
19. `treat` School *wangba* policy as a treatment variable — those who report "Fairly" or "Very restrictive" are treated; otherwise, in control; missing data are still missing; transformed from `freecafe`
20. `freeph` Freedom in using mobile phones
21. `cafe` Negative views of *wangba*
22. `games` Views about negative effects of computer games on learning
23. `ictparents` The role ICT play in parent-child relationship
24. `infonline` Trust of online information in general
25. `nontrust` Reporting non-trust of online information; transformed from `infonline`

26. `privacy` Concerns over privacy in cyberspace
27. `ictfriends` Roles ICT play in maintaining and establishing friendship
28. `support` Sources of support one has when encountering problems in using ICT
29. `ictfs` Academic use of ICT
30. `ias` Number of non-academic activities one often undertakes with the Internet
31. `acts` Total number of activities with ICT, including academic and non-academic use of ICT
32. `iabands` High, Medium, and Low levels of Internet activities
33. `actbands` High, Medium, and Low levels of total activities
34. `ictp` Personal ownership of ICT
35. `icth` Access to ICT at home
36. `ictsch` Access to ICT in school
37. `icts` Total access to ICT across the three levels
38. `pe` Parental education in years; first transformed from the highest qualification reported by students of each parent, then averaged if there are two values for two parents
39. `pe.dmy` A dummy variable for parental education in years; with or without 12 years of education
40. `pebands` Three levels of parental education – primary, secondary, or tertiary
41. `rank` Self-reported academic ranking in class (students in the three high schools are grouped by class, not by module)
42. `undera` Reporting academic underachievement, namely, "Below average" or "Bottom 10%" in class; transformed from `rank`
43. `achieve` Reporting academic achievement, namely, "Above average" or "Top 10%" in class; transformed from `rank`

D.2 Initial codes

The following codes explain how variables were coded or transformed, and the decisions made in the organisation of "raw" data from the survey. First, a very small number of students (nine) chose "I prefer not to say" when asked of their year of birth. I coded them as "NA" (missing data). The same rule applied to questions about track and class attainment status; but not to academic ranking, where different values were attached to specific categories – 0 for "I prefer not to say," 1 for "Bottom 10%," 2 for "Below average," 3 for "Average," 4 for "Above average," and 5 for "Top 10%." These values were meaningful when I compared differences in means between groups; but meaningless when I transformed responses into binary outcome variables of reporting underachievement or achievement in logit regression models.

Second, when I measured the level of access to ICT, 0 was attached to "No access," 1 for each item students chose, which means if one has a mobile phone, has access to the Internet from a personal device, and a personal computer, then her maximum score at personal level is 3. The same method was employed to measure home and school level access. Since a student's total access to ICT is the sum of access quantified across the three levels, the minimum and maximum for total access are 0 and 9 respectively. This additive approach also operates in the measurement of Internet activities, academic use of ICT, and sources of support, where each item selected represents one score, and the more students select for an item, the higher their scores on that item are.

Third, as I did in measuring academic ranking, an incremental approach was utilised to measure visits to internet cafés, where 0 was for "Never before," 1 for "I prefer not to say," 2 for "Weekends or holidays," 3 for "Often, even during term time," and 4 for "I can't cope without Internet cafés.* A similar approach was employed to measure the number of handsets ever owned, where 0 was reserved for "Never," 1 for "1 – 3," 2 for "4 – 6," and 3 for "Above 7." In the measurement of self-reported monthly mobile phone bills, 0 was for zero expense, 1 for "Below 30 *yuan*," 2 for "30 – 90," 3 for "90 – 150," 4 for "150 – 250," and 5 for "Above 250 *yuan*."

In measuring parental education, I took the same incremental approach to the highest academic qualification students selected for each parent. But the following point is worth mentioning here: A value of 1 was attached to "No formal" education. I thought

* For a justification of 1 being attached to "I prefer not to say," please see Section 9.6.1.

some value is vital, partly because no formal education does not mean they are not smart – there are many smart people out there who are not even “smart” in the conventional way as measured by school experiences; and partly because there are many students with parents having no formal education in the study, and some also selected “I prefer not to say,” to which a value of 0 was added. For other categories, 2 was reserved for “Primary,” 3, 4, 5, and 6 for “Junior secondary,” “Senior secondary,” “Higher education,” and “Graduate” respectively.

Finally, when I quantified the freedom students enjoyed in using mobile phones and visiting *wangba*, I coded “No access or no opinion” as 0, “Very restrictive” as 1, “Fairly restrictive” as 2, and “Not restrictive at all” as 3, which means the higher the score, the more autonomy students have. This variable was later transformed into a treatment variable to see the effect of school *wangba* policy on the probability of students reporting high achievement. As for the six statements in Question 20, a similar approach was utilised: 0 for “No opinion,” 1, 2, 3, and 4 for “Strongly disagree,” “Largely disagree,” “Largely agree,” and “Strongly agree” respectively – the higher the score, the more students agree with a statement.

Appendix E

Interview Guide

This interview guide only served to prompt me in earlier interviews with informants. The questions were rather rigid. But the more interviews I conducted, the less I relied upon it, although I brought it with me for each interview. That is to say, the actual interviewing was much open-ended, and students were free to raise their own questions or add comments not directly related to the questions asked. Indeed, they were even free to withdraw halfway if they felt it was necessary to do that.

Introduction

Appreciation of their time and willingness to participate in the interview
Brief description of the research project
Permission to audiotape this conversation (signature on the Informed Consent Form)
Ask for some historical information about the student and the school

Quality

For those who have:
1. What kind of mobile phone are you now using? Why this model?
2. You said in the survey that you spend about (amount) RMB per month on mobile phone bills, do you think it is expensive?
3. How satisfied are you with the service provider? Why?
4. Do you have opportunities to use a computer at home? If yes, when, how (whether or not you need to share it with other family members), and how often?
5. How often do you use school computers? When and for what purposes?

6. Have you ever visited an Internet café? If yes, why did you go there? How often and what's your impression of it? If no, why and how do you view those who do go there a lot?

For those who have not or less:
1. Why don't you use a mobile phone?
2. How do you cope without it in school?
3. Do you have any opportunities to use a computer at home? If yes, when, how (whether or not you need to share it with other family members), and how often?
4. How often do you use school computers? When and for what purposes?
5. Have you ever visited an Internet café? If yes, why did you go there? How often and what's your impression of it? If no, why and how do you view those who do go there a lot?

Purposes

1. For what main purposes do you use your mobile phone?
2. For what main purposes do you use the Internet?
3. For what main purposes do you visit an Internet café?

Meanings

For those who have:
1. How important is this mobile phone to you? Why?
2. Do you decorate your handset? Why or why not?
3. Do you personalise your ring tones? Why or why not?
4. How important is your home computer to you? Why?
5. How important are school computers to you? Why?
6. Are Internet cafés important in your life as a student? Why?

For those who have not or less: 1. How does the absence of a mobile phone affect you?
2. How do you view those who have and use mobile phones on campus?
3. How important are school computers to you? Why?
4. How important are Internet cafés to you as a student?

Utility

1. What are the most salient benefits that could be associated with your use (or non-use) of a mobile phone / the Internet / computer / Internet café? (Talk about implications on study; relationships with friends, teachers, and parents; security & privacy)
2. What are the most obvious costs or harms that could be associated with your use (or non-use) of a mobile phone / the Internet / computer / Internet café? (Talk about implications on study; relationships with friends, teachers, and parents; security & privacy)
3. Please tell me the most striking thing to you that you have observed of other students using mobile phone, computer, or the Internet since the beginning of this academic year.

Autonomy

1. What restrictions have your parents imposed upon you when you use your mobile phone / the Internet / Internet café?
2. What restrictions have your teachers imposed upon you when you use your mobile phone / the Internet / Internet café?
3. How do you respond to those restrictions?

Do you have any questions for me?
Thank you for your time!

End of the interview!

Appendix F

Multilingual Barriers?

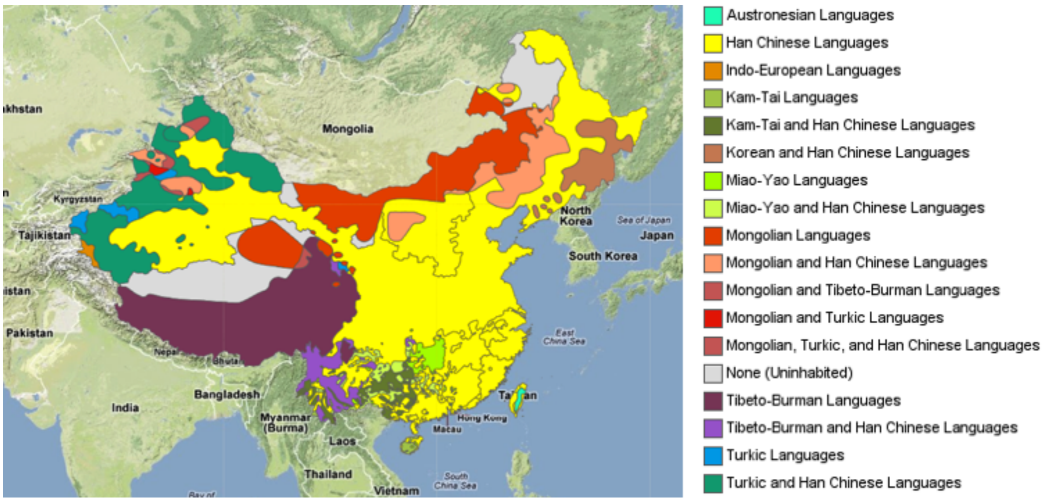

Figure F.1: *Language Regions of China (Courtesy of Harvard WorldMap)*

F.1 Linguistic implications for the research

Throughout the thesis, I provided Chinese transcripts of interview excerpts. Since all interviews in Shenzhen and Tibet were conducted in Mandarin, the official language of China, the transcripts associated with the excerpts from the two areas are in Chinese characters. But in Hunan, all interviewees spoke the local dialect called *Hengyang Hua*, which is the primary medium of instruction (textbooks are in standard Chinese) in School Hengshan. While *Hengyang Hua* is spoken by many in the county where Hengshan is situated, it does not have an official written form, which means my translation in writing of the transcripts from Mandarin to *Hengyang Hua* is likely to be strange to many in China. Even to those in Hengshan, the characters may seem familiar yet unusual, for people there rarely see the language they speak almost every day in text. Although written translations of the dialect are emerging from the Internet, they are largely meant to make people laugh, and the translations are far from consistent except for some common words.

To overcome the challenge in translation, I shared on QQ my translations of those excerpts with the students in Hengshan and asked for their feedback. I provided three versions (Mandarin, English, and *Hengyang Hua*) of the interview excerpts I used in the thesis* so that they could compare and fully understand what I wanted to convey. I also asked non-participants of the study who are native speakers of the dialect to read the translations and comment on them. I then revised earlier translations by incorporating some of their feedback. I am quite confident that the translations provided in the thesis are the closest possible approximation to, if not a faithful reflection of, what informants really meant.

Presenting excerpts in Mandarin and *Hengyang Hua* serves three purposes. The first is to more accurately translate what students said into English, for readers of the thesis who understand both Mandarin and English can compare and make better interpretations of their own. For instance, when a student mentioned "corruption" in page 165, I found it really difficult to figure out what he really meant by *tanwu*, for the Chinese word can refer to a wide range of misdeeds by those in power. Second, when I examine ICT in the three regions with specific sociolingual characteristics, I am in a better position to understand how teenagers make ICT their own or keep a certain distance from them. For example, when students in Hengshan say the machines are *haohang*, they mean the computers are of poor quality. But they also use the word to describe people. In Basum, when you hear "I am going to buy a *real* Nokia phone tomorrow," you begin to understand many Tibetans are using "knockoff" (Barboza, 2009) or *shanzhai* Nokia handsets – like many in other parts of China, they are in a disadvantaged market position.

Third, language is identity and represents the cultural profile of each school. In the age of globalisation, particularly with the permeation of the Internet, more and more languages are likely to be further marginalised, if not dying. We therefore have a shared responsibility to preserve the language that has shaped who we are, the language our

* I removed the information that could be used to identify participants in the study.

parents, grandparents, grand-grandparents grew up with and spoke years, decades, and decades ago.

By exhibiting the excerpts in their native languages, I am intentionally exposing another limitation of the study – I am not able to speak and understand Tibetan, which renders it impossible for me to decode certain nuances of Basum informants' thoughts and words as I could in Hengshan and Nanshan, although Mandarin is sufficient for me to complete the project there. Given the history of Tibetan language and the fact that it has its own oral and written forms (Badengnima, 2001), the problem is more striking in Basum than it is in Hengshan. To surface such an issue in the study, I feel it is necessary to sketch *a* linguistic background of the research context in Basum and explain why using Mandarin only in the study satisfies and cripples me at the same time.

F.2 Two to three: language education in Tibet

According to Sociologist Ma Rong of Peking University, one fundamental issue of education in Tibet today is not about whether or not Chinese should be learned, but about when and how much it should be promoted (2011, p. 7). The section which follows will explain why this is no longer an either-or question, by tracing the history of Education in Tibet.

In November 1961, the then Tibet Work Committee required all community-run primary schools to offer Tibetan, Arithmetic, and Politics. In these schools, Tibetan was the medium of instruction and all textbooks were produced in Tibetan. Chinese was introduced according to school circumstances and the level of acceptance by local populace (Zhang, 2007, p. 14, cited in Ma, 2011). Meanwhile, state-run schools were instructed to add Chinese from year 3, but Tibetan remained the primary medium of instruction. However, there emerged Chinese-medium schools in urban areas, where Mandarin was the primary language of instruction and Tibetan was taught from year 3 (Ma, 2011, pp. 8 - 9). It is worth noting in this period, it was not just Tibetan teachers who were encouraged to learn Mandarin, but Han teachers in Tibet were required to learn Tibetan too. This was deemed necessary to teach in Tibetan schools (Zenz, 2010, p. 301). However, as students progressed onto secondary level, schools encountered greater challenges, whilst attempting to teach higher-grade science subjects in Tibetan. In other words, Tibetan-medium schools had to confront the shortage of bi-lingual teachers and the lack of textbooks in Tibetan, even though the government's basic policy of adopting

Tibetan as the primary medium of instruction remained unchanged.

The second phase featured the Cultural Revolution (1966 - 1976), a countrywide campaign aiming to eliminate the "four olds" (old culture, old customs, old ideas, and old habits) and to advance to socialism (though only culturally and spiritually, given the level of economic development at that time). In this period, the Tibetan language was associated with Tibet's old custom of slavery in society and was subject to crude attacks, as were countless teachers (Badengnima, 2001, p. 93), and schools were closed for years (Bass, 1998). Although many schools gradually re-opened in the 1970s, the Tibetan language was judged under-developed and impractical for a long time. The policy which was established at that point, demanded that students learn Chinese from year 1 of the primary level and that first and foremost, their Chinese should be improved (Ma, 2011, p. 9).

Another point worth noting, during this period, is that learning was limited to Mao's thoughts, for earlier textbooks were associated with feudalism, capitalism, or revisionism, which were anti-revolutionary and anti-socialist. Therefore, they had to be attacked and abandoned. Like elsewhere in China that time, Mao's Little Red Book (quotations of Mao's thoughts, compiled by his Defence Minister, Lin Biao) was used as *the* correct and precise textbook in many schools (Zhang, 2007, p. 43, cited in Ma, 2011). However, in 1974 Mao did call upon Han Chinese in Tibet to learn Tibetan and in turn, the Tibetans to learn Chinese. Subsequently, schools frequently taught both Tibetan and Chinese, although the year group in which Chinese was introduced, varied from year 3 to 5 at the primary level (Badengnima, 2001, pp. 93 - 94).

Following the Cultural Revolution, the central government adjusted its way in the governance of Tibet and appointed local aristocratic leaders to various institutions. These individuals in due course, endeavoured to promote Tibetan language and culture. In 1980, the government required students of all ethnic backgrounds in Tibet to learn Tibetan and at that juncture, advocated a system in which Tibetan was declared the primary medium of instruction (Ma, 2011, p. 11). This period, thus, witnessed a process of what Zenz (2010) referred to as "Tibetanisation" (p. 295) in Tibetan schools. However, at this point in time very few students actually progressed onto secondary level. In 1987, 99% of graduates from 2,250 Tibetan-medium primary schools were compelled to spend a preparatory year for junior secondary education in forty middle schools (Ma, 2011, p. 10), where the language of instruction was primarily Chinese.

For those who did enter secondary level after the foundation year, it proved to be a very difficult task for them to understand and appreciate some subjects taught in Chinese, particularly science. Therefore, the disjuncture between primary and secondary levels posed a formidable obstacle for the progress towards a largely Tibetan-medium education.

