DIGITAL DIVIDE AMONG STUDENTS OF UNIVERSITIES IN KERALA

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by

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Declaration

I hereby declare that the thesis entitled **Digital Divide among Students of Universities in Kerala** is the authentic record of research work carried out by me, for my Doctoral Degree under the supervision and guidance of Dr Mohamed Haneefa K., Associate Professor and Head, Department of Library and Information Science, University of Calicut, and that no part thereof has previously formed the basis for the award of any degree or diploma or any other similar titles or recognition.

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Certificate

I, Dr. Mohamed Haneefa K., do hereby certify that the Ph.D thesis entitled **Digital Divide among Students of Universities in Kerala** is a record of bonafide study and research carried out by Mrs. Aswathi P. under my supervision and guidance.

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25th May 2019

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Contents

List of Tables

List of Figures

Abbreviations/Acronyms

ACTA	Allensbacher Computer and Technology Analysis
ANOVA	Analysis of Variance
APA	American Psychological Association
BRIC	Brazil, Russia, India and China
BYOD	Bring Your Own Device
CARD	Computer Aided Administration of Registration Department
CAS	Computer Attitude Scale
CEE	Central Eastern European Country
CUSAT	Cochin University of Science and Technology
DCTS	Digital Collaborative Texts
DMRT	Duncan's Multiple Range Test
ETD	Electronic Thesis and Dissertations
EU	European Union
Eurostat	European Community Survey
FRIENDS	Fast, Reliable Instant Efficient Network for Disbursement of Services.
GPTS	General Purpose Technologies
HEFCE	Higher Education Funding Council for England
ICSCs	Integrated Citizen Service Centres
ICT	Information and Communication Technology
IDS	Internet Demographic Study
INKAR	Indikatoren und Karten zur Raumentwicklung
ISAP	Indian Society of Agribusiness Professionals
IST	Information Society Technology
ISTAT	Italian National Statistical Institute
IT	Information Technology
KAU	King Abdulaziz Universities
KCC	Kisan Call Centre

KU	Kannur University
LFL	Learning For Life
LMS	Learning Management System
MANOVA	Multivariate Analysis of Variance
MMS	Multimedia Messaging Services
NABARD	National Bank for Agriculture and Rural Development
NTC	National Telecommunication Commission
NTIA	National Telecommunications and Information Administration
OECD	Organization for Economic Co-operation and Development
OER	Open Educational Resources
PDA	Personal Digital Assistant
PIAL	Pew Internet & American Life
PISA	The Program for International Student Assessment
RCM	Revealed Casual Mapping
RTI	Right to Information Act
SES	Socio-economic Status
SIM	Subscribers Identity Module
SMKTTA	Sekolah Menengah Kebangsaan Tengku Temenggung Ahmad
SNS	Social Networking Site
SPSS	Statistical Package for Social Sciences
TSF	The Smith Family
UC	University of Calicut
ULIC	University Libraries and Information Centres
UTAUT	Unified Theory of Acceptance and Use of Technology
ViCTERs	Virtual Class-room Technology on Edusat for Rural Schools

Abstract

Organization for Economic Co-operation and Development (OECD) defined the digital divide as the gap between individuals, households, business and geographic areas at different socio-economic levels with regard to both their opportunities to access Information and Communication Technology (ICT) and their use of the Internet for a wide variety of activities. Factors like socio-economic status, gender, age, attitude, and digital literacy/competency are the main elements that lead to digital divide. This study tried to understand the digital divide among post-graduate students of universities in Kerala. The scope of the study extends to cover regular post-graduate students from the universities. The researcher investigated the inequalities existed among the students at personal level in access to ICT devices such as computers, mobile phones and Internet connections. Thus it seeks digital access divide (first level digital divide) - the disparity of access to ICT in home and educational institutions. It also identified the divide in digital competency of the students to use digital devices as well as to perform different technological activities. Differences in the use of the Internet by the students were also examined in this study. The researcher also analysed whether socio-economic status and psychological factors act as a contributing factor to the digital divide.

The investigation involves the students from four state universities in Kerala. The universities selected for the study are University of Kerala, University of Calicut, Mahatma Gandhi University, and Kannur University. The investigator has taken a representative sample of 700 students with two-stage stratified random sampling. First, the researcher considered university-wise strata for taking the sample and then identified the subject-wise/discipline-wise

categories of the students, which was taken proportionately from three disciplines (Science, Humanities and Social Science). The study employed the survey method of research and a fully structured questionnaire was used for collecting the data. Out of 700 questionnaires distributed, 594 questionnaires were properly filled by the participants making the response rate 84.9 per cent. The collected data were segregated and consolidated with Microsoft Excel. Statistical Package for Social Sciences (SPSS), version 21 was used to do the statistical analysis.

The overall result confirmed the inequalities in access to ICT both at home and educational institution. A reasonable number of the students experienced lack of access to desktop and laptop computers at personal level and it is found to be a major issue among the students. Findings also disclosed a relatively low rate of ownership of digital devices among the students except in the case of smart phones. Regarding the Internet access at personal level, some of the students kept away from enjoying it. Eventhough universities provided computers with Internet connection and Wi-Fi facilities in the campus, it is not adequate for the students to meet their requirements. Major issue for accessing ICT among the students was the insufficient number of computers with Internet connection in their departments/libraries. Barriers like lack of personnel to maintain equipment in university departments, insufficient number of computers with Internet connection and slow speed of the Internet connection in campus were higher in Kannur University when compared to other universities. In addition, inequalities of access to ICT at personal level can also be observed along gender and geographic areas. Male students and the students from urban area had a higher level access to ICT at personal level.

The study measured digital competency of the students by asking their expertise to use different digital devices and to do various ICT related applications. On the whole, fairly wide differences can be recognized among the students with regard to their different types of ICT skills. With respect to their perceived digital competencies, a good number of the students did not consider themselves very competent in the use of ICT. An average level of digital competency can be noticed among most of the students, which means lack of adequate competency to use ICT contributed to the digital divide to some extent. In the discipline-wise analysis of digital competency, Social Science students stated a high level expertise to use digital devices when compared to those from Science and Humanities disciplines. However, there was no significant differences among the students from different disciplines in the case of expertise to do various ICT related applications. The existence of gender divide in digital competency could also be discovered from the analysis. The researcher could also establish the direct relationship between the ICT access and digital competency of the students.

Further, the findings confirmed digital inequalities in terms of the Internet use. Some respondents reported high level usage of the Internet for certain activities. Also, there existed a group who used highly the Internet for different purposes. At the same time, some students exhibited a low frequency of use of the Internet for various items. This is a sign of digital divide with regard to the Internet usage. Although the students have Internet access, (especially free in their university), there existed differences in their intensity of use of the Internet. These differences can also be seen along the gender line. However, there was no significant differences existed in the use of the Internet among the students from different disciplines. The analysis also revealed the significant variations in the use of the

Internet among the students from four universities and those from Kannur University exhibited significantly low level of use of the Internet when compared to other universities. A positive relationship between digital competency and Internet usage could also be observed among the students.

The result showed that the majority of the students have medium level attitude towards ICT, although a few of them exhibited a negative attitude. The attitudinal differences in ICT between male and female students were also vivid in the result. So a gender divide still persisted in the case of attitude towards technology among the students. Regarding the disciplines, the students from Social Science exhibited more favourable attitude towards technology compared to the other two disciplines. Finally, the researcher concluded that attitude plays a significant role in contributing digital divide as it showed significant positive relationship with ICT access, digital competency and the frequency of the Internet use.

The study confirmed that parental income acts as a key determinant factor in affecting the students' ICT access. In addition to this, the result proved that educational level of parents also acts as a key determinant in digital divide among the students. Even though the students are in the post-graduate level, the research reveals that the socio-economic status of their family crucially influences their access to and use of technology. Thus the researcher established a direct relationship between students' access to ICT, digital competency, Internet use, and socio-economic status of their family. The findings from the study can help educational authorities to develop strategies for reducing the digital divide by analysing the predictors that are crucial to developing certain types of ICT usage and by identifying certain user groups who need special support to use the ICT.

Chapter 1

INTRODUCTION

1.1 Background of the Study

The life of human beings has been changing rapidly with the emergence of technological advancements, bringing forward extra ordinary benefits and opportunities along with creation of new challenges in society. Greater awareness of the importance of information in defining the future has compelled nations across the world to commit themselves to the progressive development of industries related to Information and Communication Technology (ICT). The exponential growth of ICT and their continuous evolution have tremendous influence on many aspects of human life. Over the last few decades, ICT has changed the way people live, communicate, work, study, socialize and other day to day activities. It also transformed societies as well as economies around the world. In this era, ICTs have become an unavoidable component of modern life. The computers, the Internet and the mobile phones which form the core of ICTs have transformed human life in a rapidly globalising world. It also offers benefits to billions of people all around the world who access them (Acılar, 2011). ICT enables virtual link between people across the globe so that they can easily communicate with each other and also can share their views and ideas. In addition, it offers sustained economic development, good public welfare and effective social connections in and between nations so that a better democratic form of government prevails (Giri, 2002; Thakur, 2014).

Poor people stand to get the advantage of ICT in the form of better education, good health, job opportunities and better financial income. So ICT is treated as a prominent factor for the development of nations and individuals (Motohashi, 2001; Singh, 2008, 2010). The importance of ICT can be observed in all aspects of human life for acquiring, processing, and distributing information. It has become a support for the effective information management. Hence the influence of ICT use has penetrated social, economical, political, and educational as well as health and other related areas of human life. These extensive uses of ICT result in an information age and knowledge economy. Thus access to ICT, especially the Internet, gives a platform for expansion and exertion of knowledge globally in general and particularly in developing nations (Ani, Uchendu & Atseye, 2007; Ukpebor & Emojorho, 2012).

The digital revolution is proceeding at a remarkable speed. However, its diffusion rate is not the same all over the world. The International Telecommunication Union (2010) has given the ICT penetration rate during the first decade of 21st century. Although the Internet penetration has increased, there is no instantaneous spreading of emerging technologies, and the related diffusion process follows an 'S' like curve which differentiate early adopters of technology from latecomers (Rogers, 2003). As a result, a knowledge gap between the information-rich and the information-poor has developed over time and that has lead to keep out certain parts of the world/region from enjoying the benefits of being in a global village (Iskandarani, 2008). There exist some people who have neither access to nor equipped to use ICT and they have been excluded from the information revolution of the digital era. Ani et al. (2007) reported that for most public institutions like universities, poly-techniques, primary and post primary schools and government ministries, the provision of ICT is not lacking seriously, but remains largely inadequate. Some people have been left out of the information revolution in the digital age (Ukpebor & Emojorho, 2012).

The chances to access computers and the Internet vary greatly among different nations and/or individuals. It is a bit paradoxical that the same technologies designed to provide better access to people eventually result in creating more inequalities among the existing “haves” and “have nots”, or even create a gap – social and economic - leading to social tensions and conflicts. So, a new form of digital disparity is added to all other existing forms of inequalities. Organization for Economic Co-operation and Development (OECD, 2001) referred this concept as the digital divide. As Loan (2011) mentioned, information remains just a click away for some individuals, while miles away for others in modern networked society. This inequitable access to digital information makes a digital divide. This digital divide creates an invisible line that makes a demarcation between rich and poor, men and women, educated and uneducated and also separates the connected from the disconnected (Acılar, 2011). It can also be used to refer the unequal access to the Information Technology (IT) like computers and the Internet among different sections of society or the gap between the people with effective access to IT and those with very limited or little access (Loan, 2011). The Internet has rapidly spread to underline almost all faces of the global economy. The growth of the Internet has changed the network in to a substantial repository of information and an important means of communication. So the digital divide has often been considered as a divide in access and use of the Internet.

1.2 Digital Divide

Digital divide, being one of the most fascinating phrases of the twenty first century have its root in the United States of America. Thakur (2014) provided a brief genesis about the concept of digital divide. Some researchers opined that Andy Grove coined the term digital divide while a large majority gave the credit to Larry Irving who was a director of National Telecommunication and Information Administration and former Assistant Secretary for Communications and Information of the U.S. Department of Commerce. Larry Irving made the attention of public towards the existing gap between who can afford to buy computer hardware and software for participating in the global network with those who cannot (Dragulanescu, 2002). Benton Foundation reported in 1993 that American former president Bill Clinton had first used the term in a meeting of the National Information Infrastructure. Before the late 20th century, digital divide represented chiefly the gap between those with or without access to telephones. Then gradually the term changed to denote the inequality between those with and without computer and the Internet access, especially the broadband. But according to Van Dijk (2005), the terms like computers and Internet have been substituted with new forms of Information Technology.

The concept of a digital divide between technological "haves" and "have-nots" has been an effective aid with an attempt to promote significant, more equal access to more powerful modern ICTs, like the Internet. The term digital divide is used to explain the situation in which there is a marked gap in access as well as use of ICT devices, which is characterised by analysing various parameters like the number of land phone lines per inhabitants, the number of mobile phone users and Internet connections available in a region. OECD (2001) has defined the term digital divide as “The gap between individuals, households, business and geographic areas at different socio-economic levels with regard to both their opportunities to access ICTs and their use of the Internet for a wide variety of activities”. This definition of digital divide characterises the differences that persist in national or international level. However, digital divide exists in other levels also, like different sectors, communities and at individual levels. Singh (2010) described the digital divide as an ever increasing unequal access to ICT and its use. Many a time the socio-economic elements cause the appearance of information inequalities all over the world, existing in a country or between countries or among different communities within a country. Hanimann and Ruedin (2007) detailed three distinctive levels of digital divide: between different regions or nations (geographical digital divide), between different social classes (social digital divide) and between technology and human beings (upgraded digital divide). In the literature, many researchers tried to classify digital divide on similar lines, like the digital divide between developed and undeveloped world (global digital divide), between information rich and information poor (social divide) and between those who do and those who do not use the new ICT to further their political participation (democratic divide) (Norris, 2001; Milanovic, 2005; Singh, 2010).

Tello-Leal, Sosa-Reyna and Tello-Leal (2012) reported two primary dimensions of digital divide: domestic and international. As can be easily gauged, domestic digital divide denotes the gap in the context of regions within a country in digital content access, while the gap between larger regions like countries or continents was identified as international digital divide. Although the indicators used for determining international and domestic digital divide can vary widely, many attempts are reported in literature where common indicators are used (Balaban, Cilan & Kaba, 2010). The international digital divide is very prominent among underdeveloped, developing, and developed countries. The global digital divide is also identified as the disparities in use and ownership of computers and the Internet across nations (Wijers, 2010). Ono and Zavodny (2007) pointed out that digital divide can also occur between different demographic characteristics like genders, ages, education groups, income groups, racial groups and ethnic groups. Most of the investigation implied that an international digital divide has its roots in the differences in social and economic growth of different countries and regions and also in differences between the demographic characteristics (gender, age, education level, income level, family structure, race, etc.) of citizens (Chen & Wellman, 2004; Cuervo & Menéndez, 2006).