In response to the above challenges, diverse opinions emerged in the late 1980s. Some argued that the state should create opportunities and thereby, enable Tibetan students to learn in Tibetan at all levels. Yet others suggested the legalisation of a Tibetan-led model. However, some Tibetan cadres in cities like Lhasa contended otherwise. They reasoned that it was important to maintain a dual system, where people could choose between Tibetan and Chinese-medium schools. These factions also emphasised that students learned better when Chinese was the primary medium of instruction, and that students from Chinese-medium schools benefited and experienced additional opportunities for higher education in inland China (Badengnima, 2001, p. 95). Also knowing Chinese was an added advantage in their interactions between the TAR and inland provinces (Ma, 2011, p. 11). This view was contrary to the widely held belief that Tibetans learned better in their native language (Bass, 1998, pp. 237 - 238). In any case, these differing opinions reflected the challenges in striking a balance between the two languages.

However, in 1987, all parties ostensibly agreed that Tibetan should be the primary medium of instruction; Chinese could be introduced at higher grades only if it had no negative impact on learning and teaching in Tibetan. Beyond primary level, Tibetan continued to be the primary medium of instruction with Chinese also being learned, and if conditions permitted, the addition of a third language was allowed. This Tibetan-led model was reinforced by a later regulation, which specified that starting from 1993, most middle school subjects, except for Chinese and foreign languages, should be taught in Tibetan; from 1997 onwards, the model should apply to all high schools; and from the year 2000 onwards, higher education institutions in Tibet should gradually adopt the model (Ma, 2011, p. 12).

Nevertheless, in the 1980s, there were Chinese-medium schools in the TAR, where Chinese was the primary medium of instruction, and Tibetan was introduced as an additional language in year 3. Those schools were mainly for children of Han Chinese cadres in Tibet, and the separation between Tibetan and Chinese-medium schools was very strict. According to Ma (2011), the policy did not allow the Chinese schools to accept Tibetan students who wanted Chinese instruction. Consequently, the implementation of the Tibetan-led model encountered certain hurdles, particularly in towns and cities (Badengnima, 2001, p. 96), where many Tibetan families preferred to have their children educated in Chinese-medium schools, or ideally in inland Tibetan schools (from 1985 to 2006, over 30,000 Tibetan students studied in inland China), even though some groups publicly stressed the significance of establishing a Tibetan-led system across all levels (Ma, 2011, pp. 13 - 14).

In many schools, Chinese was once again accorded increasing influence and authority. Chinese-medium schools stopped offering Tibetan in 1994, suggesting Han Chinese students were no longer required to learn Tibetan in Tibet. Meanwhile, the government advocated a bilingual model, in which a degree of importance was attached to Tibetan, and students were expected to achieve proficiency in both Tibetan and Chinese (*zang han jian tong*), and some schools were even encouraged to offer a third language, in order to meet the demands of an expanding market economy (Zhou, 2003, p. 111). By the year 2000, although over 95% of all primary schools still adhered to the Tibetan-led model (Zhang, 2007, p. 29, cited in Ma, 2011), most schools beyond that level adopted the Chinese-led model, where most subjects were taught in Chinese and Tibetan was a compulsory subject.

It is worth mentioning that the TAR's Education Committee emphasised in 1999, that no single model should dominate all schools, for conditions in different areas varied substantially. The Committee encouraged local schools to experiment and adopt a model (or models) that best fitted their unique circumstances (Ma, 2011, p. 17). However, the People's Congress in the TAR directed that Tibetan *and* Chinese be the basic instruction languages in compulsory education and a third language be added accordingly (Zhou & Gesangjiancun, 2004), which amended the 1987 policy that Tibetan be the primary medium of instruction.

As greater prominence was attached to Chinese, the number of Tibetan teachers who could teach in both Tibetan and Chinese also rose, partially due to the return of inland-educated Tibetans. However, there were more Tibetan teachers at lower levels of schooling than at higher levels. For instance, Tibetan teachers of Mathematics constituted less than 30% of all Maths teachers at senior secondary level in 2005, whereas the percentage in middle schools was over 57% (Ma, 2011, p. 18). From 2001, all primary schools in urban areas of Tibet began to teach Chinese from year 1 (Zhang, 2007, p. 40, cited in Ma, 2011), and some schools offered English from year 3 (Lu, 2005). The consequence of this action was that in many primary schools, most subjects were taught in Tibetan (except for Chinese and Mathematics in some cases), but in middle schools, most subjects were taught in Chinese, except for Tibetan (Lu, 2005, pp. 232 - 233), and very few high schools had Tibetan as the primary medium of instruction. This implied that some students were compulsorily subjected to an abrupt shift from a Tibetan-led model at primary level to a Chinese-led model at secondary level. This shift probably explains why a few informants from rural and nomadic backgrounds in this study could not articulate their views well (or they were not willing to share their views), whereas their urban classmates had no problem at all when expressing their opinions in Mandarin.

Nonetheless, this period revealed greater flexibility in the fraternisation and socialisation of students from different ethnic backgrounds than had been allowed by the policy sanctioned in the 1980s. According to Qulina (cited in Ma, 2011, p. 19), there were Chinese and Tibetan-medium classes in Lhasa's No. 1 Middle School, and students were free to select either stream for junior secondary education. In No. 6 Middle School of Lhasa, bilingual teachers gradually reduced the use of Tibetan in higher grades and students' performance improved each year. But the decline of students' competence in Tibetan also concerned numerous sections of society – they began to doubt if the aim of bilingual education would eventually lead to proficiency in both languages, particularly after Qinghai Province's announcement of Education Outline for 2010 - 2020, which aimed to move towards a Chinese-led model by 2015. Although some middle schools in the TAR were still demanding a "pure Tibetan" model (Zenz, 2010, p. 301) with all subjects taught in Tibetan, except for Chinese and English, such a model would eventually lead to students being highly competent in Tibetan, but barely proficient in Chinese (Zenz, 2010, p. 302), and ultimately experiencing disappointment in job markets (Badengnima, 2001, pp. 95 - 96).

F.3 Linguistic capital and multilingual models

Having traced the evolution of linguistic models in Tibet, I shall examine the relationship between those models and linguistic capital in this section. According to Bourdieu (1977), resources individuals have, be they cultural or linguistic, have different market values in different social systems. A language may have a relatively low value, if it is not the mother tongue of a group. Therefore, the social system or "linguistic field" within which a language is positioned, can be more important than the intrinsic value of the language, for all groups in any society have their own linguistic capital, which refers to "the ability to utilize appropriate norms for language use and to produce the right expressions at the right time for a particular 'linguistic market' . . . there are many linguistic markets in which rare or high status forms result in profit for the user, and where non-standard or low-status language use is assigned a limited value" (Corson, 1993, p. 10).

As in economic systems, market values of languages fluctuate from time to time and vary from place to place. However, the time and place depend on the power relations between groups, which change from one linguistic field to another, as does linguistic capital (Corson, 1993, p. 15). Models of multilingual education for Tibetans in China are vivid expressions of such a power relationship. For example, Tibetanisation* was more likely to occur in Tibetan-majority areas and schools where headmasters were ethnic Tibetans than in Tibetan-minority areas or schools where people in charge were non-Tibetans (Zenz, 2010).

In the recent past, although Chinese was accorded increasing influence and authority in the TAR, different linguistic models did exist. For example, Dunzhudanzeng (2006) reported three models of bilingual education: an urban school in Lhasa used Chinese textbooks from year 1 to 6, and the primary medium of instruction was Chinese; a county school adopted Tibetan textbooks and Tibetan as its primary medium of instruction; a rural school utilised Chinese textbooks and taught students in Chinese from year 1 to 3, then switched to Tibetan textbooks and Tibetan from year 4 to 6.

The research I conducted with students in Basum also confirmed the existence of such a variety largely at the primary level. When interviewing students about their use of ICT, I also requested them to divide their educational experiences up to 2011 into chapters. Partly following Dan McAdam's method of exploring stories people live by (cf. 1993, pp. 251 - 275), in each chapter, I focused on their learning of languages and relevant school experiences. The data collected indicated that in both junior (middle) and senior (high) secondary schools, all sixteen students, though coming from widely dispersed areas of Tibet and various socioeconomic and socio-linguistic backgrounds,

* For example, adopting a "pure Tibetan" model and replacing nationally practised morning exercises with traditional Tibetan dancing in schools.

received Chinese-medium instruction and used Chinese textbooks for all subjects, with the exception of Tibetan Language and Literature, in secondary schools. However, the students were exposed to two major different models of trilingual education at the primary level, namely, Tibetan-led model in agricultural and nomadic areas, and Chinese-led model in towns and cities. They all commenced learning Chinese in year 1 of primary school and English in either years 1, 2, 3, or 4 of primary level.

The variety in students' experiences of multilingual education testifies, in some measure, to the choices made by different schools according to the relationship between linguistic models and the capital they confer (though implicitly). In any respect, the choice of one linguistic model over another, reflects the level of economic development, sociocultural composition, and proportion of Tibetan and Han Chinese population in an area, for such factors have an impact on the language that is spoken by a particular fraction of a particular group (Chen, 2008, p. 89; Hong, 2007, pp. 40 - 42).

For instance, an area with Han Chinese as the majority is likely to exhibit a linguistic pattern called *min jian han* (a minority people using their native minority language most of the time, only occasionally using Chinese). As the size of a minority population increases from one place to another, the pattern may gradually change to *han jian min* (mainstream Han Chinese using Mandarin most of the time, only occasionally using a minority language), or *min jian min* (one minority group, such as Luoba or Menba, using their native minority language most of the time, but occasionally using another minority language, such as Tibetan). When the Tibetan population overwhelmingly outnumbers the size of Han population, as in those Tibetan-majority areas mentioned in Zenz (2010), it is likely that the pattern will evolve to *han jian min*.

Despite the variety in models, Tibetan is often viewed as less beneficial than Mandarin. But some Tibetan parents do consider it necessary for their children to learn Tibetan satisfactorily. For example, informants in Zhu (2007)'s study regarded the Tibetan language as a symbol of being Tibetan and expressed grave concerns, with reference to their incompetence in their native language. In Yi (2008)'s study, parents contended that if their children had a good command of Tibetan, they would be able to communicate better with locals, upon completing their higher education and returning to their home communities as cadres. This explanation appears reasonable and understandable, because it was not uncommon in the past for Tibetan students who had spent years away at inland boarding schools, to discover that they were unable to read documents written in Tibetan upon their return to Tibet (Postiglione, Jiao, & Manlaji, 2007, p. 66).

The studies mentioned above were conducted outside the TAR, what does learning Tibetan in a satisfactory manner mean to those students who attend schools in Tibet then? According to Dunzhudanzeng (2006), 92% (22) of the teachers and parents surveyed in his study strongly disagreed with the statement that it was solely important to learn Mandarin thoroughly, 40% (19) believed that greater emphasis should be placed on Chinese in schools, only 4% (2) thought it should be on Tibetan, and 71% (17) of the parents opposed the use of Tibetan textbooks and the idea of teaching their children in Tibetan (p. 79). However, it is rather difficult to make meaningful inferences from the findings reported in the above study due to its limitations in sampling. In Tibet, parents generally assumed that it was disgraceful if their children were incapable of speaking Tibetan and communicating freely in the language with their fellow countrymen. In this study, two out of the sixteen students mainly communicated in Mandarin at home with their parents, but all their parents insisted that they should be capable of communicating in Tibetan. One student's parents spoke poor Tibetan themselves, and hence, they desired their son to have a better and improved command of the language. For another student, it was imperative to learn Tibetan, because people around him appeared easily distraught when he communicated partially in Chinese and partially in Tibetan with them. Moreover, the teachers likewise stressed that learning Tibetan thoroughly could help boost overall exam performance in the *Gaokao*.

The above cases in this study presented no indication that Tibetan was a devalued subject, as reported in Yi (2008)'s study of Tibetan schools in Qinghai (p. 84). Instead, students and teachers in Basum viewed Tibetan as imparting them with a competitive advantage in the *Gaokao* -– they simply could not afford to score low marks in Tibetan, even for those who preferred Chinese to Tibetan. For instance, *Dunzhulaba* initially believed that he would not be required to take Tibetan in the *Gaokao*, for he had studied in a Chinese-medium school in Chengdu. But as a Tibetan, he was required to take Tibetan, regardless of his weak foundation in the subject, owing to his two years he had devoted to studying in inland China. The student felt obligated to take Tibetan, for the *Gaokao*, for his parents, and most decisively, for being a Tibetan, as stated below:

> 汉语对我来说最简单了。最重要的还是藏语，汉语，然后是英语。如果说不好母语，父母会很生气。他们说我至少是个藏族，要把自己的语言说好

Figure F.2: *Basum students completing the survey*

...... 但是有点困难，因为基础没打好。

Chinese is the easiest for me. But the most important language is still Tibetan, then Mandarin, then English. My parents would be very upset if I can't speak my mother tongue well. They said I am a Tibetan and it is vital for me to speak the language well ... But it is becoming rather challenging, because I did not have a good foundation [in the language].

Appendix G

STATA Do File

```
****************************
*** PhD Quantitative Data Analysis
*** ZhiMin Xiao 2013
*** I benefited a lot from this website http://www.ats.ucla.edu/stat/stata/
****************************

* change current working directory to the address below
cd "/Users/XZM/Dropbox/Thesis/STATA"

* rename ethnicity eth
* generate age=2011-ybirth
* label define gender 1 "male" 0 "female"
* egen totalsp = rowtotal (sp1 sp2 sp3 sp4 sp5 sp6) renamed sp
* egen totalictfs = rowtotal (ictfs1 ictfs2 ictfs3 ictfs4 ictfs5 ictfs6) renamed ictfs
* replace ictfs0 = 0 if ictfs0 == 1
* codebook
* drop <variable names>
* egen totalictp = rowtotal (ictp1 ictp2 ictp3) personal use
* egen totalicth = rowtotal (icth1 icth2 icth3) home access
* egen totalicts = rowtotal (icts1 icts2 icts3) school access
* egen totalict = rowtotal (totalictp totalicth totalicts) renamed icts, access at three levels
* egen totalia = rowtotal (ia1 ia2 ia3 ia4 ia5 ia6 ia7 ia8 ia9 ia10 ia11 ia12 ia13 ia14 ia15) renamed ias, internet activities
* egen meanpe = rowmean (me fe) now edu in years, pe
* egen totalpe = rowtotal (me fe) both parents' education in years
* egen totalacts = rowtotal (totalia totalictfs) academic and non-academic use of ICT

************************************************

* format <variable names> %9,2fc * for two decimal points in output
format ias me fe pe %9.2fc
```

```
tab school, sum (ias)
tab gender, sum (ias)

histogram ias, discrete percent normal
graph box ias, over(school)
graph box ias, over(gender)

sum (ias), detail
qnorm ias
pnorm ias

* gen iabands = recode(totalia, 4, 8, 13)
* tab1 iabands
* label define ia_label 4 "Low" 8 "Medium" 13 "High"
* label values iabands ia_label

tab1 iabands, gen (iabdmy)
graph bar (mean) iabdmy1, over(school) ytitle(Proportion of Low Internet Activities)
graph bar (mean) iabdmy2, over(school) ytitle(Proportion of Medium Internet Activities)
graph bar (mean) iabdmy3, over(school) ytitle(Proportion of High Internet Activities)

codebook ictfs
tab1 ictfs
sum ictfs
tab ictfs school, col
tab ictfs school, col nofreq

tab freecafe school, col
tab freeph school, col nofreq

sum icts, detail
histogram icts, discrete percent normal
graph box icts, over(school)

tab school, sum (freecafe)
tab school, sum (freeph)
* by school, sort: summarize freeph

sum htdwell imptdwell
tab school, sum (htdwell)
tab school, sum (imptdwell)
tab eth, sum (htdwell)
tab eth, sum (imptdwell)
tab school, sum (support)
tab eth, sum (support)

codebook stream
replace stream = . if stream == 1
```

```
replace track = . if track == 1
replace eth = . if eth == 1
tab1 stream, gen (strmdmy)
graph bar (mean) strmdmy2, over(iabands) over(gender) title(Proportion of key
    class students)
graph bar (mean) strmdmy2, over(iabands) over(track) title(Proportion of key
    class students)
graph bar (mean) strmdmy1, over(iabands) over(gender) title(Proportion of
    ordinary class students)
graph bar (mean) strmdmy1, over(iabands) over(track) title(Proportion of
    ordinary class students)
graph bar (mean) ias, over(stream) over(eth) title(Total IA across eth)
graph bar (mean) ias, over(stream) over(school) title(Total IA across eth)
graph bar (mean) ias, over(stream) over(gender) title(Total IA across eth)
graph bar (mean) ias, over(stream) over(track) title(Total IA across eth)
graph bar (mean) ias, over(track) over(eth) title(Non-academic activities online
    )

sum me fe pe
qnorm me
qnorm fe
qnorm pe
pnorm pe
kdensity pe, normal
qnorm pe if school ==3
qnorm pe if school ==1
qnorm pe if school ==2
pnorm pe if school ==1

histogram support, discrete percent normal
qnorm support

spearman acts support phbill handsets
pwcorr acts support, obs

codebook eth
tab eth
codebook rank imptdwell
tab rank imptdwell
tab1 rank imptdwell
* note the differences of the above two commands! use tab1 for nominal or
    ordinal variables, for interval variables, use it if there are fewer than 30
     cases, otherwise, use summarize.*
* High dispersion means each category has a roughly equal % of responses; no
    dispersion means all cases fall into one category (homogenuous), highest %
    is the mode; cumulative % tells us where the median is*

tab age
sum age, detail
* Percentiles are synonymous with cumulative percentages. Mean bigger than
    median, or a positive skewness statistics implies a right skewed
```

```
    distribution.
sktest age
* If pr(skewness) value is less than .05, then it is significantly skewed, use median as the best measure of central tendency; if equal to or bigger than .05, then not skewed, use mean as the best measure of ct.

* use bar chart for nominal and ordinal variables, okay if an interval var has fewer than 30 cases; otherwise, use histogram for interval variables.
* Bar charts and histograms are similar, but the latter collapes categories into  ranges or bins, resulting in a compact display. Hist command produces either a bar chart or a histogram
histogram ias, discrete normal
sum acts
histogram acts, discrete percent normal
kdensity acts, normal
histogram ias, discrete percent normal
graph pie, over(school)

* gen actbands = recode(acts, 6, 12, 18)
* tab1 actbands
* label define act_label 6 "Low" 12 "Medium" 18 "High"
* label values actbands act_label
tab1 actbands, gen (actbddmy)
graph bar (mean) actbddmy1, over(school) ytitle(Proportion of Low Activities with ICT)
graph bar (mean) actbddmy2, over(school) ytitle(Proportion of Medium Activities with ICT)
graph bar (mean) actbddmy3, over(school) ytitle(Proportion of High Activities with ICT)

kdensity ias, normal
kdensity acts, normal
**histograms are sensitive to the number of bins, kernel density plot is smooth and independent of the choice of origin***
graph box ias
symplot ias
**symmetry plot graphs the distance above the median against the distance below the median***

tabulate school, summarize (pe)
** use this command to replace what I did before!
tab eth, sum (acts)
robvar acts, by (eth)
ttest acts, by (eth) unequal
tab stream, sum (acts)
robvar acts, by (stream)
ttest acts, by (stream)

* findit univar
univar icts acts ias ictfs, by(track)
tab track, sum (icts)
```

```
tab track, sum (acts)
robvar acts, by (track)
ttest acts, by (track)
robvar icts, by (track)
ttest icts, by (track) unequal
robvar ias, by (track)
ttest ias, by (track)
robvar ictfs, by (track)
ttest ictfs, by (track)

univar icts acts ias ictfs, by(stream)
tab stream, sum (icts)
tab stream, sum (acts)
robvar acts, by (stream)
ttest acts, by (stream)
robvar icts, by (stream)
ttest icts, by (stream) unequal
robvar ias, by (stream)
ttest ias, by (stream)
robvar ictfs, by (stream)
ttest ictfs, by (stream) unequal


robvar icts, by (eth)
ttest icts, by (eth) unequal
codebook school
robvar icts if school>1, by (school)
ttest icts if school>1, by (school)
robvar icts if school!=3, by (school)
ttest icts if school!=3, by (school) unequal

robvar acts, by (eth)
ttest acts, by (eth) unequal
robvar acts if school>1, by (school)
ttest acts if school>1, by (school) unequal
robvar acts if school!=3, by (school)
ttest acts if school!=3, by (school)

robvar viscafe, by (eth)
ttest viscafe, by (eth) unequal
robvar viscafe if school>1, by (school)
ttest viscafe if school>1, by (school)
robvar viscafe if school!=3, by (school)
ttest viscafe if school!=3, by (school) unequal

robvar cafe, by (eth)
ttest cafe, by (eth)
robvar cafe if school>1, by (school)
ttest cafe if school>1, by (school) unequal
robvar cafe if school!=3, by (school)
ttest cafe if school!=3, by (school) unequal
```

```
robvar acts, by (gender)
ttest acts, by (gender)
robvar acts if school>0, by (school)
robvar acts if school!=1, by (school)
ttest acts if school!=1, by (school) unequal
robvar acts if school!=2, by (school)
ttest acts if school!=2, by (school) unequal



codebook school
robvar ias if school<3, by (school)
robvar ias if school==1 | school==3, by (school)
* to compare the means of two schools out of the three, can't use two-sample
    ttest directly; the two commands yield the same results; | means or, ==
    means equal; w0 pr < .05, unequal variances assumed
ttest ias if school<2, by (school) unequal
ttest ias if school==0 | school==1, by (school) unequal
robvar ias if school==1 | school==2, by (school)
ttest ias if school==1 | school==2, by (school) unequal
* can also use if school>0
robvar ias if school==0 | school==2, by (school)
ttest ias if school==0 | school==2, by (school) unequal
* can also use if school~=1; > greater than; < smaller than; >= greater than or
    equal to; <= less than or equal to; == equal to; ~= not equal to; != not
    equal to; & and; | or
ttest ias, by (eth)
ttest ias, by (gender)
**before conducting a t-test, see whether the two variances are equal and the
    dependent variable is normal, if unequal, add "unequal" to the command; if
    ordinal, use ranksum**
robvar ias, by (gender)
* to see if two samples have equal variances, if w0 = or smaller than .05, then
    add option "unequal", here w0 Pr > F = 0.69969875, thus equal variances
    assumed
ttest ias, by (gender)
* pr greater than .05, and confidence interval contains 0
robvar ias, by (eth)
ttest ias, by (eth) unequal
* two-sample ttests, unequal variances, for w0 pr value is F = 0.00000120, which
     is smaller than .05; pr smaller than .05, confidence interval excludes 0
ttest support, by (gender)
ttest support, by (eth)
* totalsp can be normal, can use two-sample t-test I think

ranksum games, by (eth)
ranksum infonline, by (eth)
ranksum handsets, by (eth)
```

```
**wilcoxon-Mann_Whitney test, does not assume normality of dependent variable,
    almost identical to t-test**
ranksum htdwell, by (eth)
ranksum htdwell, by (gender)
***non-parametric analog to the independent samples t-test, do not assume
    dependent variable is a normally distributed interval variable (only assume
    it is at least ordinal)***
ranksum ictparents, by (track)
ranksum ictparents, by (stream)
ranksum ictparents, by (gender)
ranksum ictparents, by (eth)

codebook school
ranksum htdwell, by (eth)
ranksum htdwell if school>1, by(school)
ranksum imptdwell, by (eth)
ranksum imptdwell if school>1, by(school)
ranksum imptdwell if school!=2, by(school)
robvar support, by (eth)
ttest support, by (eth)
robvar support if school>1, by (school)
ttest support if school>1, by (school)
robvar support if school!=3, by (school)
ttest support if school!=3, by (school)




qnorm support
anova support school
***use anova when you have a categorical independent variable (with two or more
    levels) and a normally distributed interval dependent variable to see the
    differences in means***
qnorm acts
anova acts school


oneway acts school, tabulate
oneway pe school, tabulate
oneway icts school, tabulate
oneway support school, tabulate
oneway ias school, tabulate
oneway acts school, tabulate
oneway acts eth, tabulate
oneway acts gender, tabulate
oneway ictfs school, tabulate
oneway icts school, tabulate
***use oneway anova if the indep categorical variable has more than 2 values; if
     there are 2 values, use two-sample t-test***

sum ias, detail
```

```
sum acts, detail
sum pe, detail
sum cafe games ictparents infonline privacy ictfriends

graph box ias, over(school)
graph box ias, over(eth)
graph box ias, over(track)
graph box ias, over(stream)

graph box acts, over(school)
graph box acts, over(stream)
graph box acts, over(track)
graph box acts, over(gender)
graph box acts, over(eth)


* the variables below should be categorical
tabulate stream games
tabulate stream games, chi2
tabulate freecafe school
tabulate freecafe school, chi2
**for cells with a value under 5, use fisher's exact test**
tabulate eth phbill
tabulate eth phbill, exact



correlate pe ias rank handsets
**note obs=662, stata has dropped those with missing data**
pwcorr pe ias rank handsets, obs
***pairwise correlation can correct the problem mentioned above, with obs in the command, we can see how many cases for each variable***
spearman support pe
**spearman correlation does not assume normality and interval variables, but they should be ordinal**
spearman pe icts acts support handsets ictfs phbill viscafe
spearman acts pe icts support handsets ictfs phbill viscafe


anova ias school c.pe c.ictfs
***use anova command to include continuous variables, or covariates, this is analysis of covariance***
manova cafe games ictparents = school
***use manova if there are two or more continuous dependent variables and one categorical predictor variable***
mvreg ias pe = freecafe gender stream
***use multivariate multiple regress when you have two or more depen variables that are to be predicted from two or more predictors***

regress ias pe
twoway (scatter ias pe) (lfit ias pe)
```

```
predict yhat
predict resid
***this command can be shortened to predict e, resid, or predict e, r***
scatter resid yhat
**simple linear regression, one predictor, which is either continuous or dichotomous, and one response variable, which is continuous***

regress ias pe stream rank freecafe freeph
regress ias pe stream rank freecafe freeph, beta
**use beta to assess the relative strength of each predictor, beta coefficients are standardized units, whereas the coefficients are in the units of measurement. For instance, holding other predictors constant, one unit increase in meanpe yield a 0.33-unit increase in totalia, but in beta, one standard deviation increase in meanpe would yield a 0.19 standard deviation increase in totalia***
**in linear regression, some say both predictors and response vars should be normal, but in fact, we need the residuals to be normal, which is often caused by normally distributed predictors and response var***
* In regression analysis, the depen var is measured at the interval level, but the indepen vars can come in any variety - nominal, ordinal, or interval (p .137, a stata companion to political analysis, pollock 06)

regress acts ictfs
regress acts ictfs icts
regress acts ictfs icts viscafe
regress acts ictfs icts viscafe pe
regress acts ictfs icts viscafe support
regress acts ictfs icts viscafe support pe
regress acts ictfs icts viscafe support pe handsets
regress acts ictfs icts viscafe support pe handsets phbill
regress acts ictfs icts viscafe icth pe
regress acts ictfs viscafe icth pe
regress acts ictfs viscafe icth pe rank
regress acts ictfs viscafe icth pe eth
regress acts ictfs viscafe icth pe
predict residuals, resid
predict yhat
hist resid, normal
qnorm residuals
twoway (scatter residuals yhat)(lfit residuals yhat)
graph hbox residuals


tabulate school, summarize (pe)
graph box pe, over(school)
kwallis pe, by (school)
**use it when you have one indep variable with two or more levels and an ordinal depen variable. It's like anova, but does not assume normality of dependent variable meanpe**

sum icth, detail
```

```
tabulate school, summarize (icth)
kwallis icth, by (school)
kwallis icth if school==1 | school==2, by (school)
kwallis icth if school==2 | school==3, by (school)
ranksum icth if school==1 | school==3, by (school)
graph bar (mean) icth, over(school)

sum viscafe
tabulate school, summarize (viscafe)
graph bar (mean) viscafe, over(school)
ranksum viscafe if school==1 | school==3, by (school)

histogram ictfs, discrete percent normal
tabulate school, summarize (ictfs)
tabulate stream, summarize (acts)
tabulate track, summarize (acts)
robvar acts, by (stream)
ttest acts, by (stream)
robvar acts, by (track)
ttest acts, by (track)

spearman ictfs rank
spearman acts rank
spearman ias rank
spearman pe rank
spearman icth rank
spearman ictsch rank
spearman icts rank
spearman ictp rank
spearman cdwell ictfs
spearman cdwell ias
spearman cdwell icts
spearman rank cdwell
spearman rank imptdwell
spearman rank htdwell
spearman rank understd
spearman ictfs htdwell
spearman ictfs imptdwell
spearman ictfs understd
spearman ias htdwell
spearman ias imptdwell
spearman ias understd
spearman icts htdwell
spearman icts understd
spearman icts imptdwell
spearman viscafe cafe
spearman icth cafe
spearman ictfs cafe
spearman ict cafe
spearman freecafe cafe
spearman ias games
```

```
spearman games cafe
tabulate eth, summarize (infonline)
ranksum infonline, by (eth)
ranksum infonline, by (gender)
ranksum infonline, by (stream)
ranksum infonline, by (track)
ranksum infonline if school==1 | school==2, by (school)
ranksum infonline if school==2 | school==3, by (school)
spearman pe infonline
ranksum privacy, by (eth)
ranksum privacy if school==1 | school==0, by (school)
ranksum privacy if school==1 | school==2, by (school)
spearman handsets privacy
spearman pe handsets
tabulate eth, summarize (ictparents)
ranksum ictparents, by (eth)
ranksum ictparents if school==1 | school==0, by (school)
ranksum ictparents if school==1 | school==2, by (school)
ranksum ictparents if school==2 | school==0, by (school)
tab track gender
ranksum ictparents, by (gender)
ranksum ictparents, by (track)
ranksum ictparents, by (stream)
spearman ictparents rank
spearman ictparents pe
sum ictfriends
spearman ictfriends phbill
spearman ictfriends handsets
spearman ictfriends icts
spearman ictfriends pe

***********************************************
tab school
tab school, gen (school_)
**to generate dummy variables for the three schools***
tab school school_1
tab school school_2
tab school school_3
oneway ias school
oneway ias school, tabulate
***use tab to see the mean for each group***

ttest me = fe
pnorm fe
qnorm fe
**two related obs per subject, to see if the means on the two normally
    distributed interval variables differ***
signrank games = privacy
signrank infonline = privacy
signrank ictparents = ictfriends
signrank htdwell = imptdwell
```

```
signrank htdwell = cdwell
***wilcoxon signed rank sum test is the non-parametric version of a paired t-test. Use it when you do not assume the difference between the two variables is interval and normally distributed, but do assume the difference is ordinal***
signtest cafe = games
**use signtest if you don't know if the diff is ordinal, but you know it's either positive or negative***
corr ias pe
***r=0.2407, R squared is about 0.06, which means pe and ias share about 6% of the variability***
tab gender, gen (sex)
spearman ias htdwell
**use spearman correlation if one or both of the variables are not normally distributed and not interval, but they should be ordinal***
which lambda
which somersd
* use which to see if the programs are already installed in stata
ssc install lambda
ssc install somersd
*ssc statistical software components archieve, locate and install
```