Thus digital divide may exist between educated and uneducated, between rich and poor, and globally, between industrially developed nations and underdeveloped or developing nations. It may also prevail among institutions in an area who use ICT and those who don't. However, the focal point of consideration has been the articulation of population seen as under-served or socially disadvantaged, low income, rural or multicultural communities and women (Jyothi & Tadasad, 2012). Dimaggio and Hargittai (2001) suggested four broad dimensions along which the divide may exist.

1. Technical means (software, hardware, connectivity and quality),
2. Autonomy of use (location of access, freedom to use the medium for one's preferred activities),
3. Use pattern (types of users of the Internet), and
4. Skills (one's ability to use the medium effectively).

Many investigators did not interpret the term digital divide in the same manner. According to Dewan and Riggins (2005), there are three levels of digital divide viz. individual level, institutional level and global level. Based on the type of inequality to technology, Van Dijk and Hacker (2003) described digital divide to consist two inter-related classes: ICT access divide (divide in terms of access to resources of ICT like computer, Internet and mobile phone) and ICT use divide (divide in intensity, frequency and skills to use ICT) which they termed as first order digital divide and second order digital divide respectively (Jin & Cheong, 2008). On the basis of its nature, James (2009) categorised digital divide into absolute and relative digital divides comparing the level of Information Technology available in developed and developing countries.

In order to overcome the binary nature of digital divide, Martin (2003) suggested reintegrating it with a multidimensional view of access to ICT. As per Martin's model, access divided into three dimensions, including motivation, possession, and skills. In the field of education, Warschauer (2004) analysed factors for access to and use of ICT and the Internet by assigning them into four general areas: physical resources (like devices and connectivity), digital resources (content availability and content diversity including language issues), human resources (knowledge and skill required for meaningful use of computer and the Internet which include both traditional literacy and a set of new forms of digital literacy), and social resources (social relations, social structure, and social capital that support the effective use of ICT in families, communities, and in institutions).

Van Dijk (2005) model (Figure 1) suggested that effective access of ICT is dependent on four types of access and digital divide would be a result of the gaps in those four access areas. The repetitive nature of the model denotes that by the time the full process of technology adoption is completed (usage access), a new innovation arrives and the process starts again.

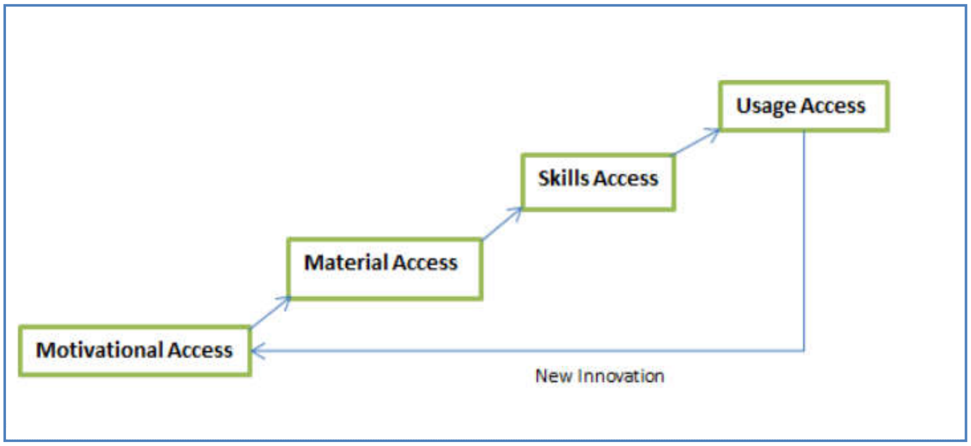

Figure 1. Access, Digital Divide & Outcomes (Van Dijik, 2005)

The diagrammatic representation of this model is given in Figure 1. The term motivational access represented the desire to have a computer and to be connected to the ICT. The factors contributing to motivational access divide could be social, cultural, mental or psychological nature, like low level of income, low level of education, computer anxiety and lack of time.

The concept of material access helps to illustrate the nature of physical access and other types of accesses that are necessary to achieve a complete connection to computers and the Internet. The factors describing the material access constituted primarily income, education and occupation. Having motivation to access ICT precede the natural access. The concept of skill access denoted possessing three types of skills i.e., 1) operational skills, the ability to handle hardware and software 2) information skills – skills to search, select and process information in computer and network sources and 3) strategic skills- related to the ability to use computer and network sources as a means to achieve particular goals thereby improving one's position in society. One of the factors that governs access divide is the lack of education. Differences in the use of ICT in daily practice result in usage access gap and include both the actual use of ICT as well as active versus passive use of ICT. Usage access is succeeded by motivation to use ICT, material access and having appropriate skills (Ghobadi & Ghobadi, 2015).

In short, digital divide refers to the gap between individuals or groups in terms of access to latest technologies and their ability to use ICT effectively, due to their differences in knowledge and technical skills. Computer knowledge and skill represent the mental capacity that a person has when it comes to handling computers, and is a form of human capital that he or she possesses when facing a technological challenge. Society also acts as an important role in contributing to the digital divide. As Cullen (2003) mentioned, digital divide has been recognized as one of the major issues that can act negatively on an individual's uptake of ICT. One of the major steps in the direction of reducing the digital divide has been the distribution of mobile networks all around the world. Mobile Internet has the potential to alleviate the digital divide to some extent due to its easy accessibility, availability and affordability of services as well as applications. But it has also some limitations like small screen size and low battery capacity. With advancement of technology mobile device penetration overreaches personal computers worldwide. But many people refuse to adopt mobile Internet.

1.3 Factors Contributing to Digital Divide

Factors contributing to digital divide vary from region to region. Studies on digital divide explored that women, aged people, less educated people, low income people, people living in rural areas, minorities, and people with low digital competency have suffered the bad effects of the digital divide at national level (Chinn & Fairlie, 2007). Actually, digital divide is an extension of other types of divides like social divide, economic divide and cultural divide. Van Dijk

(2012) reported on the issues of digital divide that the most commonly used categorical divisions included those between employed and unemployed, between managers and executives, between highly educated and a little educated, between men and women, between aged and young, between parents and their children, between whites and blacks, and finally between citizens and migrants. All these divisions are among the most powerful categories in almost every part of the world, except the white-black categorization.

Aswathi and Haneefa (2015) suggested that when digital divide among students is examined, so many factors have to be taken into account, like socio-economic background of students, gender, experience to use technology and psychological factors. According to them all these factors were affecting access to technology and their technological skills. Schleife (2010) studied the individual and regional determinants of the digital divide and concluded that in addition to the distinction due to individual factors like age, educational background and income, there is also a geographic gap (rural vs. urban) in ICT use. In short, digital inequality in the accessibility to new ICT between rich and poor, lower caste and upper caste, rural and urban has prompted a great digital divide and it is often distinguished by poverty, illiteracy, lack of computer literacy and language barriers (Narasimhamurthy, 2014; Nagamani & Veni, 2016). Here the researcher categorised the contributing factors towards digital divide as follows.

1.3.1 Socio-Economic Factors

It is very difficult for people from a low economic background to have access to ICT on their own. Technology access, especially the Internet and broadband facilities will require a proper income in family. Cost of new ICT equipments are unaffordable for low income families. In developing countries, although the poorer and illiterate people have access to the Internet, the rate of diffusion of the Internet penetration is higher among the people with high socio-economic status (Chen & Wellman, 2004). Torres-Diaz and Infante-Moro (2011) confirmed that the digital divide corresponds to the socio-economic disparity. According to their report, the level of family income has a great impact not only on the use of the Internet but also on the intensity of use of the Internet tools. Educational level also played an important role in contributing to the digital divide. The positive relation between education and Internet access is narrated by Ferro, Helbig and Gil-Garcia (2011). They showed that people with higher education tend to possess more digital devices to access the Internet. Van Deursen and Van Dijk (2009) found significant differences in digital skill between people with different educational level. They concluded that people with higher education had better digital skill than people with a low educational background.

Schleife (2010) identified the determinants of the Internet use at home in Germany and gave the proof to support the important role of education to use new technologies. Family structure is another factor affecting access to computer and the Internet especially in western countries. The number of single-parent households is very common in developed countries and its impact is severe in minority communities. National Telecommunications and Information Administration (NTIA, 1999) gave the evidence that there was a general lag in computer ownership among single parent, female-headed households with children in contrast to married couples with children. In addition to this, youth may have more restrictions and parental monitoring with regard to their technology use. This will also prevent free access to the digital content by the youth.

1.3.2 Geographical Barriers (Rural/Urban Division)

Acılar (2011) presented the importance of geographic location, which is one of the deciding factors for individuals to access ICTs. Diffusion of ICT is generally embraced first in central part of more populous cities and then gradually spread to its outermost regions and to rural areas (Aswathi & Haneefa, 2015). So rural people are expected to lag behind urban people, due to their limited telecommunication infrastructure facilities coupled with cultural differences (Malecki, 2003; Hindman, 2000; Schleife, 2010). Chen and Wellman (2004) described that geographic location is one of the important factors influencing access to and use of the Internet by people. The Internet penetration rate is higher in urban population and they have embraced and used various forms of ICT faster than rural population (Hindman, 2000; Acılar, 2011). Geographic digital divide has been seen more in developing countries as compared to developed countries (Labrianidis & Kalogeressis, 2006).

1.3.3 Gender Difference

Attitude and perception of technology between men and women are different. Men, in general, perceive technology more positively than women. Men also think that it is very easy to use, but ladies, in general, think otherwise (Bain & Rice, 2006). Many studies identified the gender differences and their impact on ICT use. It is often found that men remained more talented and experienced in the use of computer than women and the former appeared to use Internet more than the latter (Whitley, 1997; Joiner et al., 2005; Huang, Hood & Yoo, 2013). Van Dijk (2012) explained that the girls, traditionally, are less secure in handling technological devices than boys and subsequently progress into adulthood with a lesser opportunity to technically and strategically important jobs. But now the situation is changing. Girls also actively participate in the digital revolution. Still, digital divide in terms of digital skills and frequency of the Internet use is prevalent among them.

According to Cooper (2006), digital divide is basically associated with computer anxiety and its roots are deep in socialization pattern of different genders. So there is a prejudice that computers are mainly for the use of men. A model proposed by Cooper (2006) explained that there were no inborn differences between boys and girls in their expertise to use computer. However, girls begin their socialization into computers in a world where gender stereotypes for computers already existed. A gender based behaviour prediction was enforced by parents and teachers and subjected to learning activities of their students. It affects the social development of boys and girls differently. The differences in attributes of boys and girls towards their success and failures are also different. All these factors lead women to possess a negative attitude towards technology (Huang et al., 2013).

1.3.4 Race

In the beginning of 21st century, many studies on digital divide proved that there were large ethnic and racial disparity in home access to computers, the Internet and broadband in many nations including United States of America (Fairlie, 2003). Many researchers have described that culture is an influencing factor when trying to conceptualise the lack of consistency among different races in the digital divide. Another issue of digital divide is the lack of participation of minority in the development of digital economy (NTIA, 1999). Many years back, minority have faced many problems like lack of education, lack of participation in politics, and lack of access to areas like economics. So they have faced segregation from the new information society. Wilbon (2003) described that even though the number of minority population is increasing, they fail in developing ICT skill needed to engage in information society. As ICT skills become important in labour market and education, the digital divide may have a serious economic issue for disadvantaged minority groups (Fairlie, 2005).

There are many studies on the causes of racial digital divide between Whites and African Americans or Hispanic (Fairlie, 2003; 2005). Norris and Conceição (2004) explain that one of the reasons for such divide has associations with technological mastery being dominated by the White culture. Majority of such studies reported that income and educational inequalities were found to be leading causes of the racial digital divide.

1.3.5 Language

Language is another factor that influenced the digital divide components. Most of the websites in the world are written in English. This language opens doors to the digital world (Hargittai, 1999). At the same time it also forms a barrier for those who lack expertise in English language. Pearce and Rice (2014) pointed out that the Internet access and use is affected by the level of knowledge in English language. As per their view, English language is essential for handling technology including hardware and software, as most of the content in the Internet is in English language. So it remains inaccessible to a large number of people who are not proficient in this language, all over the world. Availability of devices like laptop and mobile phones (smart phones) offer greater chances for those who speak less common languages to use the technology. Even though the mastery of English in digital content has decreased to some extent, this language still remains the most prevalent language of hardware technology (Crystal, 2001; Paolillo et al., 2005). Thus the importance of knowing English promotes technology use.

1.3.6 Psychological Barriers

Prior to the physical access, people must have desire to possess computer and Internet connection. A good number of people persist at the wrong side of the digital divide due to motivational problems. Van Dijk (2012) suggested that there are not only 'have-nots', but also 'want-nots' regarding digital technology. The determinants towards motivational access are both of social and psychological nature, out of which, the psychological nature is the most pronounced element in motivational access. Computer anxiety (stress or discomfort to use computer) and technophobia (fear of technology) may lead to hesitation in accepting new technological innovation, especially among aged people, people with low educational level and a large part of girls (Van Dijk, 2012; Aswathi & Haneefa, 2015). Some students often exhibit a negative attitude towards ICT in teaching and learning. Lack of interest or need is another factor that influences the non use of computers and the Internet (Selwyn, 2006; Ghobadi & Ghobadi, 2015). People also have a belief that computer and the Internet are mainly for brainy individuals. Though these situations have changed to some extent, they have not completely disappeared.

1.3.7 Generation Gap

Generation gap is also a contributing factor to the digital divide. Reviews related to digital divide show that older people are less likely to possess and use the ICT. International Telecommunication Union

(2011) reported that, all over the world, 45 per cent of the Internet users were below the age of 25. The report indicated the active participation of younger generation in the digital world than their elder counterparts. Chopra (2010) opined that the youngsters use the Internet early in their lives and quickly becomes regular users of modern Information Technology, while older people, who experienced the Internet at a later stage of their professional lives, used Internet rare or rather poor. Ferro et al. (2011) showed that age is significantly associated with access to computer and the Internet. In their view, it is a general trend that older one appears to have a smaller number of digital devices to use the Internet. Chen and Wellman (2004), in their study pointed out that the rate of the Internet diffusion was higher among younger generation than that of older ones in both developed and developing countries. Vicente and López (2008) interpreted that young generations are more likely to use the Internet in all the countries. Generally, aged people show less technological affinity and literacy than their young counterparts.