STATA/phd.do

Appendix H

R Codes

```
### PhD quantitative data analysis in R
### ZhiMin Xiao 2013
### Thanks to Gary King, Adam Glynn, Konstantin Kashin, Margaret Roberts, Andy
    Hall, and the Spring 2013 class of Gov2001 for inspiring me and letting me
    borrow some of the codes used in this analysis. In particular, I adapted
    codes from the following people's replication studies: Jewel Gausman, Mathew
     Kiang, Aditi Krishna, Ashley Fabrizio, Yesim Sungu, Ahsan Barkatullah,
    Cassandra Peitzman, Shuky Barlev-Ehrenberg, Anna Hopper, Sam Imlay, James
    Dunham, Dominika Kruszewska, and Andreas Wiedemann.

setwd("/Users/XZM/Dropbox/Thesis/R"); load("phd.RData"); ls()
#rm(list = ls()); ls()
#load("phd.RData"); ls()
# phd <- read.csv("phd.csv", header=T, na.strings = "")

summary(phd)

# Check for packages and install them if not already installed
required.packages <- c("plm", "matrixStats", "ellipse", "vcd", "foreign", "
    MatchIt", "cem", "car", "aod", "survey", "texreg", "ggplot2", "lattice", "
    mvtnorm", "Zelig", "mice", "ZeligChoice", "Amelia", "xtable", "maps", "
    mapdata", "maptools", "scales"); new.packages <- required.packages[!(
    required.packages %in% installed.packages()[,"Package"])]; if(length(new.
    packages)) install.packages(new.packages); invisible(lapply(required.
    packages, function(x) {library(x,character.only=TRUE)}))

### A bit of recoding
phd$pe.dmy <- ifelse(phd$pe >= 12 & phd$pe <=18, 1, 0); phd$pebands[phd$pe >= 0
    & phd$pe <=6] <- "Primary"; phd$pebands[phd$pe > 6 & phd$pe <=12] <- "
    Secondary"; phd$pebands[phd$pe > 12 & phd$pe <=18] <- "Tertiary"; phd$strm.
    dmy <- ifelse(phd$stream == "Key", 1, 0); phd$trk.dmy <- ifelse(phd$track ==
     "Science", 1, 0); phd$gdr.dmy <- ifelse(phd$gender == "male", 1, 0); phd$
    eth.dmy <- ifelse(phd$eth == "Han", 1, 0); phd$acm.dmy <- ifelse(phd$acm ==
    "In School", 1, 0); phd$ias.dmy <- ifelse(phd$iabands == "Low", 1, 0);
```

```
    library(plyr); phd$sch.code <- revalue(phd$school, c('Basum'='0', 'Hengshan'='1', 'Nanshan'='2')); phd$gdr.code <- revalue(phd$gender, c('female'='0', 'male'='1')); phd$eth.code <- revalue(phd$eth, c('Tibetan'='0', 'Han'='1')); phd$trk.code <- revalue(phd$track, c('Arts'='0', 'Science'='1')); phd$strm.code <- revalue(phd$stream, c('Ordinary'='0', 'Key'='1')); phd$acm.code <- revalue(phd$acm, c('At home'='0', 'In School'='1', 'Elsewhere'='2')); phd$ias.code <- revalue(phd$iabands, c('Low'='0', 'Medium'='1', 'High'='2')); phd$sch.num <- as.numeric(levels(phd$sch.code)[phd$sch.code]); phd$gdr.num <- as.numeric(levels(phd$gdr.code)[phd$gdr.code]); phd$eth.num <- as.numeric(levels(phd$eth.code)[phd$eth.code]); phd$trk.num <- as.numeric(levels(phd$trk.code)[phd$trk.code]); phd$strm.num <- as.numeric(levels(phd$strm.code)[phd$strm.code]); phd$acm.num <- as.numeric(levels(phd$acm.code)[phd$acm.code]); phd$ias.num <- as.numeric(levels(phd$ias.code)[phd$ias.code]); tibet <- subset(phd, phd$sch.code==0); hunan <- subset(phd, phd$sch.code==1); shenzhen <- subset(phd, phd$sch.code==2); Tibetan <- subset(phd, phd$eth=="Tibetan"); Han <- subset(phd, phd$eth=="Han")

# to use different colours for the schools, I first create a new variable called "colour" in the data frame and assign "red" for Tibet, "darkcyan" for Hunan, and "blue" for Shenzhen
phd$colour <- "red"; phd[phd$school=="Hengshan",]$colour <- "darkcyan"; phd[phd$school=="Nanshan",]$colour <- "blue"

### Number of observations in each school
nrow(tibet); nrow(hunan); nrow(shenzhen); sum(tibet$eth=="Tibetan", na.rm=T) # 197 out of 200 are Tibetans
phd[phd$iabands=="Low",]$iabands


##### Summary statistics
table(phd$school, phd$pebands); round(prop.table(table(phd$school, phd$pebands), 1), 2); table(phd$school, phd$stream); round(prop.table(table(phd$school, phd$stream), 1), 2); table(phd$school, phd$iabands); round(prop.table(table(phd$school, phd$iabands), 1), 2); table(phd$pe.dmy, phd$iabands); round(prop.table(table(phd$pe.dmy, phd$iabands), 1), 2); table(phd$eth, phd$iabands); round(prop.table(table(phd$eth, phd$iabands), 1), 2); table(phd$track, phd$iabands); round(prop.table(table(phd$track, phd$iabands), 1), 2); table(phd$stream, phd$iabands); round(prop.table(table(phd$stream, phd$iabands), 1), 2); library(xtable); table(phd$school, phd$gender); table(phd$school, phd$track); table(phd$school, phd$stream); mean(tibet$age, na.rm=T); mean(hunan$age, na.rm=T); mean(shenzhen$age, na.rm=T); m.col <- c(90, 163, 100); f.col <- c(107, 147, 86); a.col <- c(99, 123, 87); s.col <- c(100, 189, 95); k.col <- c(105, 131, 96); o.col <- c(94, 180, 86); age.col <- c(17.7, 17.1, 17.3); t.sch <- as.data.frame(cbind(m.col, f.col, a.col, s.col, k.col, o.col, age.col)); rownames(t.sch) <- c("Basum", "Hengshan", "Nanshan"); colnames(t.sch) <- c("Male", "Female", "Key", "Ordinary", "Arts", "Science", "Mean Age"); xtable(t.sch, caption="Summary Statistics by School", digits=1); print(t.sch, floating=T)

### Missing data

```

```
m.pe <- phd[!complete.cases(phd$pe),]; nm.pe <- phd[complete.cases(phd$pe),]; t.
    stats.pe <- c(t.test(m.pe$cdwell,nm.pe$cdwell)$statistic,t.test(m.pe$
    imptdwell,nm.pe$imptdwell)$statistic,t.test(m.pe$htdwell,nm.pe$htdwell)$
    statistic,t.test(m.pe$rank,nm.pe$rank)$statistic, t.test(m.pe$support,nm.pe$
    support)$statistic,t.test(m.pe$icth,nm.pe$icth)$statistic, t.test(m.pe$
    viscafe, nm.pe$viscafe)$statistic, t.test(m.pe$phbill,nm.pe$phbill)$
    statistic, t.test(m.pe$handsets,nm.pe$handsets)$statistic, t.test(m.pe$sch.
    num,nm.pe$sch.num)$statistic, t.test(m.pe$gdr.num,nm.pe$gdr.num)$statistic,
    t.test(m.pe$eth.num,nm.pe$eth.num)$statistic, t.test(m.pe$trk.num,nm.pe$trk.
    num)$statistic, t.test(m.pe$strm.num,nm.pe$strm.num)$statistic, t.test(m.pe$
    acm.num,nm.pe$acm.num)$statistic, t.test(m.pe$ias.num,nm.pe$ias.num)$
    statistic); round(t.stats.pe, 3); dotchart(t.stats.pe, main="Missing Values
    for Parental Education",labels=c("Can do well","Important to do well","Hope
    to do well", "Ranking", "Support sources","Home ICT","Internet cafe visits",
     "Monthly phone bill", "Handsets ever used", "School", "Gender", "Ethnicity"
    , "Arts or Science", "Key or Ordinary", "Accommodation", "Internet
    activities"), xlim=c(-4,4), col=ifelse(abs(t.stats.pe) > 2, "red", "blue"),
    pch=ifelse(abs(t.stats.pe) > 2, 8, 16)); abline(v=0, col="red", lty=2, lwd
    =1)

m.pe.cc <- mean(phd$pe, na.rm=T); m.pe.cc; mi.pe <- phd; mi.pe[!complete.cases(
    phd$pe),]$pe <- round(m.pe.cc, 2); phd$pe.mi <- mi.pe$pe; phd$pe.mi[1:20];
    phd$pe[1:20]; phd$pe[1:20]; phd$pe.mi[1:20]; phd$rank[1:30]; phd$rk.mi
    [1:20]; phd$pe.mi.dmy <- ifelse(phd$pe.mi >= 12 & phd$pe.mi <=18, 1, 0); phd
    $pe.mi.bs[phd$pe.mi >= 0 & phd$pe.mi <=6] <- "Primary"; phd$pe.mi.bs[phd$pe.
    mi > 6 & phd$pe.mi <=12] <- "Secondary"; phd$pe.mi.bs[phd$pe.mi > 12 & phd$
    pe.mi <=18] <- "Tertiary"; phd$pe.mi.dmy[1:50]; phd$pe.mi.bs[1:50]

g <- lm(pe ~ support + icth + viscafe + handsets + school + eth + track + acm +
    ias, data=phd); summary(g); g <- update(g, .~. -acm); summary(g); g <-
    update(g, .~. -ias); summary(g); g <- update(g, .~. -track); summary(g); g
    <- update(g, .~. -viscafe); summary(g); g <- update(g, .~. -eth); summary(g)
    ; g <- update(g, .~. -support); summary(g); summary(lm(pe ~ icth, data=phd))
    ; summary(lm(pe ~ icth + school + support + handsets, data=phd)); summary(lm
    (pe ~ icth + school + support + handsets + viscafe + eth + acm, data=phd));
    summary(lm(pe ~ icth + school + acm, data=phd)); summary(lm(pe ~ icth +
    school + acm + support, data=phd)); summary(lm(pe ~ icth + school + acm +
    support + handsets, data=phd)); summary(lm(pe ~ icth + school + acm +
    support + handsets + viscafe, data=phd)); summary(lm(pe ~ icth + school +
    viscafe + eth, data=phd)); summary(lm(pe ~ support + icth + school, data=phd
    ))

cc.pe.lm <- lm(pe ~ icth + school + support, data=phd); summary(cc.pe.lm); round
    (coef(cc.pe.lm), 3); model.matrix(cc.pe.lm)[1:20,]; xtable(cc.pe.lm, caption
    ="The chosen model to predict missingness in pe", digits=2); md.frame <- phd
    [is.na(phd$pe), c("icth", "school", "support")]; rgi.pe <- phd; rgi.pe[!
    complete.cases(phd$pe),]$pe <- round(predict(cc.pe.lm, md.frame), 2); phd$pe
    .rgi <- rgi.pe$pe; phd$pe.rgi[1:20]; sum(is.na(rgi.pe$pe)); phd$pe[1:20];
    phd$pe.rgi.dmy <- ifelse(phd$pe.rgi >= 12 & phd$pe.rgi <=18, 1, 0); phd$pe.
    rgi.dmy[1:50]; sum(is.na(phd$pe.rgi.dmy)); phd$pe.rgi.bs[phd$pe.rgi >= 0 &
    phd$pe.rgi <=6] <- "Primary"; phd$pe.rgi.bs[phd$pe.rgi > 6 & phd$pe.rgi
```

```
<=12] <- "Secondary"; phd$pe.rgi.bs[phd$pe.rgi > 12 & phd$pe.rgi <=18] <- "Tertiary"; phd$pe.rgi.dmy[1:50]; phd$pe.rgi.bs[1:50]

# library(Zelig); library(mice); library(ZeligChoice); library(Amelia)

summary(lm(ias ~ eth + pe + eth:pe, phd)); summary(lm(ias ~ eth + pe.rgi + eth:pe.rgi, phd)); summary(lm(ias ~ eth + pe.mi + eth:pe.mi, phd))

phd$minzu <- as.numeric(phd$eth); phd$diqu <- as.numeric(phd$school); phd$wenli <- as.numeric(phd$track); phd$zdpt <- as.numeric(phd$stream); phd$pande <- phd$pe*as.numeric(phd$eth) # 1 for Han; 2 for Tibetan; phd$minzu; # 1 Basam, 2 Hengshan, 3 Nanshan; # 1 for Arts; 2 for Science; # 1 for Key; 2 for Ordinary

# Define a function that imputes missing values in Amelia two
Impute <- function(dataframe, m=10){
  set.seed(1405973792)
  if (ncol(dataframe)==3){
    imps <- amelia(dataframe, m=10, ords="eth", p2s=0)
  } else {
    imps <- amelia(dataframe, m=10, ords=c("eth", "track", "stream"), p2s=0)
  }
  }

# impute with all relevant predictors
all.pred <- c("ias", "eth", "track", "stream", "htdwell", "cdwell", "imptdwell", "handsets", "freecafe", "cafe", "ictparents", "infonline", "privacy", "icts", "acts", "support", "pe"); min.pred <- c("ias", "pe", "eth"); all.pred %in% colnames(phd); min.pred %in% colnames(phd)

phd.amelia.all <- subset(phd, select=all.pred); set.seed(1405973792); phd.imputed.all <- Impute(dataframe=phd.amelia.all, m=10); summary(phd.imputed.all)
plot(phd.imputed.all, which.vars=c("ias", "pe")); legend("topright", legend=c("Observed", "Imputed"), bty="n", lwd=c(1,1), col=c("black", "red"), cex=.6)
overimpute(phd.imputed.all, var="pe")
missmap(phd.imputed.all, col=c("green", "cornflowerblue"), y.cex=0.6, main="Map of missing values")

# now fit the model
fit.all <- zelig(ias ~ pe + eth + pe:eth, data=phd.imputed.all, model='ls', cite=F); summary(fit.all)
x.out0 <- setx(fit.all, eth="Tibetan"); x.out1 <- setx(fit.all, eth="Han"); set.seed(1405973792); s.out <- sim(fit.all, x=x.out0, x1=x.out1); summary(s.out)
(mean(s.out$imp1$qi$fd) + mean(s.out$imp2$qi$fd) + mean(s.out$imp3$qi$fd) + mean(s.out$imp4$qi$fd) + mean(s.out$imp5$qi$fd) + mean(s.out$imp6$qi$fd) + mean(s.out$imp7$qi$fd) + mean(s.out$imp8$qi$fd) + mean(s.out$imp9$qi$fd) + mean(s.out$imp10$qi$fd))/10 # the mean of 10 means between Han and Tibetan students
```

```
x.out0 <- setx(fit.all, eth="Tibetan", pe=0); x.out1 <- setx(fit.all, eth="Tibetan", pe=12); set.seed(1405973792); s.out <- sim(fit.all, x=x.out0, x1=x.out1); summary(s.out)
(mean(s.out$imp1$qi$fd) + mean(s.out$imp2$qi$fd) + mean(s.out$imp3$qi$fd) + mean(s.out$imp4$qi$fd) + mean(s.out$imp5$qi$fd) + mean(s.out$imp6$qi$fd) + mean(s.out$imp7$qi$fd) + mean(s.out$imp8$qi$fd) + mean(s.out$imp9$qi$fd) + mean(s.out$imp10$qi$fd))/10

x.out0 <- setx(fit.all, eth="Han", pe=0); x.out1 <- setx(fit.all, eth="Han", pe=12); set.seed(1405973792); s.out <- sim(fit.all, x=x.out0, x1=x.out1); summary(s.out)
(mean(s.out$imp1$qi$fd) + mean(s.out$imp2$qi$fd) + mean(s.out$imp3$qi$fd) + mean(s.out$imp4$qi$fd) + mean(s.out$imp5$qi$fd) + mean(s.out$imp6$qi$fd) + mean(s.out$imp7$qi$fd) + mean(s.out$imp8$qi$fd) + mean(s.out$imp9$qi$fd) + mean(s.out$imp10$qi$fd))/10
summary(phd[phd$eth=="Tibetan",]$pe); summary(phd[phd$eth=="Han",]$pe)

# Impute with fewer predictors
phd.amelia.min <- subset(phd, select=min.pred); set.seed(1405973792); phd.imputed.min <- Impute(dataframe=phd.amelia.min, m=10); summary(phd.imputed.min)
plot(phd.imputed.min, which.vars=c("ias", "pe")); legend("topright", legend=c("Observed", "Imputed"), bty="n", lwd=c(1,1), col=c("black", "red"), cex=.6)
overimpute(phd.imputed.min, var="pe")

# now fit the model
fit.min <- zelig(ias ~ pe + eth + pe:eth, data=phd.imputed.min, model='ls', cite=F); summary(fit.min)
x.out0 <- setx(fit.min, eth="Tibetan"); x.out1 <- setx(fit.min, eth="Han"); set.seed(1405973792); s.out <- sim(fit.min, x=x.out0, x1=x.out1); summary(s.out)
x.out0 <- setx(fit.min, eth="Tibetan", pe=0); x.out1 <- setx(fit.min, eth="Tibetan", pe=18); set.seed(1405973792); s.out <- sim(fit.min, x=x.out0, x1=x.out1); summary(s.out)
x.out0 <- setx(fit.min, eth="Han", pe=0); x.out1 <- setx(fit.min, eth="Han", pe=18); set.seed(1405973792); s.out <- sim(fit.min, x=x.out0, x1=x.out1); summary(s.out)

########### Visualisation
par(mfrow=c(3,1)); plot(density(phd$pe, na.rm=T), col="red", main="Parental Education: Observed"); plot(density(phd$pe.rgi, na.rm=T), col="red", main="Parental Education: Regression Imputed"); plot(density(phd$pe.mi, na.rm=T), col="red", main="Parental Education: Mean Imputed")

structable(~ school + iabands, data = phd); sieve(Freq ~ school + iabands, data = phd, gp = shading_Friendly, labeling = labeling_values) # by school

structable(~ pebands + iabands, data = phd); sieve(Freq ~ pebands + iabands, data = phd, gp = shading_Friendly, labeling = labeling_values) # by parental edcuation
```

```
par(mfrow=c(2,3)); boxplot(phd$pe ~ phd$school, border=c(’red’,’darkcyan’,’blue’
    ), main="School", ylab="Years of Parental Education", names=c("TB","HN", "SZ
    ")); boxplot(phd$pe ~ phd$stream, border=c(’red’,’blue’), main="Stream",
    ylab="Years of Parental Education"); boxplot(phd$pe ~ phd$eth, border=c(’
    blue’, ’red’), main="Ethnicity", ylab="Years of Parental Education");
    boxplot(phd$pe ~ phd$gender, border=c(’red’,’blue’), main="Gender", ylab="
    Years of Parental Education", names=c("Female","Male")); boxplot(phd$pe ~
    phd$track, border=c(’red’,’blue’), main="Track", ylab="Years of Parental
    Education"); boxplot(phd$pe ~ phd$ias.dmy, border=c(’red’,’blue’), main="
    Internet Activities", ylab="Years of Parental Education", names=c("Non-Low
    ias","Low ias"))

par(mfrow=c(1,2)); boxplot(Han$ias ~ Han$pebands, border=c(’red’,’darkcyan’,’
    blue’), main="Han Students", ylab="Number of Internet Activities", names=c("
    P","S", "T"), ylim=c(0, 15));legend("topleft", c("Primary", "Secondary", "
    Tertiary"), bty="n", pch=c("P", "S", "T"), col=c("red", "darkcyan", "blue"),
     cex=1); boxplot(Tibetan$ias ~ Tibetan$pebands, border=c(’red’,’darkcyan’,’
    blue’), main="Tibetans", ylab="Number of Internet Activities", names=c("P","
    S", "T"), ylim=c(0, 15)); legend("topright", c("Primary", "Secondary", "
    Tertiary"), bty="n", pch=c("P", "S", "T"), col=c("red", "darkcyan", "blue"),
     cex=1)

par(mfrow=c(2,3)); boxplot(phd$ias ~ phd$school, border=c(’red’,’darkcyan’,’blue
    ’), main="School", ylab="Number of Internet Activities", names=c("TB","HN",
    "SZ")); boxplot(phd$ias ~ phd$gender, border=c(’red’,’blue’), main="Gender",
     ylab="Number of Internet Activities", names=c("Female","Male")); boxplot(
    phd$ias ~ phd$stream, border=c(’red’,’blue’), main="Stream", ylab="Number of
     Internet Activities"); boxplot(phd$ias ~ phd$eth, border=c(’red’,’blue’),
    main="Ethnicity", ylab="Number of Internet Activities"); boxplot(phd$ias ~
    phd$track, border=c(’red’,’blue’), main="Track", ylab="Number of Internet
    Activities"); boxplot(phd$ias ~ phd$pe.dmy, border=c(’red’,’blue’), main="
    Parental Education", ylab="Number of Internet Activities", names=c(
    expression(pe < 12), expression(pe >= 12)))

par(mfrow=c(2,3)); boxplot(phd$icts ~ phd$school, border=c(’red’,’darkcyan’,’
    blue’), main="School", ylab="Overall Access to ICT", names=c("TB","HN", "SZ"
    )); boxplot(phd$icts ~ phd$gender, border=c(’red’,’blue’), main="Gender",
    ylab="Overall Access to ICT", names=c("Female","Male")); boxplot(phd$icts ~
    phd$stream, border=c(’red’,’blue’), main="Stream", ylab="Overall Access to
    ICT"); boxplot(phd$icts ~ phd$eth, border=c(’red’,’blue’), main="Ethnicity",
     ylab="Overall Access to ICT"); boxplot(phd$icts ~ phd$track, border=c(’red’
    ,’blue’), main="Track", ylab="Overall Access to ICT"); boxplot(phd$icts ~
    phd$pe.dmy, border=c(’red’,’blue’), main="Parental Education", ylab="Overall
     Access to ICT", names=c(expression(pe < 12), expression(pe >= 12)))

par(mfrow=c(1,2)); boxplot(phd$support ~ phd$school, border=c(’red’,’darkcyan’,’
    blue’), main="School", ylab="Sources of Support", names=c("TB","HN", "SZ"));
     boxplot(phd$support ~ phd$eth, border=c(’blue’,’red’), main="Ethnicity",
    ylab="Sources of Support")
```

```
par(mfrow=c(2,3)); boxplot(phd$acts ~ phd$school, border=c('red','darkcyan','
    blue'), main="School", ylab="All ICT Activities", names=c("TB","HN", "SZ"));
     boxplot(phd$acts ~ phd$gender, border=c('red','blue'), main="Gender", ylab=
    "All ICT Activities", names=c("Female","Male")); boxplot(phd$acts ~ phd$
    stream, border=c('red','blue'), main="Stream", ylab="All ICT Activities");
    boxplot(phd$acts ~ phd$eth, border=c('blue','red'), main="Ethnicity", ylab="
    All ICT Activities"); boxplot(phd$acts ~ phd$track, border=c('red','blue'),
    main="Track", ylab="All ICT Activities"); boxplot(phd$acts ~ phd$pe.dmy,
    border=c('red','blue'), main="Parental Education", ylab="All ICT Activities"
    , names=c(expression(pe < 12), expression(pe >= 12)))

par(mfrow=c(1,3)); plot(density(phd$acts), col="red", main="Total ICT Activities
    ", xlab="acts"); plot(density(phd$ias), main="Internet Activities", col="red
    ", xlab="ias"); plot(density(phd$ictfs), col="red", main="Academic Use of
    ICT", xlab="ictfs") # the first two are approximating normality; the last is
     not

#### Correlation statistics

colnames(phd); cor.mat <- phd[c(8:16, 26:33, 38:39)]; corr <- cor(cor.mat, use="
    complete.obs", method="s"); ord <- order(corr[1,]); xc <- corr[ord, ord]; xc
    ; colors <- c("#A50F15","#DE2D26","#FB6A4A","#FCAE91","#FEE5D9","white", "#
    EFF3FF","#BDD7E7","#6BAED6","#3182BD","#08519C"); plotcorr(xc, col=colors[5*
    xc + 6], numbers=F, diag=T); round(xc[,8], 2) # colorfun <- colorRamp(c("#
    CC0000","white","#3366CC"), space="Lab"); plotcorr(ctab, col=rgb(colorfun((
    ctab+1)/2), maxColorValue=255))

plotcorr(xc, col=colors[5*xc + 6], numbers=F, type="upper") # upper

plotcorr(xc, col=colors[5*xc + 6], numbers=F, type="lower", diag=F) #?plotcorr

cor.data <- phd[c(8:16, 20, 22)]; cor.stats <- cor(cor.data, use="complete.obs",
     method="s"); cor.stats; ord <- order(cor.stats[1,]); ord; cors.orded <- cor
    .stats[ord, ord]; colours <- c("#A50F15","#DE2D26","#FB6A4A","#FCAE91","#
    FEE5D9","white", "#EFF3FF","#BDD7E7","#6BAED6","#3182BD","#08519C");
    plotcorr(cors.orded, col=colours[5*cors.orded + 6], numbers=F, diag=T)

cor.test(phd$viscafe, phd$cafe, method="s", alternative="t", exact=F); cor.test(
    phd$viscafe, phd$cafe, method="s", alternative="t", exact=F)$estimate; cor.
    test(phd$viscafe, phd$cafe, method="s", alternative="t", exact=F)$p.value
cor.test(phd$icth, phd$cafe, method="s", alternative="t", exact=F); cor.test(phd
    $icth, phd$cafe, method="s", alternative="t", exact=F)$estimate; cor.test(
    phd$icth, phd$cafe, method="s", alternative="t", exact=F)$p.value
cor.test(phd$ias, phd$games, method="s", alternative="t", exact=F)

# viscafe cafe; icth cafe; ictfs cafe; ias cafe; freecafe cafe; ias games; games
     cafe
t.col <- c(cor.test(phd$viscafe, phd$cafe, method="s", alternative="t", exact=F)
    $estimate, cor.test(phd$icth, phd$cafe, method="s", alternative="t", exact=F
    )$estimate, cor.test(phd$ictfs, phd$cafe, method="s", alternative="t", exact