1.3.8 Digital Literacy/Digital Competency

Changes in society, educational institutions and curriculum call for new digital competence for the people especially for the students. Digital competence is the most recent concept describing technology-related skills. In recent years, several terms have been used to describe the skills and competence to use emerging technologies, such as ICT skills, technology skills, 21st century skills, information literacy, digital literacy, and digital skills (Adeyemon, 2009). While describing the Internet usage differences, the level of digital skill/competency appears to be one of the most important components. It has a strong influence on the Internet use of individuals after they have got physical access to the ICT. Many researchers identified this fact (Norris, 2001; Warschauer, 2004; Van

Dijk, 2005). Digital literacy divide is viewed as both a determinant of digital divide and as a divide in itself. It is an important element and frequently evaluated in determining the dimensions of digital divide. Mossberger, Tolbert and Stansbury (2003) define digital skills as the knowledge and skills required to use IT effectively and efficiently, highlighting the need for both technical competencies (competency to operate hardware and software) and information literacy (the ability to identify when information use can solve a problem). As Hatlevik and Christophersen (2013) stated, digital competency is an important factor to use technology for consuming and accessing information. Hence a disparity in digital competency can also act as a contributing factor towards digital divide.

In addition to all the factors discussed in this section, social support from both schools and parents can also affect teenagers' Internet usage behaviour as well as their Internet skills. Parental support is an important factor that affects students' access to technology. Vigdor, Ladd, and Martinez (2014) analysed the evidences which were consistent with other observations that home access to computer technology resulted in more productive use in household with good parental monitoring. In other words, if the parents can act as a good supporter in productive use of digital resources, it will encourage the students to use the ICT with its maximum benefits. Li and Ranieri (2013) commented that parents with higher educational level expected to have more possibility of being involved in the Internet related activities and they might be more knowledgeable about the value of the Internet than other parents. The different factors that contribute to the digital divide are detailed in this section. Many of these factors that contribute to digital divide are interlinked to each other.

1.4 Digital Divide among Students

ICT facilitates easy accessibility of information, especially for the academic community. It offers positive educational outcomes to students. Aswathi and Haneefa (2015) mentioned that ICT has transformed tremendously the education sector through its different applications associated with access, storage, preservation and dissemination of information. These transformations are approached by students in various ways. So differences can be seen in their access and use of new technologies, which in turn create a digital divide. Factors like gender, attitude, socio-economic and digital literacy/competency are the main elements that lead to digital divide among students. Socio-economic status of students depends on their parent's education, occupation and income level. Parental support is an inevitable element in determining digital divide among students. Differences in physical or mental ability of students also act as an element that lead to digital disparity to a lesser extent. The digital divide might broaden the disparity in educational achievements as the students from lower socio-economic background cannot utilise the full advantage of ICT for their educational attainments.

Digital divide is one of the important elements that affect the equity of opportunities in education. Scott (2010) opined that disparity in ICT access and use shows the inequalities in education, and is influenced by many factors like development of country, attitude of teachers and socio-economic status of students. In educational environment, digital divide arises from the school level. Ukpebor and Emojorho (2012) differentiated the level of accessibility to ICT between private and public schools. They had an opinion that the richest schools have sufficient ICTs to improve teaching and learning process while government leading public schools and other middle class schools suffer with insufficient ICT facilities.

Many governments had concerns about digital divide among students**.** A decade ago, digital divide was seen as the difference between those who accessed the computer with those who did not access. But now the situation has changed to how much technology is utilized by the people. Thus analysis of the digital divide has moved from differences in computer ownership to differences in technology utilization. Even when access to technology and connectivity prevails among students, they may have unequal learning experience. If their teachers decide on not to use technology in their teaching, students cannot be equally adapt to become knowledgeable workers and to function better in a society (Kim & Bagaka, 2005).

Wei et al. (2011) conceptualised three levels of digital divide among students. Those three levels of digital divide identified were digital access divide (first level), digital capacity divide (second level) and digital outcomes divide (third level). Digital access divide represent the inequalities in computer ownership and usage in home. Digital capacity divide and digital outcome divide are explained in terms of computer self efficacy and learning outcomes respectively. Youssef and Ragni (2008) identified three levels of educational digital divide. The first level deals with the differences in procuring ICT equipments and accessing educational ICT. It makes a boundary between those who are well equipped (Haves) from those who are not (Have not's). So there is a possibility for those who have possessed ICT devices to reap the benefits of ICT to enjoy better information, education and especially positive related externalities. But those who have less or little equipped may remain excluded from these dynamics. Researchers commented that income inequalities between social groups are the main reason for the digital divide at the microeconomic level. In macroeconomic level, the make-up of infrastructure of telecommunications acts as the main reason (Wallsten, 2002; Fink, Mattoo & Rathindran, 2003).

When the first level digital divide is solved, researchers argue, there emerges a usage divide (second level) due to differences in the use of ICT. Many researchers found that the potential of ICT in higher education is not completely utilized. There exist significant differences in the intensity and diversity of ICT usage among students and teachers. Many research outputs also showed that differences can be seen in the time devoted to Internet use and purpose of Internet use by students (Jones, et al., 2009; Zeng, 2011; Torres-Diaz & Infante-Moro, 2011). The second level digital divide emerges due to the variations in students' abilities and attitudes towards ICT (Dewan & Riggins, 2005; Donat, Brandtweiner & Kerschbaum, 2009; Zeng, 2011). Since these elements are quite different from one student to another, one can anticipate variation in their Internet usage.

According to Youssef and Ragni (2008), the determinants of usage digital divide are mainly time allocation, user skills and autonomy of use of the Internet. Intensity of use is closely related to the time devoted to do Internet activities. Since the available time is limited, students may not get enough time to use the Internet. Availability of computers and related technologies at home reflects the autonomy of use possessed by students. This improves students' ability to utilize the technology whenever possible. Kim and Bagaka (2005) examined that access to computers at home is an important factor in students' utilization of computer resources. Even though most higher education institutions provide access to computer and the Internet, there existed huge differences regarding its access at home.

Consequently the differences in intensity of ICT use could deepen among students. Lack of motivation, low digital competency and lack of interest are other contributing factors that can lead to the second level digital divide among students. This divide can be strengthened by the first level digital divide.

Having addressed the first and second levels of digital divide, Youssef and Ragni (2008) considered the existence of a third level digital divide, where the capacity to perform ICT activities by students across universities varied significantly. Some studies show a positive relationship between the ICT use and student's performance (Sosin et al., 2004), while some others detected little impact. Researchers also predict that the digital divide in performance can possibly result in a tenable divide in future job, salary, etc.

Thus unequal access to ICT, both at educational institutions and at home, intensifies educational and societal stratification thereby expanding the strength of digital divide (Bolt & Crawford, 2000; Gündüz, 2010). Even though access to computers and the Internet in educational institutions has highly improved internationally, majority institutions may not have updated ICT infrastructure and software packages, especially in developing countries like India. Gündüz (2010) opined that people have to be concerned about educational digital divide, otherwise it will affect them in terms of educational benefits, employment, future earnings, opportunities for social or civic involvement and in issues related to equity and civil rights (Aswathi & Haneefa, 2015). A similar observation was made by Jencks and Phillips (1999) and explained that disparity in academic success might broaden due to lower accessibility to ICT which created an inequalities in earnings, as the students from lower socio-economic backgrounds are less prepared to compete for higher paying jobs that need ICT skills (Gündüz, 2010; Aswathi & Haneefa, 2015).

1.5 Digital Divide in India

India has succeeded in attaining considerable growth of new ICTs to a great extent. However, the country is lagging behind in the diffusion of ICT in different parts. The term digital divide was first used in the last decade of 20^{th} century. According to Joshi (2001), this phenomenon is definitely not new and common in developing countries like India, where the existence of knowledge gap, disparity in ICT access, highly skewed distribution of ICT in different regions and wide gap in the use ICT by men and women have long been discussed extensively.

In India, digital disparity is very prominent in some states (e.g., Uttranchal, Bihar, Jharkhand, and Orrisa), while in some others (e.g., Punjab, Maharashtra and Kerala) the depth of digital divide became reduced. This imbalance also varies from technology to technology. The level of adoption of new technologies among the states varies from one another. Such differences can also be observed among some cities (e.g. Delhi, Mumbai, Kolkata) where ICTs' take up is very high as compared to other cities like Lucknow, Ahmedabad and Patna, even though these are capital states. In a few states, the overall acceptance of technology is very high, still there is a huge gap existing in rural areas. All these information reflect the undisputed fact that digital divide in India is large ("India Faces", 2003; Singh, 2010).

Singh (2010) reported a reality that digital divide in India is not only a problem of access to ICT ('Haves' and 'Have nots'), but also an issue of knowledge ('knower/not knower') in ICT and capability to do well ('doer/not-doer') with ICT, and ability to exchange information, ideas, and view with the rest of the world. There are many factors accountable for digital divide in India ("India", 2003). Poverty, unemployment, age and education are the main factors that lead to digital inequalities in India, especially among rural community. Many researchers have proved the correlations of the use of computer and the Internet with family income, occupation, educational level and age. In India, around seventy per cent of people are living in rural area and in which about seventy per cent of poor live in rural area. Most of the poor are daily wages, self employed householders, landless wagers, labourers or unemployed.

Another factor that is related to the digital divide in India is the knowledge divide. Digital divide and knowledge gap is directly related. More educated, computer literate and English language knowing persons have possibility of access to new technologies quicker (Singh, 2010). Language acts as one of the causes of knowledge divide. Aswathi and Haneefa (2013) opined that last decade showed a steady increase in the number of Indians who are fluent in English language. However, the overall per cent of Indians knowing English well still remains insignificant. As large amount of information content on the Internet is available only in English, Singh (2007) mentioned that it is a great hindrance for people who are non-native speakers of English language to get new information. Thus in practice, unless Indians know English at least to a minimum level of apprehension, which most Indians do not, achieving computer use and Internet access to everyone poses a serious difficulty (Panda, Chhatar & Mharana, 2013).

As per 2011 population census of India, the literacy rate of India has shown an improvement at 74.04 per cent. Youth literacy rate is nine per cent higher than adult literacy rate. Although India has achieved a good level of literacy, it is still a matter of concern that so many people in India have not learned how to read and write. Some children who live in rural areas may not be acquiring adequate education. Even though the government has enacted a law for compulsory education of every child under the age of fourteen, the issues of illiteracy is still large. As per 2011 census, female literacy level is 65.46 per cent whereas the male literacy rate is over 80 per cent. Many parents do not permit their daughters to attend schools or institutions of higher education. So the differences in literacy level play a significant role in deepening digital divide in India ("Literacy in India", 2011).

One of the biggest issues faced by Indian education system is that a large number of student dropouts during their education at the undergraduate level (Bansode & Patil, 2011; Panda et al., 2013). This factor also accelerates deepening of digital divide in the Indian scenario. To overcome this digital divide, government has recently taken necessary actions to introduce IT to the students' right from their school level. Singh (2010) found that there is a tremendous gap of digital divide between rural and urban India.

Thakur (2014) reported that the digital divide starts from school level in India. There are two types of school system in India, i.e. government schools and private/public schools. Private schools maintain ICT facilities much better than the government schools. In certain government schools, there exist pathetic conditions regarding the provision of ICT facilities. Actually majority of schools are funded mostly exclusively by the government. Still students from government schools are deprived from enjoying better digital learning environment. In addition to all the factors discussed, researcher concluded that unlimited population explosion, inadequate funds, inappropriate execution of policies and programmes formed some of the challenges faced by India that may lead to imbalances in the development of society which in turn ends in digital divide.

1.6 Bridging the Digital Divide in India

Government of India has taken many efforts to bridge the digital divide in the country. Government has also announced IT as one of the important areas for the country's development. In order to ensure the accessibility and availability of ICT, state governments have been implemented many IT-driven projects for the benefit of the public. All these efforts are reflected from the various initiatives taken from the government, private sectors and also through the libraries. E-governance is one of the major steps taken by the government to reduce the digital divide. Some e-governance initiatives and schemes for students and for general public to bridge digital gap are discussed below:

1.6.1 Bhoomi Project

It has started in Karnataka, aimed to better management of land records with the help of IT. This project covers 66.6 millions of records of land ownership. Bhoomi centres are situated all over the state and it reduced the time involved in interacting with the bureaucratic hierarchy of the state revenue department. This system works with software by the same name which was designed by National Information Centre. It is a fully online system to carry out mutations on land record data (Prabhu, 2004; Singh, 2007; Jyothi & Tadasad, 2012; Panda et al., 2013; Aswathi & Haneefa, 2013).

1.6.2 Kisan Call Centre (KCC)

This project was started in the state of Madhya Pradesh by the Indian Society of Agribusiness Professionals (ISAP). The main aim of this initiative is to provide extension services from Agricultural and allied sector to farmers. KCCs provide an opportunity for farmers to have direct discussions with experts who would be able to respond to their queries related to agriculture and can solve their problems instantly. So this is a great effort initiated by the ministry of agriculture, Government of India, by connecting information resources to bridge the gap between the right information resource and the user (Panda et al., 2013; Anand, 2011).

1.6.3 Gyandoot Project

Gyandoot has started in Dhar district of Madhya Pradesh, where the highest percentage of tribes and dense forest are found. Literally meaning of Gyandoot is 'Knowledge Messenger'. It is the first ever initiative in India for rural information network. It is an intranet in Dhar district, connecting rural cyber cafes catering to every day needs of people. Its main intention is to make use of ICT to rural people at low cost. It also provides equal access to new technologies for the marginalised segments of the society. Every village has "soochnalayas" (computer centres) at prominent places. People can easily login and complain or request information on crops, forest fields, water resources, etc. (Neene Singh, 2007; Bansode & Patil, 2011; Aswathi & Haneefa, 2013).

1.6.4 Lokavani

Lokavani means "voice of masses" and was started in November 2004 in Sitapur district of Uttar Pradesh. It is a public-private partnership programme for promoting governance by providing opportunity to the public to connect to the government without physical involvement. The main goal behind Lokavani is to make transparency in decision making and system administration. This project is mainly built on the model of Gyandoot and Janmitra projects (a Rajasthan government initiative). It also offers an opportunity to technology related jobs and other avenues of employment to youth. It has provisions for public to inform the government about their grievances/complaints (Tripathi, 2007: Aswathi & Haneefa, 2013).