    =F)$estimate, cor.test(phd$ias, phd$cafe, method="s", alternative="t", exact
```

```
    =F)$estimate, cor.test(phd$freecafe, phd$cafe, method="s", alternative="t",
    exact=F)$estimate, cor.test(phd$ias, phd$games, method="s", alternative="t",
     exact=F)$estimate, cor.test(phd$games, phd$cafe, method="s", alternative="t
    ", exact=F)$estimate); p.col <- c(cor.test(phd$viscafe, phd$cafe, method="s"
    , alternative="t", exact=F)$p.value, cor.test(phd$icth, phd$cafe, method="s"
    , alternative="t", exact=F)$p.value, cor.test(phd$ictfs, phd$cafe, method="s
    ", alternative="t", exact=F)$p.value, cor.test(phd$ias, phd$cafe, method="s"
    , alternative="t", exact=F)$p.value, cor.test(phd$freecafe, phd$cafe, method
    ="s", alternative="t", exact=F)$p.value, cor.test(phd$ias, phd$games, method
    ="s", alternative="t", exact=F)$p.value, cor.test(phd$games, phd$cafe,
    method="s", alternative="t", exact=F)$p.value); t.sp <- as.data.frame(cbind(
    t.col, p.col)); rownames(t.sp) <- c("viscafe vs. cafe", "icth vs. cafe", "
    ictfs vs. cafe", "ias vs. cafe", "freecafe vs. cafe", "ias vs. games", "
    games vs. cafe"); colnames(t.sp) <- c("Correlation Coefficient", "P-value");
     xtable(t.sp, caption="Spearman Correlation Tests based on the observed
    sample", digits = 4)

# viscafe cafe; icth cafe; ictfs cafe; ias cafe; freecafe cafe; ias games; games
     cafe
# correlation tests of the above variables based on 1000 bootstrapped data sets,
     p-values only
sim <- 1000; holder <- matrix(data=NA, ncol=7, nrow=sim); colnames(holder) <- c(
    "vis", "h", "fs", "ias", "free", "iagam", "gamcaf"); N <- nrow(phd); n <- N

set.seed(1405973792); for(i in 1:sim) {
  bt <- phd[sample(N, size=n, replace=T),]
  ct.vis <- cor.test(bt$viscafe, bt$cafe, method="s", alternative="t", exact=F)
  holder[i, 1] <- ct.vis$p.value
  ct.h <- cor.test(bt$icth, bt$cafe, method="s", alternative="t", exact=F)
  holder[i, 2] <- ct.h$p.value
  ct.fs <- cor.test(bt$ictfs, bt$cafe, method="s", alternative="t", exact=F)
  holder[i, 3] <- ct.fs$p.value
  ct.ias <- cor.test(bt$ias, bt$cafe, method="s", alternative="t", exact=F)
  holder[i, 4] <- ct.ias$p.value
  ct.free <- cor.test(bt$freecafe, bt$cafe, method="s", alternative="t", exact=F
     )
  holder[i, 5] <- ct.free$p.value
  ct.iagam <- cor.test(bt$ias, bt$games, method="s", alternative="t", exact=F)
  holder[i, 6] <- ct.iagam$p.value
  ct.gamcaf <- cor.test(bt$games, bt$cafe, method="s", alternative="t", exact=F)
  holder[i, 7] <- ct.gamcaf$p.value
}

psim.col <- mean(holder[,1]); mean(holder[,2]);mean(holder[,3]); mean(holder
    [,4]);mean(holder[,5]); mean(holder[,6]);mean(holder[,7])

t.col <- c(cor.test(phd$viscafe, phd$cafe, method="s", alternative="t", exact=F)
    $estimate, cor.test(phd$icth, phd$cafe, method="s", alternative="t", exact=F
    )$estimate, cor.test(phd$ictfs, phd$cafe, method="s", alternative="t", exact
    =F)$estimate, cor.test(phd$ias, phd$cafe, method="s", alternative="t", exact
    =F)$estimate, cor.test(phd$freecafe, phd$cafe, method="s", alternative="t",
```

```
    exact=F)$estimate, cor.test(phd$ias, phd$games, method="s", alternative="t",
     exact=F)$estimate, cor.test(phd$games, phd$cafe, method="s", alternative="t
    ", exact=F)$estimate); p.col <- c(cor.test(phd$viscafe, phd$cafe, method="s"
    , alternative="t", exact=F)$p.value, cor.test(phd$icth, phd$cafe, method="s"
    , alternative="t", exact=F)$p.value, cor.test(phd$ictfs, phd$cafe, method="s
    ", alternative="t", exact=F)$p.value, cor.test(phd$ias, phd$cafe, method="s"
    , alternative="t", exact=F)$p.value, cor.test(phd$freecafe, phd$cafe, method
    ="s", alternative="t", exact=F)$p.value, cor.test(phd$ias, phd$games, method
    ="s", alternative="t", exact=F)$p.value, cor.test(phd$games, phd$cafe,
    method="s", alternative="t", exact=F)$p.value); psim.col <- c(mean(holder
    [,1]), mean(holder[,2]), mean(holder[,3]), mean(holder[,4]), mean(holder
    [,5]), mean(holder[,6]), mean(holder[,7])); t.sp <- as.data.frame(cbind(t.
    col, p.col, psim.col)); rownames(t.sp) <- c("viscafe vs. cafe", "icth vs.
    cafe", "ictfs vs. cafe", "ias vs. cafe", "freecafe vs. cafe", "ias vs. games
    ", "games vs. cafe"); colnames(t.sp) <- c("Correlation Coefficient", "P-
    value", "sim p"); xtable(t.sp, caption="Spearman Correlation Tests based on
    the observed sample", digits = 4)

# infonline pe; handsets privacy
# ictparents rank; ictparents pe; ictfriends phbill; ictfriends handsets;
    ictfriends icts; ictfriends acts; ictfriends pe
# correlation tests of the above variables based on 1000 bootstrapped data sets,
     p-values only
sim <- 1000; holder <- matrix(data=NA, ncol=7, nrow=sim); colnames(holder) <- c(
    "prk", "ppe", "ffb", "fhs", "fts", "fas", "fpe"); N <- nrow(phd); n <- N

set.seed(1405973792); for(i in 1:sim) {
  bt <- phd[sample(N, size=n, replace=T),]
  ct.prk <- cor.test(bt$ictparents, bt$rank, method="s", alternative="t", exact=
      F)
  holder[i, 1] <- ct.prk$p.value
  ct.ppe <- cor.test(bt$ictparents, bt$pe, method="s", alternative="t", exact=F)
  holder[i, 2] <- ct.ppe$p.value
  ct.ffb <- cor.test(bt$ictfriends, bt$phbill, method="s", alternative="t",
      exact=F)
  holder[i, 3] <- ct.ffb$p.value
  ct.fhs <- cor.test(bt$ictfriends, bt$handsets, method="s", alternative="t",
      exact=F)
  holder[i, 4] <- ct.fhs$p.value
  ct.fts <- cor.test(bt$ictfriends, bt$icts, method="s", alternative="t", exact=
      F)
  holder[i, 5] <- ct.fts$p.value
  ct.fas <- cor.test(bt$ictfriends, bt$acts, method="s", alternative="t", exact=
      F)
  holder[i, 6] <- ct.fas$p.value
  ct.fpe <- cor.test(bt$ictfriends, bt$pe, method="s", alternative="t", exact=F)
  holder[i, 7] <- ct.fpe$p.value
}

mean(holder[,1]); mean(holder[,2]);mean(holder[,3]); mean(holder[,4]);mean(
    holder[,5]); mean(holder[,6]);mean(holder[,7])
```

```
rel.r <- c(cor.test(phd$ictparents, phd$rank, method="s", alternative="t", exact
    =F)$estimate, cor.test(phd$ictparents, phd$pe, method="s", alternative="t",
    exact=F)$estimate, cor.test(phd$ictfriends, phd$phbill, method="s",
    alternative="t", exact=F)$estimate, cor.test(phd$ictfriends, phd$handsets,
    method="s", alternative="t", exact=F)$estimate, cor.test(phd$ictfriends, phd
    $icts, method="s", alternative="t", exact=F)$estimate, cor.test(phd$
    ictfriends, phd$acts, method="s", alternative="t", exact=F)$estimate, cor.
    test(phd$ictfriends, phd$pe, method="s", alternative="t", exact=F)$estimate)
    ; rel.p <- c(cor.test(phd$ictparents, phd$rank, method="s", alternative="t",
     exact=F)$p.value, cor.test(phd$ictparents, phd$pe, method="s", alternative=
    "t", exact=F)$p.value, cor.test(phd$ictfriends, phd$phbill, method="s",
    alternative="t", exact=F)$p.value, cor.test(phd$ictfriends, phd$handsets,
    method="s", alternative="t", exact=F)$p.value, cor.test(phd$ictfriends, phd$
    icts, method="s", alternative="t", exact=F)$p.value, cor.test(phd$ictfriends
    , phd$acts, method="s", alternative="t", exact=F)$p.value, cor.test(phd$
    ictfriends, phd$pe, method="s", alternative="t", exact=F)$p.value); psim.col
     <- c(mean(holder[,1]), mean(holder[,2]), mean(holder[,3]), mean(holder[,4])
    , mean(holder[,5]), mean(holder[,6]), mean(holder[,7])); t.rel <- as.data.
    frame(cbind(rel.r, rel.p, psim.col)); rownames(t.rel) <- c("ictparents vs.
    rank", "ictparents vs. pe", "ictfriends vs. phbill", "ictfriends vs.
    handsets", "ictfriends vs. icts", "ictfriends vs. acts", "ictfriends vs. pe"
    ); colnames(t.rel) <- c("Coefficient", "P-value", "psim"); xtable(t.rel,
    caption="Spearman correlation tests based on the observed sample", digits =
    4)

#% Wilcoxon rank sum tests
wilcox.test(phd$infonline ~ phd$gender); wilcox.test(phd$infonline ~ phd$stream)
    ; wilcox.test(phd$infonline ~ phd$track); wilcox.test(Han$infonline ~ Han$
    school); wilcox.test(phd$infonline ~ phd$eth); wilcox.test(phd[phd$school!="
    Nanshan",]$infonline ~ phd[phd$school!="Nanshan",]$school); wilcox.test(phd$
    privacy ~ phd$eth); wilcox.test(phd[phd$school!="Nanshan",]$privacy ~ phd[
    phd$school!="Nanshan",]$school)

#% based on 1000 simulated data sets
sim <- 1000; holder <- matrix(data=NA, ncol=8, nrow=sim); colnames(holder) <- c(
    "1", "2", "3", "4", "5", "6", "7", "8"); N <- nrow(phd); n <- N

set.seed(1405973792); for(i in 1:sim) {
  bt <- phd[sample(N, size=n, replace=T),]
  holder[i, 1] <- wilcox.test(bt$infonline ~ bt$gender)$p.value
  holder[i, 2] <- wilcox.test(bt$infonline ~ bt$stream)$p.value
  holder[i, 3] <- wilcox.test(bt$infonline ~ bt$track)$p.value
  holder[i, 4] <- wilcox.test(bt[bt$school!="Basum",]$infonline ~ bt[bt$school!=
      "Basum",]$school)$p.value
  holder[i, 5] <- wilcox.test(bt$infonline ~ bt$eth)$p.value
  holder[i, 6] <- wilcox.test(bt[bt$school!="Nanshan",]$infonline ~ bt[bt$school
      !="Nanshan",]$school)$p.value
  holder[i, 7] <- wilcox.test(bt$privacy ~ bt$eth)$p.value
  holder[i, 8] <- wilcox.test(bt[bt$school!="Nanshan",]$privacy ~ bt[bt$school!=
      "Nanshan",]$school)$p.value
```

```
}

mean(holder[,1]); mean(holder[,2]);mean(holder[,3]); mean(holder[,4]);mean(
    holder[,5]); mean(holder[,6]);mean(holder[,7]); mean(holder[,8])

w.col <- c(wilcox.test(phd$infonline ~ phd$gender)$statistic, wilcox.test(phd$
    infonline ~ phd$stream)$statistic, wilcox.test(phd$infonline ~ phd$track)$
    statistic, wilcox.test(Han$infonline ~ Han$school)$statistic, wilcox.test(
    phd$infonline ~ phd$eth)$statistic, wilcox.test(phd[phd$school!="Nanshan",]$
    infonline ~ phd[phd$school!="Nanshan",]$school)$statistic, wilcox.test(phd$
    privacy ~ phd$eth)$statistic, wilcox.test(phd[phd$school!="Nanshan",]$
    privacy ~ phd[phd$school!="Nanshan",]$school)$statistic)
pw.col <- c(wilcox.test(phd$infonline ~ phd$gender)$p.value, wilcox.test(phd$
    infonline ~ phd$stream)$p.value, wilcox.test(phd$infonline ~ phd$track)$p.
    value, wilcox.test(Han$infonline ~ Han$school)$p.value, wilcox.test(phd$
    infonline ~ phd$eth)$p.value, wilcox.test(phd[phd$school!="Nanshan",]$
    infonline ~ phd[phd$school!="Nanshan",]$school)$p.value, wilcox.test(phd$
    privacy ~ phd$eth)$p.value, wilcox.test(phd[phd$school!="Nanshan",]$privacy
    ~ phd[phd$school!="Nanshan",]$school)$p.value)
psim.col <- c(mean(holder[,1]), mean(holder[,2]), mean(holder[,3]), mean(holder
    [,4]), mean(holder[,5]), mean(holder[,6]), mean(holder[,7]), mean(holder
    [,8])); t.rks <- as.data.frame(cbind(w.col, pw.col, psim.col)); rownames(t.
    rks) <- c("infonline vs. gender", "infonline vs. stream", "infonline vs.
    track", "infonline in Hunan and Shenzhen", "infonline vs. eth", "infonline
    in Hunan and Tibet", "privacy vs. eth", "privacy in Hunan and Tibet");
    colnames(t.rks) <- c("Coefficient", "P-value", "psim"); xtable(t.rks,
    caption="Wilcox rank-sum tests based on the observed sample", digits = 4)

# more Wilcoxon tests
wilcox.test(phd$ictparents ~ phd$eth); wilcox.test(Han$ictparents ~ Han$school);
     wilcox.test(phd[phd$school!="Nanshan",]$ictparents ~ phd[phd$school!="
    Nanshan",]$school); wilcox.test(phd[phd$school!="Hengshan",]$ictparents ~
    phd[phd$school!="Hengshan",]$school); wilcox.test(phd$ictparents ~ phd$
    gender); wilcox.test(phd$ictparents ~ phd$stream); wilcox.test(phd$
    ictparents ~ phd$track); wilcox.test(phd$ictfriends ~ phd$gender); wilcox.
    test(phd$ictfriends ~ phd$eth); wilcox.test(phd$ictfriends ~ phd$stream);
    wilcox.test(phd$ictfriends ~ phd$track)

#%-----------------------------
# correlation tests of variables based on 1000 bootstrapped data sets
sim <- 1000; holder <- matrix(data=NA, ncol=12, nrow=sim); colnames(holder) <- c
    ("t.eth", "p.eth", "t.strm", "p.strm", "t.trk", "p.trk", "t.gdr", "p.gdr", "
    t.hsns", "p.hsns", "t.bsns", "p.bsns"); N <- nrow(phd); n <- N
set.seed(1405973792); for(i in 1:sim) {
  bt <- phd[sample(N, size=n, replace=T),]
  tt.eth <- t.test(bt[bt$eth=="Han",]$acts, bt[bt$eth=="Tibetan",]$acts)
  holder[i, 1] <- tt.eth$statistic
  holder[i, 2] <- tt.eth$p.value
  tt.strm <- t.test(bt[bt$stream=="Key",]$acts, bt[bt$stream=="Ordinary",]$acts)
  holder[i, 3] <- tt.strm$statistic
  holder[i, 4] <- tt.strm$p.value
```

```
  tt.trk <- t.test(bt[bt$track=="Arts",]$acts, bt[bt$track=="Science",]$acts)
  holder[i, 5] <- tt.trk$statistic
  holder[i, 6] <- tt.trk$p.value
  tt.gdr <- t.test(bt[bt$gender=="female",]$acts, bt[bt$gender=="male",]$acts)
  holder[i, 7] <- tt.gdr$statistic
  holder[i, 8] <- tt.gdr$p.value
  tt.hsns <- t.test(bt[bt$school=="Hengshan",]$acts, bt[bt$school=="Nanshan",]$
      acts)
  holder[i, 9] <- tt.hsns$statistic
  holder[i, 10] <- tt.hsns$p.value
  tt.bsns <- t.test(bt[bt$school=="Basum",]$acts, bt[bt$school=="Nanshan",]$acts
      )
  holder[i, 11] <- tt.bsns$statistic
  holder[i, 12] <- tt.bsns$p.value
}

mean(holder[,1]); mean(holder[,2]);mean(holder[,3]); mean(holder[,4]);mean(
    holder[,5]); mean(holder[,6]);mean(holder[,7]); mean(holder[,8]);mean(holder
    [,9]); mean(holder[,10]); mean(holder[,11]); mean(holder[,12])

library(xtable); t.col <- c(mean(holder[,1]), mean(holder[,3]), mean(holder[,5])
    , mean(holder[,7]), mean(holder[,9]), mean(holder[,11])); p.col <- c(mean(
    holder[,2]),mean(holder[,4]),mean(holder[,6]),mean(holder[,8]),mean(holder
    [,10]),mean(holder[,12])); t.boot <- as.data.frame(cbind(t.col, p.col));
    rownames(t.boot) <- c("Han vs. Tibetan", "Key vs. Ordinary", "Arts vs.
    Science", "Female vs. Male", "Hengshan vs. Nanshan", "Basum vs. Nanshan");
    colnames(t.boot) <- c("True t-score", "True p-value"); xtable(t.boot,
    caption="The same t-tests iterated 1000 times", digits = 4)

#%--------------------------------------
# install.packages("lambda.r"); install.packages("Hmisc")
library(lambda.r); library(Hmisc); library(vcd)
cor(phd$rank, phd$cdwell, use="complete.obs", method="spearman"); cor(phd$rank,
    phd$cdwell, use="complete.obs", method="s"); cor(phd$infonline, phd$privacy,
     use="complete.obs", method="spearman"); cor.test(phd$infonline, phd$privacy
    , method="s", alternative="t", exact=F); cor.test(phd$rank, phd$cdwell,
    method="s", alternative="t", exact=F); cor.test(phd$rank, phd$cdwell, method
    ="k", alternative="t", exact=F); rcorr.cens(phd$games, phd$htdwell, outx=T)
    # use outx=T argument to rcorr.cens to get gamma, with standard error

### Regression Analyses

# consult the book: Linear Models with R by Julian Faraway 2005 # page 6: the
    response must be a continuous variable, but the explanatory variables can be
     continuous or discrete # page 7: regression analysis objectives, to predict
     future observations; to assess the effect of, or relationship between,
    explanatory variables and the response; provide a general description of the
     data; # univariate regression with a binary predictor
summary(lm(ias ~ eth + pe, phd))