1.6.5 CARD Project

Computer Aided Administration of Registration Department (CARD), is a project launched by the government of Andhra Pradesh. Its main purpose is to boost citizen–government interface by explaining the effective use of IT. Using these initiatives, computerised counters are opened in every land registration offices throughout the state of Andhra Pradesh so that people can complete their registration procedures without much difficulties (Singh, 2007). Electronic document writing is introduced by CARD project to improve the citizen interface. Data related to properties are easily available to every people due to its transparent system of evaluation of properties (Prabhu, 2004; Aswathi & Haneefa, 2014).

1.6.6 Sourkaryan and E–Seva

Sourkaryan is one of the projects of government of Andhra Pradesh in the port city of Visakhapatnam, in order to give the facility for people to pay their taxes online. It also enables to view the details of plans and projects of the government and local bodies. E–Seva Kendras in the Hyderabad is also a similar initiation to avoid personal contact between citizen and the bureaucracy (Singh, 2007; Dubey & Devanand, 2010). It offers a one stop venue for services of various state and central government departments in an efficient, reliable, transparent, and integrated manner by easy access through a chain of computerised Integrated Citizen Service Centres (ICSCs) (Aswathi & Haneefa, 2013).

1.6.7 Lokamitra/Smart Project

NABARD provided grants to start a project named Lokamitra in Himachal Pradesh. Its main goal is to make available government information and provision of e–governance services to the general public, especially for those who are living in rural areas. "Lokamitra Soochnalaya Kendras" (People friendly information centres) have been built up in twenty five panchayat areas run by unemployed youth (Singh, 2007; Dubey & Devanand, 2010). Thus the main aim of the project is to distribute government information better to the remotest places using ICT, which has resulted in good awareness among rural people about various Govt. schemes and policies ("Lokmitra", n.d.).

1.6.8 Vidya Vahini Project

This project was launched in 2003 with an initiation of school computerisation programme aimed at connecting 60,000 Government and aided schools through the Internet and Intranet for information exchange. Department of IT and Ministry of Communication has taken initiative to start this project towards bridging the digital divide. The programme provide the school with computer labs to facilitate IT education, access to the Internet, online library, academic services, web broadcast and e-learning (Singh, 2007; Aswathi & Haneefa, 2013).

1.6.9 Akshaya

It is executed jointly by the Kerala IT mission and Department of Science and Technology, with tie ups with local bodies and voluntary agencies. It was the first district-wide e-literacy project in India which was inaugurated by Dr. A P J Abdul Kalam, former President of India on 18th November 2002. The main aim of this project was to make one person in the family to be computer literate (Madhavan, Jishnu, & Smitha, n.d.). Akshaya e-kendras offer ICT access to the entire population of Kerala and try to improve the quality of available ICT infrastructure in the state. Thus Akshaya Centres act as agents for rural empowerment and economic development. It can assist online services such as e-vidya online exam, e-krishi, e-payment service and e-district.

1.6.10 FRIENDS

Kerala state IT mission initiated a project named 'FRIENDS' an acronym stands for the Fast, Reliable Instant Efficient Network for Disbursement of Services. The main aim of this project is to alleviate the difficulties of people when paying taxes by removing middle men, delays and long queues. This initiative was extended across all districts of Kerala to serve around thirteen million people (Singh, 2007; Panda et al., 2013). IT enabled payment counters receiving different payments are open to ease citizens' trouble. In this project, people are treated as valued customers. People can do their payment of different bills, like utility bills for water, electricity, revenue taxes, university fee, through FRIENDS centres (Aswathi & Haneefa, 2013).

1.6.11 IT@School

Department of General Education, Government of Kerala, has set-up a project named IT@School in 2002, in order to foster the IT enabled education in schools all over the state. It was started with an intention to make over four lakh students from government schools computer literate every year. The main aim of this project is to empower all school students and teachers with ICT enabled teaching-learning systems so as to create an ICT literate community and promote the quality of education via emerging ICT technology. IT@School also acts as a nodal agency for executing EDUSAT network for education to run an exclusive channel for education called ViCTERs (Virtual Class-room Technology on Edusat for Rural Schools) (Aswathi & Haneefa, 2013; "IT@school", 2013). Digital Collaborative Texts (DCTs) under IT @ School is a major programme to revolutionise the school education sector, which was introduced first in Kerala. In addition to access the scanned copy of normal textbooks, DCTs also offer information provided by persons all around the world in audio or video formats ("Kerala's Vision 2020", 2015).

In addition to the above mentioned initiatives, the central and state governments of India, primarily the Ministry of Information Technology, have adopted several initiatives for rural development through community information centres. Many more projects have been implemented by governments in different states of the country for bridging the digital divide. But a few projects are discussed in this section. These projects are the major initiatives taken by the government to remove the gap between information haves and have–nots in India. Out of all projects discussed in this area, Vidya Vahini Project, IT@school and Akshaya play an important role in bridging the digital divide among students. FRIENDS, Akshaya and IT@school are the major initiatives set up by the Government of Kerala in order to foster the use of IT.

1.7 Need and Significance of the Study

In this modern era, both developed and developing countries pursue a society where all people can reach and share information smoothly. However, this is not currently the case, and there are significant differences between individuals, groups, regions, and countries in terms of reaching and sharing required information. Many countries are trying to form supportive policies in order to eliminate those differences. Forming these policies successfully is only possible by determining the differences in the use of ICT between individuals, regions, or countries. At this stage understanding the nature of digital divide existing in a society becomes crucial (Çilan, Bolat & Coşkun, 2009).

The digital divide is not just a technological gap; serious socio-economic and development issues are inherent to this divide. There can be social, political and economic setbacks as a consequence of continued digital divide. No real progress can be made if the society is perennially divided in to ''Information haves'' and ''Information have not's' and a laissez-fair attitude is adopted. Digital divide, by its simple existence, can degrade or even derail the progress of a society. Hence, it's imperative that serious attempts are to be made for identifying the factors contributing to the digital divide; governments should prioritize policies for its continued decrease. Hence specific interventions are to be planned and executed well if the government wishes to minimise or bridge the divide.

As India is a large and pluralistic country, the situation of digital divide in India is of predominantly importance fundamentally. There is diversity of languages, religions, cultures, customs and also great variation in the development stages as well as the nature of geographic terrains. The penetration of ICTs also shows enormous disparities in regional and social or economic segments of society. The presence of digital divide is too glaring to be denied. Sometimes it is argued that the divide is 'in-built' into the technology. Probably, this requires a re-thinking. It is not the technology *per se* but the specific applications and the contextual factors that contribute to the divide. It is a bit paradoxical that the same technology designed and implemented for faster delivery of services, eventually plays spoil sport in generating a barrier for some to access the same services.

However, if the experiments and projects are designed and executed well, then the same technology can go a long way in minimising, instead of increasing the divide (Joshi, 2001).

The digital divide could be part of a larger problem for those groups who are already suffering an economic gap. There may be educational complications for somebody living in remote rural conditions. Students in higher educational institutions might be interested in opportunities to learn and explore new technologies. But if a group has limited resources to access and use information technology, it can become a continuing problem for generations, thereby creating a situation of ever increasing gap of digital divide. Barriers exist for students to obtain the needed education and exposure to Information Technology has to identify so that their full potential can be achieved.

If students are unable to access and make effective use of the technology, then they may become disadvantaged to compete for higher paying jobs and eventually may become economically disadvantaged. This reality reveals a vicious and potentially unbreakable cycle, if digital divide is not identified and cured quickly. Here the investigator reminded that the concept of digital divide becomes more considerable as information explosion occurs rapidly in the world. Subsequently, researchers and policy makers have a great interest in observing this phenomenon.

Currently ICT make a prominent place in education sector. Hence research is needed to analyse the situation, assess the ICT in educational systems, identify inadequacies in the ICT facilities and eventually propose measures for better ICT penetration. The situation is similar in developing and underdeveloped countries (Thakur, 2014). Kucukaydin and Tisdell (2008) mentioned that much of the study on digital divide has been delineating on the extent of the ICT adoption and dispersion. It is not reasonable for discerning how and why the digital divide continued to prevail even when students are imparted with free access to the technology. For getting additional insight into the digital divide, there is a need for intensive research that looks not only at the access level of digital communication technologies, but also at other factors as well.

Even though, Kerala is renowned for its highest grades of literacy, there is very limited research and information available on the extent of digital divide among its people. Since little academic attention has addressed the extent of 'digital divide' among students in Kerala, this study has examined the differences in ICT access, use and digital competency of the students. There has been little research extending the digital divide studies among post-graduate students in university level and exploring the factors contributing to the digital divide. University students are appropriate population for understanding technology penetration. They are living in an era of technology revolution. So they are expected to adopt the technology fairly easily and could be proficient in the use of ICT. Students represent the hope and future of any country. So there is a need to assess the level of digital divide among students from universities in Kerala.

The study can contribute to the discourse on ICT by analysing access and use of the ICT among students. Thus the study helps to identify students' ICT needs. The study can also explore the implications of socio-cultural and gender-wise inequalities on their access pattern of digital content. Further, the study helps to get an overview of current understanding of the post graduate students within the context of technological advancement and their socio-economic background. Examining these factors is a requisite to form suggestions on how to alleviate digital divide among students. The findings and suggestions of the study are expected to be helpful for policy makers and educational planners in designing ICT based educational strategies. This study, therefore, seeks to expand the frontiers of knowledge regarding the extent of digital divide among the students. Taking adequate steps to bridge the growing digital gap through a proper understanding of the digital divide is vital. It is hoped that bridging the digital divide among the students can overcome problems like poverty, disease, unemployment, corruption and social inequalities in society.

1.8 Profile of the Universities Selected

At present there are thirteen universities in Kerala approved by the UGC. Among these, four universities were taken for the study viz. University of Kerala, University of Calicut, Mahatma Gandhi University and Kannur University. Post-graduate students from universities were taken as population for the study. A brief description of the universities surveyed for the study is detailed in this section.

1.8.1 University of Kerala

The University of Kerala was formed in 1957. The university, being the first in the state, originally had the entire state under its jurisdiction. However, with formation of the University of Calicut (1968), the Cochin University of Science and Technology - CUSAT - (1971), Kerala Agricultural University (1971) and Mahatma Gandhi University (1983), currently the University of Kerala takes care of colleges in districts of Thiruvananthapuram, Kollam and Alappuzha as well as some parts of the district of Pathanamthitta. The university has over 150 affiliated colleges. The total number of students in these colleges is close to 90,000. At present, the university campus has sixteen faculties and forty one departments of teaching and research in addition to study centres and other departments. They primarily focus on post-graduate (masters) programmes, MPhil programmes (1-year research degree) and doctoral research. The total number of full-time students in the university departments is above 2000 including research students and a modest number of foreign students ("University of Kerala," n.d.).

1.8.2 University of Calicut

University of Calicut was established in the year 1968, bifurcating the University of Kerala. The university was originally designed to cater education and research from the seven northern districts of the state of Kerala. However, with its bifurcation in 1996 for forming the Kannur University, it's activities are restricted to four districts of Kerala, viz., Calicut, Malappuram, Palakkad and Thrissur. Together with its affiliated colleges, 427 in number, the University of Calicut provides education to over 100,000 students every year. The university campus, located at Thenhipalam, 24 km south of Calicut is the main hub of academic activities. It hosts over 36 postgraduate teaching and research departments ("University of Calicut," n.d.).

1.8.3 Mahatma Gandhi University

Mahatma Gandhi University was set up on 2nd October 1983 at Priyadarsini Hills Campus at Athirampuzha has jurisdiction over the revenue districts of Kottayam, Ernakulam, Idukki and parts of Pathanamthitta and Alappuzha. The university conducts a range of programmes at the undergraduate, postgraduate, MPhil and doctoral levels through its seventeen university departments, one International and Inter University Centre, seven Inter University Centres, ten Inter School Centres, seventy seven Govt./Aided Affiliated Colleges, ten Autonomous Colleges, 200 Unaided

Affiliated Colleges and 199 Recognized Research Centres ("Mahatma Gandhi University," n.d.).

1.8.4 Kannur University

As already mentioned, the Kannur University was established in 1996 for promotion and development of higher education in Kasargod and Kannur districts as well as the Mananthavady Taluk of Wayanad District by the Act 22 of 1996 of Kerala Legislative Assembly. Kannur University is unique in the sense that it is a multi-campus university with campuses spread over different locations (Kannur, Kasargod, Mananthavady, Payyannur, Thalassery and Kanhangad) under its jurisdiction. It has over 70 affiliating colleges ("Kannur University," n.d.).

1.9 Statement of the Problem

As the benefits of use of technology for teaching and learning got wide acceptance, many programmes and initiatives are being implemented for enhancing digital access in education. However, the inequality in access and use of ICT still remains among students. ICT access is not equal for all students in information rich world. Most of the students are expected to develop technological fluency. But their socio-demographic level and ICT facilities provided in their educational institutions are not sufficient enough to access and use ICT. These inequalities also lead to the divide in digital competency among students. So the students will be disadvantaged for technology based tasks and miss out a lot of educational opportunities with technology resources.

As mentioned by Dewan and Riggins (2005) digital divide among the students can be categorised from two points of view. The first one is the digital access divide - the disparity of access to ICT in home and educational institutions. The second one is the digital skill divide, which implies the inequality in their ability to exploit ICT arising from the first level digital divide and other associating factors like socio-economic status and psychological factors. In addition to Dewan and Riggins (2005) frame work of digital divide, a third one is that the digital outcome divide which indicates the inequality of outcomes in exploiting the ICT raised from second level digital divide and other contextual factors like motivation and effective usage (Wei et al., 2011; Adhikari, Mathrani & Parsons, 2016). The study tried to investigate the ICT infrastructural divide (first level of digital divide) among students. Further, the study explored the extent of the digital competency divide and Internet usage divide (second level of digital divide) existing among the students. The researcher also analysed whether socio-economic status of the students and their attitude towards ICT act as contributing factors to the digital divide. The problem taken for the study is entitled as “Digital Divide among Students of Universities in Kerala”.

1.10 Definition of Key Term

The key concept of the research problem and their operational definitions are given below.

1.10.1 Digital Divide

The definition of digital divide is given by many scholars. Digital divide can be defined as “The gulf between those who have ready access to computers and the Internet, and those who do not: there is a ‘digital divide’ between rich and poor, black and white, in terms of computer use” (Digital divide, 2013). “The socio-economic and other disparities between those people who have opportunities and skills enabling them to benefit from digital resources, especially the Internet, and those who do not have these opportunities or skills can also be defined as digital divide" (Digital divide, 2014).

As stated earlier, Youssef and Ragni (2008) addressed three levels of educational digital divide among students. These are inequalities in ICT equipment access, ICT usage divide and performance divide or output divide. In this context, the researcher analysed the first two levels of divide among the post-graduate students from the universities. It refers to the inequalities existing among students in accessing ICT devices such as computers, mobile phones (smart phones) and the Internet. It also refers the divide in digital competency of the students in performing different technological activities and variation to use the Internet for different purposes. The digital divide is therefore operationally defined as the inequality in ICT access and Internet use, and differences in digital competency in various activities. Socio-economic and psychological factors contributing to the digital divide among the students are also identified in the study.

1.11 Objectives of the Study

As Tello-Leal, Sosa-Reyna and Tello-Leal (2012) stated, the examination of the elements of the concept 'digital divide' has changed over time. Earlier studies were mainly focussed on access and infrastructure divide on ICT. In later studies, the analysis incorporated the development of capabilities and skills required to use ICT, i.e. education and training. Presently, researchers added the study of usage intensity of the Internet resources and services integrated into modern technologies. In this study, digital divide was quantified in terms of imbalances in physical access to ICT as well as the competency needed to the post-graduate students of universities in Kerala in order to effectively participate as digital citizens. The following are the specific objectives of the study.

1. To study the students' access to Information and Communication Technology.
2. To assess the digital competency of the students.
3. To study the use of the Internet by the students.
4. To study whether socio-economic status of the students contributes to the digital divide.
5. To study whether attitude of the students towards Information and Communication Technology contributes to the digital divide.

1.12 Hypotheses

The researcher formulated ten hypotheses to be tested with appropriate statistical methods.

1. The place of residence of the students significantly affects their access to ICT.
2. There is no significant university-wise difference in the level of barriers experienced by the students to access and use ICT.
3. There exists a significant relationship between the digital competency of the students and their access to ICT.
4. There is no significant difference in the frequency of Internet use among the students of different universities.
5. There exists a significant relationship between the digital competency of the students and their frequency of use of the Internet.

6. There exist significant gender differences in ICT access, digital competency, frequency of the Internet use and attitude towards ICT among the students.

7. There exists significant difference in the ICT access among the students of different disciplines.

8. There is no significant difference in the attitude towards ICT among the students of different disciplines.

9. Attitude of the students towards ICT significantly influences the digital divide among them.

10. The socio-economic status of the students significantly influences their access to ICT, digital competency, Internet use and attitude towards ICT.

1.13 Scope and Limitations of the Study

The study is to analyse the digital divide among the students of universities in Kerala. The use of ICT is expected to be high among the post-graduate students. Even though they are in the higher level of education, differences can exist in their access and use of ICT due to various factors. The scope of the study extends to cover regular post-graduate students of the UGC approved universities in Kerala, excluding deemed to be universities. Out of the thirteen universities, the investigation confines to a sample of four state universities, namely, University of Kerala, University of Calicut, Mahatma Gandhi University and Kannur University. The study selected a sample of 700 students from Science, Humanities and Social Science disciplines of the four university campuses.

The research sought to understand students' access to various hardware, software and Internet connection. It was also designed to know the variations in digital competency of the students and their

Internet use. Further, the researcher analysed the role of attitude towards ICT and socio-economic status of the students in contributing to the digital divide. Accordingly, access to ICT, digital competency, Internet use, socio-economic status and attitude were selected as dependent variables, while gender, discipline of study, place of residence, university of study, family income and parental education level were treated as independent variables.

The researcher has taken necessary steps to make the investigation as accurate as possible. However, as the sample consists of post graduate students from university campuses, it is not possible to make generalised conclusions pertaining to all institutions of higher education. Self reported questionnaire was the tool for data collection. As with all self-report measures, responses are crucially dependent on participant's accuracy of self-disclosure and often share a common response bias. So it was not free of subjectivity in the respondents and researcher could not measure the change of participant's reaction over time. The study has not considered all dimensions of digital divide. The definition of ICT includes an array of networking components, digital devices and software applications. But the researcher analysed the ICT access in terms of the availability and accessibility of certain digital devices that are commonly used by the students and Internet connections. The heterogeneity of socio-economic status of participants has been restricted by family income and educational level of their parents. Practical measures to assess the digital competency of the students were not used in this study. The study used Likert scale for measuring the digital skills.

1.14 Organisation of the Thesis

The whole study is organised into five chapters in the thesis as follows. The appendix and select bibliography are attached at the end of the thesis.

Chapter I includes brief description about the digital divide, factors contributing to digital divide, digital divide among students, digital divide in India and some initiatives to bridge the digital divide in India. Further, the chapter outlines the need and significance of the study, statement of the problem, definitions of key terms, objectives of the study, hypotheses used in the study and finally the scope and limitations of the study.

Chapter II provides the review of literature conducted in India and abroad. In this chapter the literature related to digital divide is given under subsections like ICT access divide, digital competency divide,

Internet usage divide, socio-economic factors, and psychological factors.

Chapter III describes the methodology adopted in the study, variables selected for the study and the tool used for data collection. It also covers the details of the sample selected for the study, data collection procedures used in the study, consolidation of data and data analysis techniques followed in the study.

Chapter IV includes the analysis and interpretations of results. These results are also presented in tables and graphs in order to understand simplified manner.

Chapter V summarises the overall results of the analysis followed by tenability of hypotheses, suggestions of the study, recommendations for further research and conclusions.

Style Manual Used

In this study the researcher followed guidelines in the APA (American Psychological Association) 6th edition for preparing references and bibliography albeit with minor variations in the in-text citations. In order to assist readability, the researcher has limited explicit mentioning of the names of authors up to the first three during in-text citations. However, in the references and select bibliography, the names of authors are provided following the style manual.

1.15 Conclusion

Digital divide represents an important social problem following the diffusion of the Internet. Individuals and groups keep away from quality access to desire information due to this integral wedge. So these create a divide among the people who have information to have nots. Digital inequalities have also seen in educational sector. The academic level of a student depends upon their socio-economic, cultural and psychological factors. All these factors lead to deeper differences in ICT access and usage. Digital divide puts the weaker students at a competitive and economic disadvantage due to its impacts on society at many levels. So the current investigation tries to understand the extent of digital divide among the students. It also seeks various factors that cause the digital divide. The findings from the study can help educational authorities to develop strategies for reducing the digital divide by analysing the predictors that are crucial to developing certain type of ICT usage and by identifying certain user group that need special support when using the ICT.

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Chapter 2

REVIEW OF LITERATURE

2.1 Introduction

There are a number of factors that explain why the digital divide phenomenon is still appearing even after spreading of the Internet worldwide. In order to identify those factors, a thorough review of studies related to this phenomenon is required. There have been many completed researches that focus on the digital divide which covers various dimensions/determinants of this aspect. Studies on the digital divide detailed a broad array of topics and issues related to digital inequalities. The reviews covered various dimensions of digital divide such as global digital divide, socio-economic divide, educational divide and gender divide.

In this chapter the researcher attempts to provide a comprehensive review of previous studies on digital divide paying attention to the data used, methods adopted, sampling techniques employed, etc. Studies on digital divide provide many interesting and useful results. The reviews have been taken from E-ShodhSindhu, Internet, online journals and printed journals. This literature review also includes description on prior empirical evidence that tried to identify the existence of the digital divide phenomenon over a variety of situations and scenarios. The studies are categorized under the following headings.

a) ICT access divide

b) Digital competency divide

c) Internet usage divide

d) Socio-economic factors

e) Psychological factors

2.2 ICT Access Divide

One of the essential aspects to characterise the digital divide among the students is the equitable access to hardware, software, the Internet and technology support primarily within educational institutions augmented by access to technology at home. Increase in ICT access will promote an increase in its use, and decreases the digital divide. There are some demographic differences, namely, gender, education, household income, and age, which also lead to create a gap between those who have access to ICT with those who do not. As reported by Van Dijk (2012), most of the studies on digital divide committed to the examination of divides of physical access to personal computers and the Internet among different demographical categories that are clear in this respect: income, education, age, sex and ethnicity. ICT access denotes the availability and affordability of different hardware, software and Internet connection. Here the investigator reviews the previous studies to understand how digital divide is prevalent in terms of access to ICT.

The advancement of European integration and associated increase in their economic wealth appear as explanatory factors for the digital divide. To prove this aspect, Cruz-Jesus, Oliveira and Bacao (2012) observed the digital asymmetries within 27 member states of European Union (EU-27) with data for the year 2010. For the purpose, they conceptualised the ICT as General Purpose Technologies (GPTs) and used sixteen variables for analysing the digital divide. Some of the variables used for the study were household Internet access, broad band penetration, use of mobile devices, e-banking, e-mail, e-learning, e-governance, etc. Their result leads to an identification of two latent dimensions and five groups of countries. It was revealed that North European Countries presented a high level of both ICT infrastructure and adoption by population and e-business and Internet access cost when compared to the least digitally developed countries like Bulgaria and Romania. Conclusion obtained from the study explained that digital divide still existed within EU, although it was narrowing.

The dispersion of broadband in Europe is framed by its diffusion rates of the member countries of the Union. However, the level of diffusion is not the same as a result of the existence of the digital divide among the countries. Convergence of the gap in the digital divide in Europe was studied by Kyriakidou, Michalakelis and Sphicopoulos (2011). They estimated the rate of digital convergence within European borders, the rate of fixed broadband penetration across a number of European countries with the contribution of each country to the process of broadband diffusion. The methodology was developed based on calculation of relative broadband penetration during 2001 to 2009 from an updated dataset extracted from Eurostat. The study inferred that the total level of broadband diffusion was not the same due to the digital divide among the countries. So the study proved that digital divide is still evident in European countries, although the diffusion kept increasing.

Çilan, Bolat and Coşkun (2009) sort out the digital divide within and between the member and candidate countries of European Union (EU). They first analysed whether a digital divide existed between EU members, new members and candidate members. They identified what was the level of digital divide in 2004. Secondly they tried to find out whether digital divide had a significant association with becoming an EU member or whether information society level would be an indicator for becoming an EU member. Data for the study was taken from Eurostat. The study explored information society indicators such as percentage of individuals using Internet regularly, households having access to Internet, broadband access and access to networks. There was no significant digital divide between the countries that were members of the Union in 2004, when compared to the new members joined in 2004. Further the result showed that there existed a digital gap between the EU countries and the candidate countries of EU in 2004.

In developing countries, generally women face gender related intolerance in accessing technologies. Therefore, Hilbert (2011) analysed the differences between men's and women's access to and use of ICT in developing countries. The researcher employed 25 datasets from 12 Latin American and 13 African countries from 2005 to 2008 (total of 1,176,816 observations) which allowed to execute a series of uncontrolled and controlled empirical tests that provide further insight into digital divide between men and women. The result revealed the reason that why fewer women access and use ICT is a direct result of their unfavourable conditions with respect to employment, education and income. Gender inequalities in relation to digital divide in the current analysis is of high relevance, as majority of the respondents are female students.

In pursuance of the role of mobile communication technology in bridging the digital divide, Chircu and Mahajan (2009) evaluated the digital inequalities among the four fastest growing developing countries – Brazil, Russia, India and China (BRIC) and matching developed countries. Theoretical sampling was used for country selection and to ensure triangulation through multiple sources of information (i.e., databases, reports, and web searches) and multiple coders who independently collected, coded and verified the data. While considering the mobile technology depth, BRIC countries had, on an average, lower mobile technology depth than the developed countries, though a few BRIC countries achieved high mobile technology depth levels. The analysis of mobile technology service breadth showed that BRIC and developed countries had similar high mobile technology breadth level, some BRIC countries even exceeding levels of developed countries. The researcher also exhibited that there were slight variations in different dimensions of digital divide among some BRIC countries and developed countries. The penetration of mobile Internet has great potential in bridging the digital divide.

Even though the access to broadband has increased in developed countries or regions to a great extent, a geographic divide in broadband access and mobile phone services are still remaining. Yuguchi (2008) tried to describe how institutions in Japan deal with geographical digital divide problem and its association with market economy. The researcher opined that the provision of fixed broadband service in local areas was only benefited to the local inhabitants. In contrast, the mobile services provided access to a spectrum of users. The researcher highlighted the broadband and mobile geographic digital divide.

The advancement of mobile communication technologies helps to close the digital divide as mobile phones and mobile Internet are available at low cost compared to computers and laptops. Srinuan, Srinuan and Bohlin (2012) examined the determinant factors for mobile Internet access in Thailand. The data used for the study were based on a survey sample of individual users commissioned by the National Telecommunication Commission (NTC), the Thai Telecom regulator in 2010. The analysis showed that price of mobile Internet services, availability of fixed telephony, age of user, living area, and mobile operator were important drivers for usage and adoption of mobile Internet. The researchers provided a better understanding of application attributes of mobile Internet such as e-mail, social network, but these applications were still at an early stage in

Thailand and had not influenced mobile Internet adoption as expected. The result also indicated that mobile Internet could be a potential mean to bridge the digital divide in areas that lack fixed telephone facilities. In the current study also, the investigator attempts to understand the accessibility of mobile Internet of the students.

To disclose the digital divide, a lot of studies have analysed the determinants of mobile Internet access at an individual level. Koegelenberg, Belle and Rai (2010) investigated the potential barriers as well as the impact of being digitally disadvantaged to the adoption of mobile Internet in Cape Town, South Africa. They reported a quantitative survey which consisted of 100 adopters and non adopters of mobile Internet. The study was based on contingency model of research, proposed by Sarker and Wells (2003). Researchers analysed the individual barriers, technological barriers, contextual barriers and awareness barriers. They uncovered the fact that being digitally disadvantaged did have a significant impact on the adoption of mobile Internet. Cost, awareness, lack of know-how, and perceived risk were the factors that found to influence the adoption decision by digitally disadvantaged users.

There are different concepts and parameters related to digital divide. In order to determine the access level to different technologies that Venezuelan people had and how effective the government policies were to reduce the digital gap, Guasch and Ugas (2007) reviewed a range of published research literature on digital divide. They also made a survey in the second largest city of Venezuela Maracaibo. The population for the study consisted of 1,372,724 inhabitants, represented by a sample of 277 subjects. The study identified that digital gap for Maracaibo city was determined as 65.7 per cent and the main reasons for the digital gap were inaccessibility to computers or connection to Internet and lack of awareness.

Schreckenberg (2004) examined the computer access by African American adult, aged at least 25 years, living in Johnson City, Tennessee. Researcher also examined the factors that influence their computer access. The population for the study was obtained by administrating the questionnaire to 271 individuals living in the area. The analysis conveyed that a digital divide existed within African American community in terms of income which was being a strong determinant of access to computer. Result also revealed that computer access at home showed a decline as age increased while gender had little influence in their computer access. This study showed certain demographics, education and income, strongly influence the difference between those who have access to ICT and those who do not.