```

```
ias.lm1 <- lm(ias ~ pe, phd); summary(ias.lm1); plot(ias ~ pe, phd, pch=as.character(school), xlab="Parental Education in Years", ylab="Number of Internet Activities", main="Regression of ias on pe", col=phd$colour); abline(ias.lm1, col="navy"); legend("topleft", c("Tibet", "Hunan", "Shenzhen"), bty="n", pch=c("B", "H", "N"), col=c("red", "darkcyan", "blue"), cex=1)

plot(ias.lm1, 3, col="blue")
plot(fitted(ias.lm1), residuals(ias.lm1), pch=as.character(phd$school), main="Checking for Conditional Constant Variance", xlab="Fitted", ylab="Residuals", col=phd$colour); abline(h=0, col="navy"); legend("topleft", c("Tibet", "Hunan", "Shenzhen"), bty="n", pch=c("B", "H", "N"), col=c("red", "darkcyan", "blue"), cex=1); summary(lm(abs(residuals(ias.lm1)) ~ fitted(ias.lm1)))
library(car); qqPlot(ias.lm1, main="Q-Q plot of Residuals", ylab="Studentized residuals", xlab="Theoretical t-Quantiles", col='blue', col.main="navy",col.lab="navy"); shapiro.test(residuals(ias.lm1))
crPlots(ias.lm1, col="blue")
residualPlots(ias.lm1, col="blue") # test results show the linear model is adequate

#%-----------------------------
ias.lm2 <- lm(ias ~ pe + eth, phd); summary(ias.lm2); plot(phd$pe, phd$ias, xlab="Parental Education in Years", ylab="Number of Internet Activities", pch=ifelse(phd$eth=="Tibetan", 1, 0), col=ifelse(phd$eth=="Tibetan", "red", "blue")); abline(coef(ias.lm2)[1] + coef(ias.lm2)[3], coef(ias.lm2)[2], lty=5, lwd=2, col="red"); abline(coef(ias.lm2)[1], coef(ias.lm2)[2], lty=1, lwd=2, col="blue"); legend("topleft", c("Tibetan", "Han"), bty="n", lty=c(5, 1), pch=c(1, 0), col=c("red", "blue"), cex=1)

xtable(ias.lm2, digits=2, floating=F)

plot(fitted(ias.lm2), residuals(ias.lm2), pch=as.character(phd$school), main="Checking for Constant Variance", xlab="Fitted", ylab="Residuals", col=phd$colour); abline(h=0, col="navy"); legend("topleft", c("Tibet", "Hunan", "Shenzhen"), bty="n", pch=c("B", "H", "N"), col=c("red", "darkcyan", "blue"), cex=1); summary(lm(abs(residuals(ias.lm2)) ~ fitted(ias.lm2)))
library(car); qqPlot(ias.lm2, ylab="Studentized residuals", xlab="Theoretical t-Quantiles", col='blue', col.main="navy",col.lab="navy"); shapiro.test(residuals(ias.lm2))
crPlots(ias.lm2, col="blue"); library(mgcv); gc.1 <- gam(ias ~ s(pe) + eth, data=phd); summary(gc.1) # phd$pe.sq <- phd$pe^2; gc.2 <- gam(ias ~ s(pe) + s(pe.sq) + eth, data=phd); summary(gc.2) # plot(gc.2, col="red") # plot(gc.1, col="red")
vis.gam(gc.1, view =  c("eth", "pe"), type = "link", phi = 10, theta = 35)
residualPlots(ias.lm2, col="blue") # some problems with this model, Turkey test p-value smaller than .05, suggesting that the linear model is inadequate; but this conflicts with the below below, what should we do then? The same questions arise from the associated normality and constant variance tests, results are significant, but graphs show otherwise, there seem to be no consistent procedures to follow, and it relies upon a lot on our judgement as researchers. So these are the questions I am having for you ... which model best helps us understand the phenomenon in question?
```

```
pe.model1 <- lm(ias ~ pe, phd); phd$pe2 <- as.factor(phd$pe); pe.model2 <- lm(ias ~ pe2, phd); anova(pe.model1, pe.model2) # Test for linearity # pe is treated as continuous variable that takes on different values; y = b1 + b2*pe + error # this model treats pe as a set of dummy regressors, it becomes a categorical variable in this model; y = b1 + b2*pe1 + b3*pe2 + ... + error; model1, which is linear, is a special case of model2, which captures any pattern of relationship between error(y) and pe; in other words, model1 is nested within model2 # we can then do an incremental F-test for linearity - if the linear model2 adequately captures the relationship, then the p would be statistically insignificant; here p is not significant, a linear trend adequately captures the trend in the data; so linearity assumption is met; the pattern in gam actually reflects the interaction effect of both pe and eth, non-linearity here is caused by the interaction effect.

ias.lm3 <- lm(ias ~ pe + eth + pe*eth, phd); summary(ias.lm3); plot(phd$pe, phd$ias, xlab="Parental Education in Years", ylab="Number of Internet Activities", pch=ifelse(phd$eth=="Tibetan", 1, 0), col=ifelse(phd$eth=="Tibetan", "red", "blue")); abline(coef(ias.lm3)[1] + coef(ias.lm3)[3], coef(ias.lm3)[2] + coef(ias.lm3)[4], lty=5, lwd=2, col="red"); abline(coef(ias.lm3)[1], coef(ias.lm3)[2], lty=1, lwd=2, col="blue"); legend("topleft", c("Tibetan", "Han"), bty="n", lty=c(5, 1), pch=c(1, 0), col=c("red", "blue"), cex=1)

library(xtable); xtable(ias.lm3, digits=2, floating=F)

plot(fitted(ias.lm3), residuals(ias.lm3), pch=as.character(phd$school), main="Checking for Constant Variance", xlab="Fitted", ylab="Residuals", col=phd$colour); abline(h=0, col="navy"); legend("topleft", c("Tibet", "Hunan", "Shenzhen"), bty="n", pch=c("B", "H", "N"), col=c("red", "darkcyan", "blue"), cex=1); summary(lm(abs(residuals(ias.lm3)) ~ fitted(ias.lm3)))

library(car); qqPlot(ias.lm3, main="Q-Q plot of Residuals", ylab="Studentized residuals", xlab="Theoretical t-Quantiles", col='blue', col.main="navy",col.lab="navy"); shapiro.test(residuals(ias.lm3))

residualPlots(ias.lm3, col="blue", layout=c(3,1)) # the linear model is adequate

##### Simulations
# In order to show that our OLS model is still unbiased, let's simulate!
## let's first try 1000 iterations

sim <- 1000; holder <- matrix(data=NA, ncol=4, nrow=sim); colnames(holder) <- c("Intercept", "pe", "ethTibetan", "pe:ethTibetan"); N <- nrow(phd); n <- N

set.seed(1405973792); for(i in 1:sim) {
  bt <- phd[sample(N, size=n, replace=T),]
  bt.lm <- lm(ias ~ pe + eth + pe*eth, bt)
  holder[i, 1] <- bt.lm$coefficient[1]
  holder[i, 2] <- bt.lm$coefficient[2]
  holder[i, 3] <- bt.lm$coefficient[3]
  holder[i, 4] <- bt.lm$coefficient[4]
}
```

```
par(mfrow=c(2,2)); plot(density(holder[,1]), col="darkcyan", main="Sampling
    Distribution", xlab="1000 Intercepts", lwd=2, xlim=c(0.5, 4), ylim=c(0, 1.5)
    );abline(v=mean(holder[,1]), col="red",lty=1);abline(v=ias.lm3$coefficient
    [1], col="blue",lty=5);legend("topleft", c("True Parameter", "Point Estimate
    "), lty=c(1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "blue")); plot(
    density(holder[,2]), col="darkcyan", main="Sampling Distribution", xlab="
    1000 Coefficients for pe", lwd=2, xlim=c(0, 0.4), ylim=c(0, 14));abline(v=
    mean(holder[,2]), col="red",lty=1, lwd=2);abline(v=ias.lm3$coefficient[2],
    col="blue",lty=5);legend("topleft", c("True Parameter", "Point Estimate"),
    lty=c(1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "blue")); plot(
    density(holder[,3]), col="darkcyan", main="Sampling Distribution", xlab="
    1000 Coefficients for ethTibetan", lwd=2, xlim=c(-1, 3), ylim=c(0, 1.2));
    abline(v=mean(holder[,3]), col="red",lty=1, lwd=2);abline(v=ias.lm3$
    coefficient[3], col="blue",lty=5);legend("topleft", c("True Parameter", "
    Point Estimate"), lty=c(1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "
    blue")); plot(density(holder[,4]), col="darkcyan", main="Sampling
    Distribution", xlab="1000 Coefficients for pe:ethTibetan", lwd=2, xlim=c
    (-0.4, 0.1), ylim=c(0, 9));abline(v=mean(holder[,4]), col="red",lty=1, lwd
    =2);abline(v=ias.lm3$coefficient[4], col="blue",lty=5);legend("topleft", c("
    True Parameter", "Point Estimate"), lty=c(1, 5), lwd=c(1, 1), bty="n", cex
    =0.6, col=c("red", "blue"))

set.seed(1405973792)
lm.sim <- function() {
  bt <- phd[sample(N, size=n, replace=T),]
  bt.lm <- lm(ias ~ pe + eth + pe*eth, bt)
  holder[i, 1] <- bt.lm$coefficient[1]
  holder[i, 2] <- bt.lm$coefficient[2]
  holder[i, 3] <- bt.lm$coefficient[3]
  holder[i, 4] <- bt.lm$coefficient[4]
}

plot(phd$pe, phd$ias, main="First 100 Sample LCEFs vs. the True LCEF", xlab="
    Parental Education in Years", ylab="Number of Internet Activities", pch=
    ifelse(phd$eth=="Tibetan", 1, 0), col=ifelse(phd$eth=="Tibetan", "red", "
    blue")); abline(mean(holder[,1]) + mean(holder[,3]), mean(holder[,2]) + mean
    (holder[,4]), lty=1, lwd=2, col=rgb(1,0,0, 0.5)); abline(mean(holder[, 1]),
    mean(holder[,2]), lty=1, lwd=2, col=rgb(0,0,1, 0.5)); abline(coef(ias.lm3)
    [1] + coef(ias.lm3)[3], coef(ias.lm3)[2] + coef(ias.lm3)[4], lty=5, lwd=2,
    col=rgb(0,1,0)); abline(coef(ias.lm3)[1], coef(ias.lm3)[2], lty=5, lwd=2,
    col=rgb(0,1,0)); legend("topleft", c("Bootstrapped True Regression Line", "
    First 100 Sample Regression Lines", "The Observed Regression Line"), lty=c
    (1, 5, 5), lwd=c(2, 1, 2), bty="n", cex=0.8, col=c(rgb(0.5,0,0.5), rgb
    (0.5,0,0.5), "green"))
for(i in 1:100){
  abline(holder[i,1] + holder[i,3], holder[i,2] + holder[i,4], col=rgb
      (1,0,0,0.1), lty=5, lwd=0.8)
  abline(holder[i,1], holder[i,2], col=rgb(0,0,1,0.1), lty=5, lwd=0.8)
}
```

```
#%% 30 iterations

sim <- 30; holder <- matrix(data=NA, ncol=4, nrow=sim); colnames(holder) <- c("
    Intercept", "pe", "ethTibetan", "pe:ethTibetan"); N <- nrow(phd); n <- N

set.seed(1405973792); for(i in 1:sim) {
  bt <- phd[sample(N, size=n, replace=T),]
  bt.lm <- lm(ias ~ pe + eth + pe*eth, bt)
  holder[i, 1] <- bt.lm$coefficient[1]
  holder[i, 2] <- bt.lm$coefficient[2]
  holder[i, 3] <- bt.lm$coefficient[3]
  holder[i, 4] <- bt.lm$coefficient[4]
}

par(mfrow=c(2,2)); plot(density(holder[,1]), col="darkcyan", main="Sampling
    Distribution", xlab="30 Intercepts", lwd=2, xlim=c(0.5, 4), ylim=c(0, 1.5));
    abline(v=mean(holder[,1]), col="red",lty=1);abline(v=ias.lm3$coefficient[1],
     col="blue",lty=5);legend("topleft", c("True Parameter", "Point Estimate"),
    lty=c(1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "blue")); plot(
    density(holder[,2]), col="darkcyan", main="Sampling Distribution", xlab="30
    Coefficients for pe", lwd=2, xlim=c(0, 0.4), ylim=c(0, 14));abline(v=mean(
    holder[,2]), col="red",lty=1, lwd=2);abline(v=ias.lm3$coefficient[2], col="
    blue",lty=5);legend("topleft", c("True Parameter", "Point Estimate"), lty=c
    (1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "blue")); plot(density(
    holder[,3]), col="darkcyan", main="Sampling Distribution", xlab="30
    Coefficients for ethTibetan", lwd=2, xlim=c(-1, 3), ylim=c(0, 1.2));abline(v
    =mean(holder[,3]), col="red",lty=1, lwd=2);abline(v=ias.lm3$coefficient[3],
    col="blue",lty=5);legend("topleft", c("True Parameter", "Point Estimate"),
    lty=c(1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "blue")); plot(
    density(holder[,4]), col="darkcyan", main="Sampling Distribution", xlab="30
    Coefficients for pe:ethTibetan", lwd=2, xlim=c(-0.4, 0.1), ylim=c(0, 9));
    abline(v=mean(holder[,4]), col="red",lty=1, lwd=2);abline(v=ias.lm3$
    coefficient[4], col="blue",lty=5);legend("topleft", c("True Parameter", "
    Point Estimate"), lty=c(1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "
    blue"))

set.seed(1405973792)
lm.sim <- function() {
  bt <- phd[sample(N, size=n, replace=T),]
  bt.lm <- lm(ias ~ pe + eth + pe*eth, bt)
  holder[i, 1] <- bt.lm$coefficient[1]
  holder[i, 2] <- bt.lm$coefficient[2]
  holder[i, 3] <- bt.lm$coefficient[3]
  holder[i, 4] <- bt.lm$coefficient[4]
}

plot(phd$pe, phd$ias, main="30 Sample LCEFs vs. the True LCEF", xlab="Parental
    Education in Years", ylab="Number of Internet Activities", pch=ifelse(phd$
    eth=="Tibetan", 1, 0), col=ifelse(phd$eth=="Tibetan", "red", "blue"));
    abline(mean(holder[,1]) + mean(holder[,3]), mean(holder[,2]) + mean(holder
    [,4]), lty=1, lwd=2, col=rgb(1,0,0, 0.5)); abline(mean(holder[, 1]), mean(
```

```
holder[,2]), lty=1, lwd=2, col=rgb(0,0,1, 0.5)); abline(coef(ias.lm3)[1] + coef(ias.lm3)[3], coef(ias.lm3)[2] + coef(ias.lm3)[4], lty=5, lwd=2, col=rgb(0,1,0)); abline(coef(ias.lm3)[1], coef(ias.lm3)[2], lty=5, lwd=2, col=rgb(0,1,0)); legend("topleft", c("Bootstrapped True Regression Line", "30 Sample Regression Lines", "The Observed Regression Line"), lty=c(1, 5, 5), lwd=c(2, 1, 2), bty="n", cex=0.8, col=c(rgb(0.5,0,0.5), rgb(0.5,0,0.5), "green"))
for(i in 1:30){
  abline(holder[i,1] + holder[i,3], holder[i,2] + holder[i,4], col=rgb(1,0,0,0.1), lty=5, lwd=0.8)
  abline(holder[i,1], holder[i,2], col=rgb(0,0,1,0.1), lty=5, lwd=0.8)
}

### %% 15 iterations
sim <- 15; holder <- matrix(data=NA, ncol=4, nrow=sim); colnames(holder) <- c("Intercept", "pe", "ethTibetan", "pe:ethTibetan"); N <- nrow(phd); n <- N

set.seed(1405973792); for(i in 1:sim) {
  bt <- phd[sample(N, size=n, replace=T),]
  bt.lm <- lm(ias ~ pe + eth + pe*eth, bt)
  holder[i, 1] <- bt.lm$coefficient[1]
  holder[i, 2] <- bt.lm$coefficient[2]
  holder[i, 3] <- bt.lm$coefficient[3]
  holder[i, 4] <- bt.lm$coefficient[4]
}

par(mfrow=c(2,2)); plot(density(holder[,1]), col="darkcyan", main="Sampling Distribution", xlab="15 Intercepts", lwd=2, xlim=c(0.5, 4), ylim=c(0, 1.5)); abline(v=mean(holder[,1]), col="red",lty=1);abline(v=ias.lm3$coefficient[1], col="blue",lty=5);legend("topleft", c("True Parameter", "Point Estimate"), lty=c(1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "blue")); plot(density(holder[,2]), col="darkcyan", main="Sampling Distribution", xlab="15 Coefficients for pe", lwd=2, xlim=c(0, 0.4), ylim=c(0, 14));abline(v=mean(holder[,2]), col="red",lty=1, lwd=2);abline(v=ias.lm3$coefficient[2], col="blue",lty=5);legend("topleft", c("True Parameter", "Point Estimate"), lty=c(1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "blue")); plot(density(holder[,3]), col="darkcyan", main="Sampling Distribution", xlab="15 Coefficients for ethTibetan", lwd=2, xlim=c(-1, 3), ylim=c(0, 1.2));abline(v=mean(holder[,3]), col="red",lty=1, lwd=2);abline(v=ias.lm3$coefficient[3], col="blue",lty=5);legend("topleft", c("True Parameter", "Point Estimate"), lty=c(1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "blue")); plot(density(holder[,4]), col="darkcyan", main="Sampling Distribution", xlab="15 Coefficients for pe:ethTibetan", lwd=2, xlim=c(-0.4, 0.1), ylim=c(0, 9)); abline(v=mean(holder[,4]), col="red",lty=1, lwd=2);abline(v=ias.lm3$coefficient[4], col="blue",lty=5);legend("topleft", c("True Parameter", "Point Estimate"), lty=c(1, 5), lwd=c(1, 1), bty="n", cex=0.6, col=c("red", "blue"))

set.seed(1405973792)
lm.sim <- function() {
  bt <- phd[sample(N, size=n, replace=T),]
```

```
  bt.lm <- lm(ias ~ pe + eth + pe*eth, bt)
  holder[i, 1] <- bt.lm$coefficient[1]
  holder[i, 2] <- bt.lm$coefficient[2]
  holder[i, 3] <- bt.lm$coefficient[3]
  holder[i, 4] <- bt.lm$coefficient[4]
}

plot(phd$pe, phd$ias, main="15 Sample LCEFs vs. the True LCEF", xlab="Parental Education in Years", ylab="Number of Internet Activities", pch=ifelse(phd$eth=="Tibetan", 1, 0), col=ifelse(phd$eth=="Tibetan", "red", "blue")); abline(mean(holder[,1]) + mean(holder[,3]), mean(holder[,2]) + mean(holder[,4]), lty=1, lwd=2, col=rgb(1,0,0, 0.5)); abline(mean(holder[, 1]), mean(holder[,2]), lty=1, lwd=2, col=rgb(0,0,1, 0.5)); abline(coef(ias.lm3)[1] + coef(ias.lm3)[3], coef(ias.lm3)[2] + coef(ias.lm3)[4], lty=5, lwd=2, col=rgb(0,1,0)); abline(coef(ias.lm3)[1], coef(ias.lm3)[2], lty=5, lwd=2, col=rgb(0,1,0)); legend("topleft", c("Bootstrapped True Regression Line", "15 Sample Regression Lines", "The Observed Regression Line"), lty=c(1, 5, 5), lwd=c(2, 1, 2), bty="n", cex=0.8, col=c(rgb(0.5,0,0.5), rgb(0.5,0,0.5), "green"))
for(i in 1:15){
  abline(holder[i,1] + holder[i,3], holder[i,2] + holder[i,4], col=rgb(1,0,0,0.1), lty=5, lwd=0.8)
  abline(holder[i,1], holder[i,2], col=rgb(0,0,1,0.1), lty=5, lwd=0.8)
}