Digital disparity may occur both at homes and schools. Home access to ICT is a matter of concern while determining digital divide. Araque et. al (2013) identified the effect of computer access in home on low-income families participating in the Computer for Families Program. They studied the participants' general computer usage, access, knowledge, employment, education and academic performance of their children. The study included a quasi-experimental design, consisted focus groups, pre-tests and post tests, and self reported surveys with experimental and control groups. The results showed that participants in the program were more likely to have access to the Internet at home than non-participants. The use of frequency of computer, completion and submission of online job applications and resumes electronically were found to be higher among the people who participated in the programme as compared with the non-participants. Through this study, the authors discussed the social and behavioural implications in terms of computer access and usage in low-income urban communities.

Digital divide can be observed among the employees in an organization, as a result of their nature of job and holding position. Cooke and Greenwood (2008) studied the extent and impact of restricted access to ICT based communications by specific groups of staff in higher education institutions in UK. A web based questionnaire, case-study, and semi-structured interview were used in the study. The analysis revealed that there was adequate hardware and networked infrastructure, but lack of ICT skills, motivation and line managers' resistance to staff using computer or accessing ICT training in work time were the major hindrance in using ICT. The survey also showed that job function was a factor associated with the lack of access, as working class staff involved in cleaning, catering and estates were least likely to have access. Here the researchers explored the major hindrance in using the ICT in an organization.

To highlight the importance of acquiring the ICT among students, Huang and Russell (2006) found out the degrees of their access to computers and the Internet, and also explored the relationship between technology accessibility and academic achievements in public schools situated in the state of Oklahoma in USA. The research was based on survey conducted among principals, fifth grade teachers and parents of fifth graders of the participating elementary schools. The findings of the study showed that the digital divide existed cutting through various socio-economic factors in terms of access. They also found a possible relationship between technology accessibility and academic achievement, although it was complicated by other compounding factors such as subjects of learning, the use of technology and socio-economic conditions. The research highlighted that the socio-economic conditions affected ICT access and the consequences of technology use.

University libraries can offer access to computers, the Internet and different types of database to alleviate digital disparity among students. Kumar and Joshi (2006) assessed the role played by University Libraries and Information Centres (ULIC) in bridging the digital divide. They described the need for developing different software, hardware and Internet connectivity in order to bridge digital divide by ULICs. The study also emphasised the importance for subscribing electronic materials and other communicable material by library professionals. By describing the major factors responsible for digital divide, the investigators argued that users of university libraries in developing countries could use recent digital information by utilizing subject gateways, digital libraries, arrangement of consortia, etc. They also focussed on the advantages of information literacy programmes and training programmes organised by information professionals in order to bridge digital divide.

In this digital era, librarians have to rethink, redesign and reformulate their functions and services for disseminating information using modern technologies so that the students can better utilise ICT for accessing better information. Aqili and Moghaddam (2008) illustrated various dimensions of the digital divide that pertain to service as well as the responsibilities of libraries and librarians. The study emphasised on the role of librarians and information professionals in bridging the digital divide by indicating some aspects related to it as evidenced in the literature including its definition, aspects, factors affecting and Internet users. According to the researchers, library should be treated as one of the major social tools which has the potential to solve the information divide rooted in the digital divide and can contribute significantly to the realization of a more democratic society.

Salinas (2003) addressed the digital divide through a collection of development in libraries. The study provided specific examples of services and/or programmes that had been implemented with the objective to address the digital divide through collection development. Their working definition of digital divide included various components such as access to technology, skill to use the technology and access to relevant content, which were the main factors contributed to disparity in access to digital information. Then the author discussed each of these contents in relation to libraries and also provided an overview of how collection development had changed the emergence of digital technology. Here the role of libraries in reducing the digital divide and the importance of partnership among various institutions of society was addressed.

Pattern of the Internet access and implications of social inequalities on the access pattern of university students in South Africa were studied by Oyedemi (2012). The study also examined how access to the Internet was an indication of inequalities in other social utilities and resources that individuals needed to participate in an information society. It also showed that Internet penetration among university students gave a pattern of digital inequalities that reproduced existing structure of social inequalities in the country. Individual and household Internet connections remain a challenge for many students which also showed a pattern of inequalities with students from certain location, race, and household type and family income. The students tend to be from population groups that bear the brunt of social inequalities in South Africa, as they were from families that suffered high rate of poverty, less access to other public and private resources, suffered the consequence of rural-urban inequalities, income inequalities and gender inequalities. Thus the study depicts how the social inequalities exacerbate procuring ICT among the students and lead to the digital divide.

The educators and administrators are concerned about providing initial technology infrastructure in educational institution. A qualitative study was made by Gyabak and Godina (2011) to examine the value of digital story telling as pedagogical mediation for reducing the digital disparity among public school students in rural Bhutan. They examined whether technology accessibility enable rural community schools to engage students in new literary practices like digital storytelling. In addition they tried to explore the social implications of technology development in rural community schools. The primary population of the study constituted the elementary school children who had not at all used the computer technology previously and were beneficiaries of donated classroom set of laptops. The study incorporated observation, interviews, focus group discussion and intervention among four females and four males who were selected from the general pool of students. The secondary participants included two teachers, the headmasters and the parents of the eight focal students. The outcome of the examination depicted that technology instruction and infrastructure naturally lay out the ethical and cultural differences between education personnel, school children and their families.

Use of modern technologies for teaching and learning are common in higher education institutions. However, the disparities in accessing and using these technologies still exist in this area. Such disparities have to be identified. Therefore, Ricoy, Feliz and Couto (2013) tried to explore the digital divide among university freshmen by noticing the availability of ICT resources accessible for training and personal benefits. They also analysed the nature of use of ICT i.e. whether academic or personal. It was carried out in the University of Vigo, Spain. It was a qualitative study and used techno-autobiographies of a total of 91 students. The result conferred the inequalities to use

ICTs and also implied the existence of digital divide. Such inequalities in ICT indicated the insufficient availability of ICT resources for some of those newcomers and also their difficulties in accessing the Internet. The result also showed the preferences of students in using the digital technologies for communication rather than for using academic purposes. This study disclosed how the inequalities in accessing the ICT leads to the digital divide among students.

A number of investigations implied that home access to computer and the Internet helps students to use these technologies more, especially if they face inaccessibility of ICT and technological limitations in their educational institutions. By giving importance to access of computers at home, in minimizing the digital divide among students, Yuen and Park (2012) attempted to examine the use of ICT in home and tried to understand the digital divide in education with home computing in Hong Kong secondary 2 (Grade 8) students during the year 2011-2012. Employing the survey method in a sample of 468 students, the study found that students' use of ICT in schools remained a crucial predictor to their use of ICT at home, both for learning and leisure activities. In addition, the parents play a key role in the students' access as well as use of ICT at home.

Young generations adopt modern technology faster than their older counterparts. Digital divide is visible not only among students, but also between students and teachers. Khalid (2011) attempted to find out the digital divide between teachers and students in urban Bangladesh, and the divide between English and Bangla medium institutes. The study tried to understand whether or not the teachers and students in urban Bangladesh, especially those in the capital, have access to ICTs and believe that they can use it. The sample taken for the study consisted of 965 students and 185 teachers and responses collected were put on a Learning Management System (LMS) questionnaire survey module. The result indicated that teachers and students from educational institute of the capital of Bangladesh did not have significant digital divide in terms of access, ownership and basic ability to use. While considering the ability to use mobile phone features, students had higher ability to use as opposed to teachers. Thus the study explored the existence of the digital divide among the students and teachers.

Kalyanpur and Kirmani (2005) analysed the intersection of technology and diversification in class room, associated with equity of access and use of ICT among specific groups of students from low income minority family and also from culturally disparate backgrounds. They also identified digital inequities among the students with disabilities and among the female students. The researchers reported that the digital divide among low income minority students were due to demographic and geographic factors. They analysed the cultural differences, differences in communication style, language barriers and unfamiliarity with services and hardware that lead to digital divide among students. Societal attitudes and gender bias affect girls' access to and use of computers and the Internet. In this study, the investigator highlighted the causes of differences in access and use of ICT.

Digital divide is also prevailing among government and private schools, as government schools, in general, are deprived of quality access to ICT and modern technologies when compared with the private schools. These technological differences were analysed by Ukpebor and Emojorho (2012) among secondary school students in Benin City Cosmopolis and examined how these differences were being widening. They observed that there was a disparity in accessing ICT between private and public sector of the economy in

Nigeria. Socio-economic status of students has also played a significant role in digital divide. The study highlighted the existence of digital divide in Nigeria by reviewing literature related to digital divide. It was found that the richest schools had sufficient ICTs in enhancing educational process for secondary school students while the public schools run by government and other middle class private schools had no significant items attributable to digital community.

Goktas, Gedik and Baydas (2013) revealed the barriers faced by Turkish primary school teachers in integration of ICT and potential enables to overcome those barriers. They also compared the status of ICT integration in 2011 with those of in 2005. The level in 2005 was gauged from the doctoral study by Goktas, while that for 2011 was gathered by surveying 1373 teachers from 52 schools. The analysis showed that lack of hardware, lack of appropriate software materials, limitations of hardware, lack of in-service training were the major hindering factors in ICT integration in Turkish primary schools. Improving ICT infrastructure with sufficient supporting staff for students and teachers was identified as the major enable. By applying an independent t-test, it was found that most barriers showed significant differences and most enablers showed moderate or low differences between teachers' perceptions of their situations in 2005 and in 2011. Through this investigation, the researcher summarised the role of teachers in minimising the digital divide.

There are many compounding factors that affect variations in ICT access and use in educational settings. In order to explore the issues associated with access and use of ICT among Canadian youth, a descriptive study was made by Looker and Thiessen (2003). They inspected the compounding factors like gender, socio-economic status and rural-urban location that contribute to the inequalities in access and use of ICT among Canadian high school students. The result of the study portrayed the existence of digital divide among Canadian youth in ICT access and experience. The researchers find out that rural youth were less likely to procure computer at home, but their frequency of use of technology and their perceived expertise level were found to be middle ground. But in the case of female students, low level of parental education and ICT competency lead to limited access to computers in their homes. The outcome of the study also opined that they tend to spend less time on computer as compared to male students. Thus the authors portrayed factors like the gender and location (rural or urban) of the participants and the level of education of parents contributed to the ICT access and use.

Chikati (2013) tried to assess the impact of high school digital divide in academic performance at tertiary education in Botswana. They analysed the first year results for computer technology students at Botswana Accounting College and showed that those who did their secondary education at private schools were performing better in later examinations than their counterparts from public schools. The study also pointed out that private schools were known to be better in availing ICTs than public schools; hence the digital divide created by means of the place where one did their secondary education. The study put forward some suggestions that can be performed at secondary school level as well as universities to bridge the digital gap. This study reminded the fact that while studying the digital divide among higher education students, their level of exposure to technology at school levels can also form an important factor.

Finer details on the schools' contextual factors, like type of class room and teachers' characteristics may also cause the digital disparity in the access and use of new technologies. Kim and Bagaka (2005) explored the inequality in access and utilization of technology among students in elementary schools in North Eastern Ohio by observing the location of school, schools' technological support and the experience of teacher. Non-random sampling was applied to get sample. Data for the inquiry gathered from 1027 fourth and fifth grade students in 48 class rooms and from 48 teachers. The study tried to know the variation in student's usage of computer tools as a function of teachers' characteristics and practices as well as school contextual variables. The result showed that while digital divide in physical access to computer in schools was not significantly different by location of schools, students in suburban school had significantly greater access to computer at home than students from rural/urban schools. The result conveyed that school location, school technological support, teachers experience were significant factors associated with the gap in classroom use of technology by students. In this study, the researchers highlighted the point that access to computers at home and in schools is an important factor in students' utilization of computer resources.

There may be a possibility that the students and teachers from high resource schools are more likely to use technology in more creative and experimental fashion than those from low resource schools. Valadez and Durán (2007) identified that a binary digital divide persisted between high and low resource schools with reference to the technology inequality in the US society. They surveyed teachers from six southern California schools. Out of the six schools, five schools were classified as low resource schools while the remaining one was characterised as high resource school for comparative study. The study used principal component analysis and ANOVA (Analysis of Variance) to distinguish the six schools along with prescribed factors. Researchers compared the schools in terms of physical access, computer and Internet (C & I) use, use of various instructional factors and social consequence of technology use. The result reported that teachers from high resources school had significantly more physical access to C & I than those from low resources schools. They were also more frequent and creative users of C & I, and communicated by e-mail more often with students as compared with teachers from low resources schools. The frequency of professional activities, like on-line communication, was higher among teachers from high resources schools. So the analysis of accessibility to ICT is an essential criterion while determining the digital divide.

Atkinson, Black and Curtis (2008) tried to find out whether digital divide existed in Albury, Australian Regional City. The researchers formed a methodology in order to explore the digital divide in multiple forms. Semi-structured interviews, focus groups, and a telephone survey were conducted among the city residents for collecting data. Analysis revealed that a digital divide existed in terms of differences in the access to computer, based on their level of income and place of residence. The study also analysed possible differences in access to Internet in relation to their age, education and income level. The research output revealed that the people with low level of education, low socio-economic status and elderly ones were having a relatively low level access to ICT as well. Thus the study favoured literature which showed that individual's access to the Internet and computer ownership was influenced by the factors like their income, age and education. However, no gender differences, in terms of ICT access could be identified in the study.

Onwe and Ezekwe (2014) in their study discussed the digital divide among students by using ICT access/ICT skills and inadequate ICT facilities in tertiary institutions in Nigeria. According to them greater per cent of the students got admissions in these institutions with inadequate ICT access. The study was anchored on Technological

Determination Theory in which ICT has overwhelming power to drive human actions. It explored the fact that lack of fund has remained a significant problem in adoption of new technologies. Irregular power supply and its concomitant destruction of some of the ICT facilities make some students reluctant to use ICT. In addition to access, the investigator pointed out that lack of professional knowledge in ICT and heavy usage of manual and traditional practices of searching information also tend to minimize the use of ICT. This study reminded the importance of provision of ICT access in educational institutions. It also mentioned hindrance in accessing ICT in these institutions.

Even though people get access to ICT, they may face difficulties to maintain ICT equipments and net connection. Gonzales (2016) interviewed 72 low-income US residents from both metropolitan city and a medium-sized mid-western town, for understanding whether they had faced any struggle to maintain physical access to ICT. Results showed that although most of the individuals used Internet, many of them faced regular interferences in their Internet use, mainly due to lack of adequate money to pay monthly service bills, conduct maintenance of hardware, etc. So maintaining the physical access to Internet was a great problem among the people, which supported the technology maintenance theory. The theory stated that access was not stable and was marked by frequent disruptions. The outcome of the study also suggested that the less the people's access to information, the more they possessed negative attitudes towards use of modern technology. Thus the study highlighted the need of shift in the digital divide studies from issues of ownership of ICT to issues related to sustainability.

This section discusses the existence of digital divide in access level across different sections in society at national as well as international levels. The reviews highlight the existence of digital divide in developed countries, albeit at a lesser level when compared to that among under developed or developing countries. The role of libraries in alleviating the digital divide by promoting access and use of ICT was also examined in this section. Further the researcher illustrates how the digital divide appears among the students in terms of access in both educational institutions as well as at home. The influence of socio-economic status, gender, place of residence (rural and urban) and perception towards technology in accessing digital technology were also discussed in the reviews. Household characteristics such as race/ethnicity, age and family structure may also contribute to the regional variations in rates of ICT access. Access to ICT also affects the use of ICT and competency for using digital technology. So the reviews related to literature on ICT access divide has clearly overlapped in certain areas. The above reviews described how the inequality in access to technology contributes to the digital divide.

2.3 Digital Competency Divide

In this era, digital divide is not prominent in higher education sector in terms of physical access but a matter of digital skill and expertise the students possess to use computer and the Internet. Van Dijk (2012) opined that the mere provision of physical and material access to technology doesn't guarantee high usage of technology. In addition to access, there is a need to develop several digital skills for using technology. Many large-scale surveys have disclosed considerable differences in the digital skills acquired by people from small groups to populations of nations (Van Dijk, 2005; Warschauer, 2004). The following reviews deals with the role of digital literacy in contributing towards digital divide.

Latest researches in the field of digital divide have conveyed that as the adoption stages of ICT overcome, there appear further levels of digital divide in the form of equity of information literacy and learning outcomes. In support of this, Adhikari, Mathrani and Parsons (2016) reported findings from the evaluation of Bring Your Own Device (BYOD) project in secondary school in New Zealand, which provided a new insight in to the digital divide problems in the field of technology mediated learning. To analyse the equity in terms of access level, digital skills and leaning outcomes, the online surveys and interviews were conducted with students, teachers and parents. Result of the study conveyed limited access issues at home and outside schools due to socio-economic status and geographical locations. It also showed the improvement of digital skill over the time, once BYOD is applied across all year levels. But a small fraction of students exhibited their worries about lack of skills in identifying, processing and applying information in to their learning activities. So the researchers opined that information literacy is evolving as an important aspect that requires more in-depth examination in the technology mediated learning environment. Thus the researcher substantiated that having the ICT access or skills may not be the only factor that detailed the leaning outcomes of the students any more. Information literacy forms an important predicting factor that might have an impact on students learning outcomes.

It is practicable that the digital skill divide is exhibited differently within the younger generation which is changing with new emerging communication technologies. Gui and Argentin (2009) carried out a survey on the digital skills of a random sample of 980 students from high schools in Italy. Three dimensions of digital skills i.e theoretical knowledge, operational skills, and evaluation skills were analysed in the survey, which covered knowledge questions, situation-based questions and tasks performed online. Investigators also checked whether a divide in skills exists based on gender and family education. The outcome of the survey conveyed that family educational level is closely related to physical access conditions at home, which in turn resulted in small differences in the students' level of skill. Similar skill differences could be observed in the case of gender, even though there were no significant differences in terms of access. The researchers also concluded that students had performed better on operational skills than on theoretical skills and comparatively lower on evaluation skills.

There can be seen differences in searching information online and there may exist large variations among individuals in the time taken to find different kinds of information. The differences in people's online skills were empirically investigated by Hargittai (2002) to understand the second level digital divide. The data for the study were obtained by in-person observations and interview with 54 Internet users, randomly selected from the suburban towns and boroughs of New Jersey. Different tasks related online activities were assigned to them to analyse people's competency in finding information on the Internet in various topical domains. Findings of the study identified that there was individual variations in searching the online content and also reasonable differences in time taken to complete online tasks. The analysed data illustrated that the more time people use the Internet, the higher their chances to navigate well through the contents of a web page. Thus the researcher observed a positive relationship between online skills and experience with technology.

Digital inequality was identified by Hargittai and Hinnant (2008) by examining difference in young adult's online activities across United

States in a national survey. The study was concentrated on measuring the use of Internet in terms of skills and visits to capital enhancing web sites. The researchers analysed the data regarding the use of web by 270 adults ranging 18-26 years old, and exposed the variation in online activities. They also studied the social factors that disclose the variation in online activities. The result indicated a lower level of understanding about the Internet terms by women participants. It also revealed that educational level, autonomy of use and experiences in using Internet were positively associated with the level of self reported skills, usage of Internet and number of capital enhancing sites visited by the user. A similar result was obtained by Hargittai (2002).

Determination of digital competency level of schools, teachers, and students gives information about the weaker areas for involving in the digital world effectively. Hatlevik and Christophersen (2013) explored digital competence in upper secondary schools and to examine the factors that influence students' digital competency when entering upper secondary. The research included 4087 students from 24 upper secondary schools. In this study, digital competency to acquire and process digital information was operationalised through web based test. The result indicated that there were variations in digital competency between schools and within schools. Language integration, cultural capital along with mastery orientation and academic aspiration did forecast digital competence, and explained a substantial share of the total variation in digital competency. There were differences in what students mastered with ICT, and therefore, the students have various requirements. Here the researcher explored the various components of digital competency which are useful while measuring the digital competency of students in the current study.

Hatlevik and Guðmundsdóttir (2013) explored student's information literacy and the factors that predict student's ability to use ICT for completion of lower secondary schools in Norway. Factors related to digital divide like books at home and academic aspirations were analysed in their study. The sample included in the survey covered 3,727 students from 50 lower secondary schools of grade 10. The findings of the study confirmed through statistical multilevel analysis and indicated that the number of books at home, language spoken at home and students' academic aspirations explained a very large proportion of the variations in information literacy between schools. Information literacy divide did not appear to be primarily based on ethnicity, but rather on a broad-based socio-economic background of the learners. The result also revealed that a considerable part of variation between students with in schools in terms of information literacy. Here the investigators explained the factors that promote the students ability to use ICT.

A large number of studies exhibited the digital divide in terms of frequency and breadth of online activities, which are essential for active involvement and for greater technological skills among young people. The factors that predict online content creation among college students of two large public universities in South Western United States was studied by Correa (2010). The research on the digital divide, technology adoption and self determination theory described the role of Internet experience, online skills and psychological factors that contribute towards the participation divide in web. A web based survey using a systematic random sample was used by the investigator. The survey revealed that there were differences by gender, race, and age even among that wired group of students. The outcome of the study showed those psychological factors like perceived competency and both extrinsic (Perceived usefulness of technology) and intrinsic (Perceived enjoyment and satisfaction) content creation on Internet. Researcher also revealed that while considering the experience variables, having a computer in student's own room also facilitates content creation when controlling all other variables. The researcher established that the differences in Internet experience, online skills and psychological factors were connected to the digital divide.

Even though the access to computer and the Internet in schools has increased, there remain uncertainties that whether low socio-economic status (SES) schools allocate students with equitable assistance for ICT literacy. Hohlfeld et al. (2008) compared the equity of the resources and support from those Florida K-12 public schools and teachers provide for ICT literacy relative to the schools' SES during four school years (2003-2004 to 2006-2007). The study first presented a theoretical model to examine the digital divide with in schools. The sample included all public elementary, middle, and high schools from Florida's 67 school districts that participated in the Florida innovative survey. Analysis tried to determine trends of nine different aspects of school technology integration (access to different software and Internet) for promoting ICT competency. The research revealed statistically significant differences between high and low SES schools at every level in terms of student's access and use of software and the level of technology support which are essential for promoting ICT literacy.

Technology integration in classroom promotes the use of ICT. Vie (2008) attempted to describe some of the pedagogical implications by paying attentions to Generation M's use of online social networking sites. Researcher defined Generation M students as those who used the technology heavily in their everyday lives and remained comfortable with this. Instead of viewing the issue of digital divide in terms of access, the researcher advocated for making use of the students' interest in social networking and other digital technologies for the academic uplift. The researcher gave recommendation that compositionists should focus on incorporating in to pedagogy, technologies that students were more familiar with, such as online social networking sites, podcasts, audio -mash up and wikis. As the new generation are often more technologically adept than their teachers, it is required that the latter pursue training in ICT to catch up with the former.

The second and third dimensions of digital divide are important while measuring the digital divide among university students, which are portrayed by Tien and Fu (2008) by analysing the correlates of the digital divide and their impact on college student learning in universities in Taiwan. Access to computer was not a serious problem in these universities. The study mainly concentrated on four research questions regarding the computer use, performance in regarding the computer knowledge and skills, correlates of digital divide and finally the consequences of digital divide on academic performance. The survey investigated 3,083 first year college students of 12-14 years old. The findings of the study indicated that most students had adequate computer knowledge. Students who studied in public universities tended to use computers to fulfil more kinds of needs in daily lives than their private university counterparts.

It was also found that male students, studied in the field of natural sciences and engineering, and went to public university tended to spend significantly more time using computers than their peers who were females, studied in the field of the humanities and social sciences and were registered in private universities. The researcher found that students used computers not only for fulfilling their academic requirements or searching for information, but also for entertainment. Socio-economical factors didn't affect the purpose of use of computers of students of Taiwan University, but the students in public universities performed better in computer knowledge than the students from private universities. Finally, the study concluded that computer knowledge and devotion to using computers for academic related work had a moderate effect on the students' learning, while various other uses of computers did not. One of the major findings of this research is that digital divide also occurred between students of different disciplines.

Goode (2010) explored the development and impact of students' technological proficiency on their academic life in California. The study identified the educational and social factors related to the reported technological proficiency level of university students. The study employed quantitative survey followed by individual case study. The study pointed out that an inequitable distribution of critical computing conditions for students was extensive in California and revealed that university students had deeply integrated the role of technology into their social and academic lives. Still there was a range for the knowledge students possessed in using the technology, with low income students and females falling at the low end of the spectrum. Analysis also revealed that the students' opportunities to learn - including teachers' technology knowledge and digital curricular experiences - impact their level achieved in technological knowledge and skills. The outcomes of study also offered snapshot of university students along the four facets of a technology identity: knowledge, attitudes, opportunities, and motivation concerning technology. The major contribution of the study stressed the point that the students with high technological proficiency had high interest to incorporate technology rich disciplines in academic environment than those who had low technological proficiency.

IT literacy is a prominent component in digital divide research, and many researchers identified user characteristics with respect it. Ferro, Helbig and Gil-Garcia (2011) studied the process of acquisition of IT skills in order to provide policy makers with more refined perspectives on the digital divide. The empirical analysis was based on a longitudinal dataset made available by the ICT observatory of the Piedmont Region in Italy. The sample was taken from a database provided by the Italian National Statistical Institute (ISTAT). Researchers used different interpretation models to show the important role of basic IT skills in both Internet access and use. They highlighted different approaches to acquire basic IT skills and diverse usage level of Internet. They proposed a digital divide user topology such as the athletes (technophiles), the laid back (who did not have incentive to do) and the needy (who did not have physical capacity) which constituted a useful interpretation tool in order to make a policy support. The study also highlighted that informal and self learning was at least as important as formal face-to-face training course in the process of basic IT skills acquisition.

Claro et al. (2012) tried to evaluate fifteen year old Chilean students' ICT skills *vis-à-vis* their result in tests. A performance based assessment has designed in a virtual environment to measure the skills. The result showed that the majority of students were able to solve tasks related to the use of information as a consumer and very few of them were able to succeed in tasks related to the use of information as producers. Socio-economic status, access, daily use and confidence in doing ICT related activities were all positively associated with higher score showing the need to implement strategies to compensate the inequalities in ICT skills. Researchers highlighted the point that ICT skills of the students were also influenced by their socio-economic conditions and their motivational factors.

Codoban (2005) made a study to find out the Internet usage and digital divide among Babes-Bolyani University students, Romania. Gender differences were measured in terms of technological access, ability of students to utilize access, take up of access and impact of access. The analysis of 275 questionnaires pointed out a complex situation. Even though both male and female students enjoyed somewhat equal level of technological access, there appeared to have a significant gender digital divide in terms of amount of experience, ability, and knowledge in using technology. Based on the survey, other indicators like demographic information were also analysed and discussed in this study.

A higher knowledge of digital technology is needed for the higher use of the Internet. People must have extended digital skills to complete the complicated tasks using modern technologies. Two dimensions of digital inequality, namely skills and autonomy of Internet users were examined by Stiakakis, Kariotellis and Vlachopoulou (2009). Skill dimensions was measured by taking level of formal education as a representative variable and autonomy dimensions was analysed by using the density of population in different geographic area. The investigation was based on member states of European Union (EU). The analysis exhibits that EU faced the problem of digital divide to a great extent in terms of skills and autonomy. One of the drawbacks of the study was that, it concentrated only two dimensions of digital divide. But it can be extended to other dimensions of digital divide like technical access and purpose of use of technology.

Teachers' beliefs and interest in using the ICT play a significant role for promoting the use of ICT and improving the technological skills of students. The contribution of teachers to overcome the digital divide in rural schools in Chile, in order to generate conditions conductive for student learning and use of ICT was examined by Salinas and

Sánchez (2009). Their study discussed the concept of digital divide and proposed a multidimensional definition that includes teachers' knowledge, expectations, access to and use of ICT. Data were collected by interview schedule and questionnaire surveys applied to the teachers and students from 145 rural schools. The result showed that the teachers were not the first to introduce the students to the technology. That task was more strongly associated with peers and other people among rural communities. However, the teachers' skills in using ICT tools had a significant contribution in students' frequency of use and skills in ICT usage as they generated fundamental conditions for their students' appropriation of technology. Finally, the result contributed to a better understanding of the new role that teachers and schools played in rural areas for integrating the ICT in learning.

Yu and Lin (2011) tried to identify whether there were any differences among post graduate students from a University in southern China in terms of four subcategories of information literacy such as information consciousness, information ethics, information knowledge, and information ability by adopting self reported questionnaire. They also analysed whether any gender difference can be found and checked whether there were any potential strategies to improve students' information literacy level. The result indicated that there was no significant difference either between boys and girls or between senior and junior post-graduate students. The overall low information literacy scores indicated that there was a need for improvement, especially in the case of information knowledge, which causes information literacy divide at individual level. The need for incorporating the information literacy while measuring the digital divide is the main focus of this study.