##### Map of China with the three regions and the capital
# version one
map("worldHires", "China", exact=T, boundary=T, interior=T, col="navy", fill=F); points(112.61, 26.89, pch=15, col="darkcyan", cex=2); points(114.07, 22.62, pch=16, col="red", cex=2); points(91.76, 29.18, pch=17, col="red", cex=2); points(116.46, 39.92, pch=1, col="darkgray", cex=2); text(112.61, 28.20,"Hengshan, HN", cex=0.6, col="darkcyan"); text(114.07, 24.00,"Nanshan, SZ", cex=0.6, col="blue"); text(91.76, 31.18, "Basum, TB", cex=0.6, col="red"); text(116.46, 41.20, "Beijing", cex=0.6, col="darkgray"); legend("bottomleft", c("TB: Tibet", "HN: Hunan", "SZ: Shenzhen"), bty="n", text.col=c("red", "darkcyan", "blue"), cex=0.8)

# version two
if (require(maps) && require(mapdata)) {
  map("china")
  map("china", col="gray", add = T)
}
points(112.61, 26.89, pch=15, col="darkcyan", cex=2); points(114.07, 22.62, pch=16, col="red", cex=2); points(91.76, 29.18, pch=17, col="red", cex=2); points(116.46, 39.92, pch=1, col="navy", cex=2); text(112.61, 28.20,"Hengshan, HN", cex=0.6, col="darkcyan"); text(114.07, 24.00,"Nanshan, SZ", cex=0.6, col="blue"); text(91.76, 31.18, "Basum, TB", cex=0.6, col="red"); text(116.46, 41.20, "Beijing", cex=0.6, col="navy"); legend("bottomleft", c("TB: Tibet", "HN: Hunan", "SZ: Shenzhen"), bty="n", text.col=c("red", "darkcyan", "blue"), cex=0.8)
# version three
```

```
if (require(maps) && require(mapdata)) {
  map("china")
  map("china", col=8, add = T)
}
points(112.61, 26.89, pch=15, col="darkcyan", cex=1.5); points(91.76, 29.18, pch=17, col="red", cex=1.5); points(114.07, 22.62, pch=16, col="blue", cex=1.5); text(112.61, 28.30,"HS", cex=0.6, col="darkcyan"); text(91.76, 31.28, "BS", cex=0.6, col="red"); text(114.07, 24.10,"NS", cex=0.6, col="blue"); legend("bottomleft", c("HS: Hengshan in Hunan", "BS: Basum in Tibet", "NS: Nanshan in Shenzhen"), bty="n", text.col=c("darkcyan", "red", "blue"), cex=0.8)

###### logit model to predict academic underachievement
phd$rank; summary(phd$rank)

# to make academic ranking a binary variable called undera, average or above as 0; below average as 1; NA as NA; inverse coding
phd$undera <- NA; phd$undera[phd$rank %in% c(3,4,5)] <- 0; phd$undera[phd$rank %in% c(1,2)] <- 1; phd$undera

### comparison between Han and Tibetan students
epv.undera <- c("undera", "diqu", "minzu", "htdwell", "cafe", "pe", "pande"); epv.undera %in% colnames(phd); data.undera <- na.omit(phd[epv.undera]); nrow(data.undera)

initial <- glm(undera ~ htdwell + cafe + minzu + pe + pande, data.undera, family=binomial("logit")); summary(initial)
round(xtable(initial),digits=2)

sum(data.undera[data.undera$minzu==1,]$undera==1)/nrow(data.undera[data.undera$minzu==1,]) # Han students reporting below average
sum(data.undera[data.undera$minzu==2,]$undera==1)/nrow(data.undera[data.undera$minzu==2,]) # Tibetans reporting below average
sum(data.undera[data.undera$minzu==1,]$undera==1) # Han
nrow(data.undera[data.undera$minzu==1,]) # Han
sum(data.undera[data.undera$minzu==2,]$undera==1) # Tibetan
nrow(data.undera[data.undera$minzu==2,]) # Tibetan
nrow(data.undera) # total

# the log-likelihood function
ll.logit <- function(beta, X, y){
-sum(log(1+exp((1-2*y)*X%*%beta)))
}

y <- as.matrix(data.undera[,"undera"]); X <- as.matrix(cbind(1, data.undera[,c("htdwell", "cafe", "minzu", "pe", "pande")])); head(X)

opt.t1m1 <- optim(par=rep(0,6), y=y, X=X, fn=ll.logit, method="BFGS", control=list(fnscale=-1), hessian=T); opt.t1m1; t1m1.coef <- opt.t1m1$par; head(X); t1m1.coef; t1m1.ses <- sqrt(diag(solve(-opt.t1m1$hessian))); t1m1.ses
```

```
coef.col <- t1m1.coef; ses.col <- t1m1.ses; optim <- as.data.frame(cbind(coef.col, ses.col)); rownames(optim) <- c("Intercept", "htdwell", "cafe", "minzu", "pe", "pande"); colnames(optim) <- c("Optimised Coefficients", "Std. Errors"); xtable(optim, caption="Optimal Coefficients", digits=2); print(optim)

undera <- y==1; nrow(X[undera,]); sum(undera); base.line <- c(apply(X[undera,], 2, median)); base.line

library(MASS); set.seed(1405973792); betas <- mvrnorm(n=50000, mu=t1m1.coef, Sigma=solve(-opt.t1m1$hessian))
h.zu <- z.zu <- base.line; h.zu["minzu"] <- 1; z.zu["minzu"] <- 2; h.zu; z.zu

col1 <- c(1,1); col2 <- c(4,4); col3 <- c(2,2); col4 <- c(1,2); col5 <- c(9,9); col6 <- c(9,9); fd.tab <- as.data.frame(cbind(col1, col2, col3,col4,col5,col6)); rownames(fd.tab) <- c("Han", "Tibetan"); colnames(fd.tab) <- c("Intercept", "htdwell", "cafe", "minzu", "pe", "pande"); xtable(fd.tab, caption="First differences in reporting underachievement between Han and Tibetan students", digits=2); print(fd.tab)

first.diffs <- 1/(1+exp(-z.zu%*%t(betas))) - 1/(1+exp(-h.zu%*%t(betas))); mean(first.diffs); quantile(first.diffs, c(.025, .975)) # 95% CI: -0.26485741 -0.03884868 for median; -0.31573210 -0.03854787 for mean
plot(density(first.diffs), col="red", main="Comparison between Han and Tibetan students"); abline(v=0, col="steelblue", lty=2) # Tibetans significantly less likely to report undera


###### comparison of probability in reporting underachievement between Han and Tibetan students as pe increases by 1.5 years

epv.undera <- c("undera", "diqu", "minzu", "htdwell", "cafe", "pe", "pande"); epv.undera %in% colnames(phd); data.undera <- na.omit(phd[epv.undera]); nrow(data.undera)

# the log-likelihood function
ll.logit <- function(beta, X, y){
-sum(log(1+exp((1-2*y)*X%*%beta)))
}

y <- as.matrix(data.undera[,"undera"]); X <- as.matrix(cbind(1, data.undera[,c("htdwell", "cafe", "minzu", "pe", "pande")])); head(X)

opt.t1m1 <- optim(par=rep(0,6), y=y, X=X, fn=ll.logit, method="BFGS", control=list(fnscale=-1), hessian=T); opt.t1m1; t1m1.coef <- opt.t1m1$par; head(X); t1m1.coef; t1m1.ses <- sqrt(diag(solve(-opt.t1m1$hessian))); t1m1.ses

undera <- y==1; nrow(X[undera,]); sum(undera); base.line <- c(apply(X[undera,], 2, median)); base.line

summary(data.undera$pe); pe.seq <- seq(0, 18, 1.5); length(pe.seq); pe.seq
```

```
base.line["pe"] <- NA; base.line["minzu"] <- NA; base.line <- matrix(rep(base.line), nrow=length(pe.seq), ncol=length(base.line), byrow=T); base.line[,5] <- pe.seq; bl.h <- base.line; bl.h[,4] <- 1; bl.t <- base.line; bl.t[,4] <- 2

library(MASS); set.seed(1405973792); betas <- mvrnorm(n=50000, mu=t1m1.coef, Sigma=solve(-opt.t1m1$hessian)); summary(betas)

exp.holder <- matrix(data=NA, ncol=6, nrow=length(pe.seq))
for (i in 1:length(pe.seq)){
  han.pr.sim <- 1/(1+exp(-bl.h[i,]%*%t(betas)))
  exp.holder[i,1] <- mean(han.pr.sim)
  exp.holder[i, 2:3] <- quantile(x=han.pr.sim, prob=c(.025, .975))
  tb.pr.sim <- 1/(1+exp(-bl.t[i,]%*%t(betas)))
  exp.holder[i,4] <- mean(tb.pr.sim)
  exp.holder[i, 5:6] <- quantile(tb.pr.sim, c(.025, .975))
}

exp.holder[,1]/exp.holder[,4]

plot(pe.seq, exp.holder[,4], type="l", ylim=c(0,1), lwd=2, col="red", xlab="Parental education in years", ylab="Probability of reporting underachievement", cex=.1); lines(pe.seq, exp.holder[,1], col="darkcyan", lwd=2); lines(pe.seq, exp.holder[,2], col="darkcyan", lwd=1.2, lty=2); lines(pe.seq, exp.holder[,3], col="darkcyan", lwd=1.2, lty=2); lines(pe.seq, exp.holder[,5], col="red", lwd=1.2, lty=2); lines(pe.seq, exp.holder[,6], col="red", lwd=1.2, lty=2); legend("topright", legend=c("Tibetan", "Han"), bty="n", lwd=c(2,2), lty=c(4,4), col=c("red", "darkcyan"), cex=.6)

###### nontrust of online information
phd$infonline; summary(phd$infonline)
# to make infonline a binary variable called nontrust, agree as 0 for trusting online information; disagree as 1 for not trusting online information; No opinion and NA as NA; inverse coding
phd$nontrust <- NA; phd$nontrust[phd$infonline %in% c(0,3,4)] <- 0; phd$nontrust[phd$infonline %in% c(1,2)] <- 1; phd$nontrust

epv.nontrust <- c("nontrust", "minzu", "wenli", "zdpt", "htdwell", "cdwell", "imptdwell", "handsets", "freecafe", "cafe", "ictparents", "privacy", "icts", "acts", "support", "pe", "pande", "ictfs", "ias", "viscafe", "phbill")

data.nontrust <- na.omit(phd[epv.nontrust]); nrow(data.nontrust)

initial <- glm(nontrust ~ viscafe + minzu, data.nontrust, family=binomial("logit")); summary(initial)

# the log-likelihood function
ll.logit <- function(beta, X, y){
-sum(log(1+exp((1-2*y)*X%*%beta)))
}
```

```
y <- as.matrix(data.nontrust[,"nontrust"]); X <- as.matrix(cbind(1, data.nontrust[,-1])); head(X)

opt.t1m1 <- optim(par=rep(0,21), y=y, X=X, fn=ll.logit, method="BFGS", control=list(fnscale=-1), hessian=T); opt.t1m1; t1m1.coef <- opt.t1m1$par; head(X); t1m1.coef; t1m1.ses <- sqrt(diag(solve(-opt.t1m1$hessian))); t1m1.ses

nontrust <- y==1; nrow(X[nontrust,]); sum(nontrust); base.line <- c(apply(X[nontrust,], 2, median)); base.line

set.seed(1405973792); betas <- mvrnorm(n=50000, mu=t1m1.coef, Sigma=solve(-opt.t1m1$hessian))
h.zu <- z.zu <- base.line; h.zu["minzu"] <- 1; z.zu["minzu"] <- 2; h.zu; z.zu
first.diffs <- 1/(1+exp(-z.zu%*%t(betas))) - 1/(1+exp(-h.zu%*%t(betas))); mean(first.diffs); quantile(first.diffs, c(.025, .975))
plot(density(first.diffs), col="red", main="Comparison between Han and Tibetan students"); abline(v=0, col="steelblue", lty=2) # no significance between Han and Tibetans 95% CI -0.05044576  0.16003832

#%-------------------------------------

#rm(list = ls()); ls()
#load("phd.RData"); ls()

# library(MatchIt); library(Zelig); library(cem)

# make academic ranking a binary variable called achieve, average or below as 0; above average or above as 1; prefer not to say and NA as NA

phd$achieve <- NA; phd$achieve[phd$rank %in% c(1,2,3)] <- 0; phd$achieve[phd$rank %in% c(4,5)] <- 1; phd$achieve; sum(is.na(phd$achieve)) # 94 missing values

# treat freecafe as a treatment variable
phd$T <- NA; phd$T[phd$freecafe %in% c(0,3)] <- 0; phd$T[phd$freecafe %in% c(1,2)] <- 1; phd$T; sum(is.na(phd$T)) # 36 missing values # phd$T <- recode(phd$freecafe, "c(0,3)=0; c(1,2)=1; else=NA")
# phd$T # 0 no opinion, no access, or not restrictive at all for the control; fairly restrictive and very restrictive as 1 for treatment. outcome variable is achieve (phd$achieve, reporting above average or top 10% in academic performance)

# create a dataset for matching
select.m <- c("achieve", "T", "diqu", "htdwell", "pe", "icts", "acts", "zdpt", "wenli"); select.m %in% colnames(phd); data.lw <- na.omit(phd[select.m]); nrow(data.lw)

# the log-likelihood function
ll.logit <- function(beta, X, y){
-sum(log(1+exp((1-2*y)*X%*%beta)))
```

```
}

y <- as.matrix(data.lw[,"achieve"]); X <- as.matrix(cbind(1, data.lw[,c("T", "diqu", "htdwell", "pe", "icts", "acts", "zdpt", "wenli")])); head(X)

opt.t1m1 <- optim(par=rep(0,9), y=y, X=X, fn=ll.logit, method="BFGS", control=list(fnscale=-1), hessian=T); opt.t1m1; t1m1.coef <- opt.t1m1$par; head(X); t1m1.coef; t1m1.ses <- sqrt(diag(solve(-opt.t1m1$hessian))); t1m1.ses

achieve <- y==1; nrow(X[achieve,]); sum(achieve); base.line <- c(apply(X[achieve,], 2, median)); base.line

library(MASS); set.seed(1405973792); betas <- mvrnorm(n=50000, mu=t1m1.coef, Sigma=solve(-opt.t1m1$hessian))
t <- c <- base.line; c["T"] <- 0; t["T"] <- 1; c; t

first.diffs <- 1/(1+exp(-t%*%t(betas))) - 1/(1+exp(-c%*%t(betas))); mean(first.diffs); quantile(first.diffs, c(.025, .975))

plot(density(first.diffs), col="red", main="Effect of Internet cafe policy in Hengshan") # cafe policy has no effect in Hengshan

#### baseline imbalance

bl.imb <- imbalance(data.lw$T, data.lw, drop=c("achieve", "T")); bl.imb

m.t <- matchit(formula = T ~ diqu + htdwell + pe + acts, data=data.lw, method="cem", eval.imbalance=T); summary(m.t); mt.data <- match.data(m.t); head(mt.data); dim(mt.data)

plot(m.t, type="QQ", which.xs=c("htdwell", "acts", "pe"), col="red")
m.t$nn[2,]
plot(m.t, type="jitter", col="steelblue", interactive=F)
plot(m.t, type="hist", border=c("cornflowerblue"))

fit <- zelig(achieve ~ T + diqu + pe + htdwell + acts, mt.data, model="logit"); summary(fit); x.out <- setx(fit, data=match.data(m.t, "treat")); set.seed(1405973792); s.out <- sim(fit, x=x.out); summary(s.out); s.out$stats; plot(s.out)

x.out0 <- setx(fit, T=0, diqu=1); x.out1 <- setx(fit, T=1, diqu=1); set.seed(1405973792); s.out <- sim(fit, x=x.out0, x1=x.out1); summary(s.out); plot(s.out)

x.out0 <- setx(fit, T=0, diqu=2); x.out1 <- setx(fit, T=1, diqu=2); set.seed(1405973792); s.out <- sim(fit, x=x.out0, x1=x.out1); summary(s.out); plot(s.out)

x.out0 <- setx(fit, T=0, diqu=3); x.out1 <- setx(fit, T=1, diqu=3); set.seed(1405973792); s.out <- sim(fit, x=x.out0, x1=x.out1); summary(s.out); plot(s.out, )
```

```
### using Amelia to impute missing values

select.m <- c("achieve", "T", "diqu", "htdwell", "icts", "pe", "acts"); select.m %in% colnames(phd); data.m <- phd[select.m]; dim(data.m); n <- dim(data.m)[1]; k <- dim(data.m)[2]; data.mi <- data.m; idx <- sample(1:n, .3*n); sum(is.na(data.m$achieve)) # 94 missing values

set.seed(1405973792); invisible(sapply(idx, function(x) data.mi[x, sample(2:k,1)]<<-NA)); set.seed(1405973792); imputed <- amelia(data.mi, 10, p2s=0, noms=c("T", "achieve")); mi.dsets <- imputed$imputations[1:10]; summary(mi.dsets)

mat <- cem("T", datalist=mi.dsets, drop=c("achieve")); mat; att(mat, achieve ~ T, data=mi.dsets)

col1 <- c(54,47,47,52,51,49,54,46,52,47); col2 <- c(73,62,61,84,67,64,74,68,67,66); mn.tab <- as.data.frame(cbind(col1, col2)); rownames(mn.tab) <- c("Multiply Imputed Dataset 1", "Multiply Imputed Dataset 2", "Multiply Imputed Dataset 3", "Multiply Imputed Dataset 4", "Multiply Imputed Dataset 5", "Multiply Imputed Dataset 6", "Multiply Imputed Dataset 7", "Multiply Imputed Dataset 8", "Multiply Imputed Dataset 9", "Multiply Imputed Dataset 10"); colnames(mn.tab) <- c("Control", "Treatment"); xtable(mn.tab, caption="Matched cases in each imputed dataset", digits=0)

###### comparison of probability in reporting achievement between control and treatment groups as pe increases by 1.5 years

epv.ach <- c("achieve", "T", "diqu", "htdwell", "pe", "icts", "acts", "zdpt", "wenli"); epv.ach %in% colnames(phd); data.ach <- na.omit(phd[epv.ach]); nrow(data.ach)

# the log-likelihood function
ll.logit <- function(beta, X, y){
-sum(log(1+exp((1-2*y)*X%*%beta)))
}

y <- as.matrix(data.ach[,"achieve"]); X <- as.matrix(cbind(1, data.ach[,c("T", "diqu", "htdwell", "pe", "icts", "acts", "zdpt", "wenli")])); head(X)

opt.t1m1 <- optim(par=rep(0,9), y=y, X=X, fn=ll.logit, method="BFGS", control=list(fnscale=-1), hessian=T); opt.t1m1; t1m1.coef <- opt.t1m1$par; head(X); t1m1.coef; t1m1.ses <- sqrt(diag(solve(-opt.t1m1$hessian))); t1m1.ses

ach <- y==1; nrow(X[ach,]); sum(ach); base.line <- c(apply(X[ach,], 2, median)); base.line

summary(data.ach$pe); pe.seq <- seq(0, 18, 1.5); length(pe.seq); pe.seq

base.line["pe"] <- NA; base.line["T"] <- NA; base.line <- matrix(rep(base.line), nrow=length(pe.seq), ncol=length(base.line), byrow=T); base.line[,5] <- pe.seq; bl.c <- base.line; bl.c[,2] <- 0; bl.t <- base.line; bl.t[,2] <- 1
```

```
library(MASS); set.seed(1405973792); betas <- mvrnorm(n=50000, mu=t1m1.coef,
    Sigma=solve(-opt.t1m1$hessian)); summary(betas)

exp.holder <- matrix(data=NA, ncol=6, nrow=length(pe.seq))
for (i in 1:length(pe.seq)){
  c.pr.sim <- 1/(1+exp(-bl.c[i,]%*%t(betas)))
  exp.holder[i,1] <- mean(c.pr.sim)
  exp.holder[i, 2:3] <- quantile(x=c.pr.sim, prob=c(.025, .975))
  t.pr.sim <- 1/(1+exp(-bl.t[i,]%*%t(betas)))
  exp.holder[i,4] <- mean(t.pr.sim)
  exp.holder[i, 5:6] <- quantile(t.pr.sim, c(.025, .975))
}

exp.holder[,1]/exp.holder[,4]

plot(pe.seq, exp.holder[,4], type="l", ylim=c(0,1), lwd=2, col="red", xlab="
    Parental education in years", ylab="Probability of reporting achievement",
    cex=.1); lines(pe.seq, exp.holder[,1], col="darkcyan", lwd=2); lines(pe.seq,
     exp.holder[,2], col="darkcyan", lwd=1.2, lty=2); lines(pe.seq, exp.holder
    [,3], col="darkcyan", lwd=1.2, lty=2); lines(pe.seq, exp.holder[,5], col="
    red", lwd=1.2, lty=2); lines(pe.seq, exp.holder[,6], col="red", lwd=1.2, lty
    =2); legend("topright", legend=c("Treatment", "Control"), bty="n", lwd=c
    (2,2), lty=c(4,4), col=c("red", "darkcyan"), cex=.6)




#%------------------------------------

save(phd, file="phd.RData")
```

R/phdv8.R