Provision of better education among the people is an important remedy for eliminating digital disparities. This is checked by Huang and Wu (2009) by analysing the digital divide of adult students in supplementary junior high school in Taiwan. The participants of the study were composed of 396 adult learners who were above 20 years old and most of them ranging from 41-70. The result showed that the main reasons which had led to the existence of digital divide among adults were lack of awareness in using technology, unfamiliarity to search Internet for what they need, lower information literacy, less chance to use computers in the workplace etc. One of the important points was that most respondents had high interest in digital learning. By observing the results the researchers hoped to offer some suggestions for adult educators and educational administrative organisations on making decisions.

Peña-López (2010) studied the state of the digital divide at educational level and compared the findings at different stages of the education system especially in secondary and higher education. The study pointed out the main characteristics of three projects proposed to bridge the digital divide in primary and secondary education – Plan Ceibal in Urugay, Habilidades Digitales pura Todos, Mexico and Plan Escuela 2.0, Spain and then related these projects to the need to bridge the digital divide in higher education. By analysing those three projects the researcher claimed that implementing policies heavily focussed on establishing infrastructural facilities like laptops may not provide a sustainable answer to bridge digital divide, as they mostly leave digital competency or skill development unattended. Here the researcher pointed out the importance of digital skill in reducing the digital divide among students.

The open access to digital resources in educational institutions has to be structured to meet the particular needs of students who have less access to ICT at home. These open educational resources promote the use of ICT, and subsequently boost their digital skill. The impact of Open Educational Resources (OER) on bridging the educational digital divide was examined by Lane (2009). The researcher found that mere provision of open access to digital and educational resources does not assure the eradication of digital and educational divide. Increasing technological complications and the lack of expertise in using these technologies were explaining the reason for that. According to the researcher, the digital divide and educational divide are not completely different; the combination of different factors like social, economic, cultural, geographic and attitudinal variations makes the division between students. The investigator substantiated that motivation of students and teachers, their fluency in digital and educational skills, and also the support from intermediaries like librarians, technical staff also helps to bridge the digital divide among students. Thus author gave evidences that the openness (open access and open educational resources) alone are not sufficient to the successful engagement with digital technologies. In addition to the openness, necessary digital skills and confidence to use technologies are essential to alleviate digital inequalities.

Digital disparities are not a straight forward phenomenon and appear to relate, not to ownership, but to preferences and previous experiences with ICT. As an attempt to establish this fact, McNaught, Lam and Ho (2009) carried out a survey to find out the digital divide between students and teachers in a Chinese University at Hong Kong. A stratified random sample was taken to investigate ownership of digital technology, mobile phones and their features, use and confidence of using technologies (digital skills) etc. from 689 students and 56 of their teachers from eight disciplines. The analysed data demonstrated that there was a clear digital divide between teachers and students. The use of technological devices and reported skills in using the technology were showing significant differences between teachers and students. The study also revealed that both gender and discipline of studies were related to the diversity. Findings of the study gave an indication that the students did not constitute a homogeneous group as there were students who did not own certain devices or appears to have requisite digital skill.

For analysing the digital divide between teachers and students, Masoumeh et al. (2013) directed a study in girl's schools situated at Astara County. The main objectives of the study were to get familiarity with types of hardware equipments possessed by teachers and students, and to become aware of their usage level of ICT. The study also checked that if educational level of teachers had any impact on their possession and use of ICT equipments. Statistical population included for this study were 94 teachers and 432 students. Separate questionnaires were used for teachers and students. The result of the study showed that the possession level of hardware facilities found to be the same among teachers and students. It was also evident that the teachers had more expertise in using ICTs than the students; however, the use of ICT was higher among the students as compared to their teachers. Thus the output of the study clearly showed the digital divide between the teachers and the students. The result also indicated that teachers' level of education did not affect their possession and use of ICT. The study explored the fact that the mere possession of ICT does not guarantee an equal usage and expertise in using it.

Mohamed et al. (2012) examined whether ICT literacy contributed to narrowing the digital divide between rural and urban areas of Kundang Ulu in Malaysia. It was a quantitative study and questionnaire was used to collect data. The questionnaire covered the data concerning students' background, ICT usage and ICT skills. Sample taken for the study included 585 students in Sekolah Menengah Kebangsaan Tengku Temenggung Ahmad (SMKTTA). The findings showed that the digital gap was a persistent issue in Kundang Ulu because of small percentage of computer ownership, low usage of ICT and weak to moderate levels of fundamental and basic ICT skills. Here the researcher first addressed the first level digital divide and explained the role of ICT skills in narrowing the digital divide.

While detecting the digital competency of students, many factors have to be taken into account like gender, location of ICT access, experience and training in ICT, language and their socio-economic background. Guðmundsdóttir (2010) conducted a study in four schools in Cape Town, South Africa on seventh-grade learners to know the prevalence of digital divide in terms of their access, use and competency in utilizing the ICT. Participants composed of 7th grade learners (i.e., N=290), their teachers and principals from four schools. Out of which, three schools were mainly for disadvantaged learners, while the last one was formerly for Whites only. Data were collected through interviews, observation and questionnaire. ICT competency of respondents was analysed among the four schools in terms of gender, home access, and home language, along with the support and training facilities for teachers. Results revealed that, the disadvantaged schools showed differences in learners' ICT use and skills. It was also interpreted that home access, home language and teacher's competency play a significant role in determining learners

ICT competency. Here the investigator gave an important point that while addressing the digital divide among students, their school environment as well as outside factors have to be taken in to consideration.

Fairlie (2012) checked whether inequalities in access to home computers were affecting the expansion of computer skills. Researcher applied a field experiment among community college students from Northern California. Participating students were randomly provided free computers for home use. The random assessment evaluation was conducted with 286 students who acquired financial assistance from college. Of this number, 141 students got free computer. At the end of the academic year, participant's computer skills were observed. The experiment output showed that the participants who got free computers have significant higher level of computer skills than other group. Here the investigator revealed the strong relation between ICT access and digital skills.

Van Deursen and Van Dijk (2009) addressed one of the factors that appear to be important in several conceptualization of how to approach the digital divide i.e., the differential possession of so called digital skills. Definitions for operational, formal, information and strategic skills were used to measure the Internet skills of Dutch population at large by giving 109 subjects, nine government related assignment to be completed on the Internet. The subjects were selected randomly from the books/list of fixed telephony subscribers followed by drawing a selective quota sample for the strata of gender, age, and education level. The result indicated that digital skills were varying among Dutch population and strategic skills became very low. The study was supporting the fact that equality in access to Internet connection does not mean the usage rate are the same. Digital skill is an important factor in overcoming the digital divide.

The dynamic change of adolescent's self reported digital skills and the main effects and interaction effects of macro-level social system (represented by countries), micro-level social system (represented by schools) and individual level factors that shape the international digital skill divide among adolescents were explored by Zhong (2011). Based on PISA (The Program for International Student Assessment) data in 2003 and 2006, the researcher developed a hierarchical linear model to identify multilevel explanatory variable of adolescents' self reported digital skill divide. At the macro level, the study found a negative relationship between the ICT penetration rate of a country and adolescents' digital skill, which implied that increased ICT penetration rate did not guarantee more chances to learn and use ICTs. Output of the analysis indicated that at school level, ICT access was positively related to self reported digital skill and at the individual level self reported digital skill was affected by home ICT access, socio-economic status, gender and their history of using ICTs.

Wu et al. (2014) proved the notion that access to ICT is not enough to alleviate the digital divide among students by investigating the digital divide between aged students with learning disabilities (LD) and their nondisabled counterparts in elementary school in Taiwan. They examined ICT access, ICT competency and scale of digital participation of the students by using a self-reported questionnaire. A total of 117 children with LD and a same number of students without disabilities were selected for the study. The outcome of the analysis revealed that there were no significant differences in ICT access at home and at school between the students from the two groups. But a significant difference existed in the case of ICT competency among the students. In addition, the children without LD improved their competency in year by year, but those with LD gradually did not. The importance of integration of ICT instruction programs in educational institutions was also highlighted in the study.

Gender and socio-economic related differences in performance based ICT competency among 378 sixth grade students of 58 primary schools in Flanders (the Dutch speaking region of Belgium) were assessed by Aesaert and Van Braak (2015). They made a computer and performance based assessment using 56 items to measure ICT competency. SES was operationalised as the highest educational level of the students' mothers. The result revealed that students have particular difficulties in higher order ICT competency that include communicating in a socially acceptable and clearly understandable way. It also showed that girls had better ICT competency than boys and educational level of the mother was positively related to students' ICT competency. Thus the study tried to tackle the shortcoming of indirect measurements of ICT competency that suffer from self reported bias.

Thus from the above reviews discussed in this section, the researcher concludes that during the last few years, there have seen numerous important international contributions aimed at giving the relevance of digital competency in studying the concept of digital divide. These reviews identified that digital competency of the people influenced by their access to digital technologies, socio-economic factors in society, gender difference and motivational factors. The researcher also summarised that autonomy of use of ICT and experiences in using technology were positively related to higher level of self reported digital skills. Digital competence, which has become a key concept in discussions of the kind of skills and understanding people needed in the digital era. All the reviews in this part highlighted the different components of digital competency. At the same time the reviews revealed the fact that the self-assessment questionnaire by respondents in their level of competency may be somewhat subjective, as perception of knowledge and ability in computer skills do not always correspond to the reality. As the population for this study is too large, it is difficult to conduct a performance based test to measure the digital competency. Hence self reported digital skill level is used in this study.

2.4 Internet Usage Divide

In most of the studies on digital divide, it was found that even after people overcome the initial connectivity divide, variations could remain in the ways they incorporate the Internet into their daily lives (e.g., Barzilai-Nahon, 2006; Van Dijk 2005). Jung, Qiu and Kim (2001) opined that digital divide is more than just a problem of ownership and access to ICT. They stated that there is a positive relationship between time and proficiency in Internet usage which implied the role of intention when going online and what they do once they are online. So it is very essential to understand studies on Internet use to provide better understanding of digital inequality involved. This section overviews studies related to Internet usage divide.

The unbalanced growths in information technology sector, infrastructure problems, ICT literacy barriers, etc. can cause Internet usage divide among the students. This was supported by Loan (2011), who addressed the digital divide among rural and urban degree college students of Kashmir valley studying in the faculties of general science, computer science, social science, humanities, business and commerce. Survey method along with stratified sampling was used for selection of students. The findings of the study revealed that there was wide difference in the use of the

Internet between students in the rural and urban areas. The prominent reasons responsible for the digital divide were lack of awareness to use Internet, lack of facilities, lack of Internet access and lack of training to use Internet. The result also showed that boys outnumbered girls as Internet users and lack of training and awareness were more common problems to the latter. Insecurity in using the cyber cafés was also another hurdle in the way of smooth Internet use.

In addition to variations across gender lines, researches propound that race can also be significant to different aspects of Internet use. Jones, et al. (2009) ascertained whether race and gender make a difference in Internet use among US college students. They collected survey data from 7,421 respondents from colleges and universities in continental US. For comparison with the general US population, a nationwide telephone survey was undertaken. The outcome of the study was that male students spent more time online than their female counterparts. However, female students tend to use the Internet for communicative and academic purposes more frequently than male students. On the other hand, the male students saw the Internet primarily as an outlet for leisure. Data on non-White and Hispanic college student users of the Internet provided an insight into Internet use among a group that appeared to be under-represented in the literature on college students and Internet use. Despite significant differences in use of Internet, Hispanic, Black non Hispanic, and White non Hispanic incorporated the Internet relatively equally into their social lives and also had similar attitude about the Internet as an educational tool. The study helped in understanding the differential Internet uses existed along gender and race.

Keil, Meader, and Kvasny (2003) examined a unique and innovative approach that was taken in LaGrange, Georgia to address the digital divide. They described the free Internet initiatives and explored the history of initiatives and documented the achievements made, as well as problems faced by the city officials in bridging the digital divide. It was exploratory in nature using case research methodology. The field research included semi structured interviews with all the major stakeholders including government officials, citizens, and business owners. The outcome of the study has important implications for theory and practice towards minimising digital divide. It revealed that providing access to Internet, even when completely free, was insufficient to address the digital divide. Some other factors like money, desire, interest and willingness to learn also contributed to digital divide. Here the researchers explored the fact that mere provision of Internet doesn't alleviate the problem of digital divide completely.

The nature of rural people in using computers and Internet are varying within or between developing countries and various factors are associated with these variations. This was established by Zhou, Singh and Kaushik (2011) by surveying 500 individuals across three different South Asian countries, i.e., Bangladesh, Nepal and Sri Lanka. They analysed house-hold level determinants of computer and Internet use in situations where access has been provided by a developmental agency. The study used the data relating to income, house-hold size, education and occupation as well as infrastructure factors to find out the digital divide in rural South Asia. The sample was collected randomly in computer kiosks in rural areas of these countries. Result revealed that there was still noticeable variation in the use of Internet among individuals due to factors like income and education. The major finding was that education (especially in the case of English language knowledge) seems to be an important positive determinant at the micro-level for reducing the digital divide.

The prevalence of digital divide was investigated by Ani, Uchendu, and Atseye (2007) in University of Calabar Metropolis, Nigeria. The main aim of the study was to know the pattern of access to the new communication technology with a view to bridging any observed digital divide. The study investigated the various forms of digital divide such as gender, marital status, age, education, purpose of Internet use, and other factors impeding access to and use of the Internet. The survey method was conducted to extract the information, using questionnaire. A total of 400 questionnaires were administered randomly to the respondents and 324 usable questionnaires were retrieved for data analysis. The result explored that the use of Internet is higher in boys than girls and the age of the participants also played a significant role in accessing/using the Internet. The findings generalised that, the digital divide still existed in Nigeria due to poor Internet services, infrastructure facility, lack of financial capacity to pay, and inaccessibility to the Internet. The prevalence of various forms of digital divide such as gender, marital status, age and educational level of Internet users were disclosed in this study.

Some of the research output pointed out that the students' Internet use at home are significantly associated with the support obtained from their parents. Lei and Zhou (2012) examined how students' home Internet access and parental support were related to students' Internet usage pattern. They further tried to understand how the usage pattern was related to the students' self efficacy, collaboration skills, problem solving skills, ICT skills etc. Survey data were collected from 1576 middle school students in China. Results indicated that students who had access to Internet and good parental support at home reported a higher Internet usage than the students lacked the same. It also showed that home Internet access and parental support had a positive effect on the students' computer and Internet self efficacy, attitudes towards technology and developmental outcomes. Findings from this study had important implications for research and practices on efforts to narrow down the digital divide at home.

Castaño-Muñoz (2010) analysed the digital inequality among university students in developed countries and its relation to academic performance. The researcher presented an overview of the state of each dimension of digital inequality in universities in developed countries. Investigator also analysed the role played by each of these dimensions and the relations between them, in the academic performance of the students. Researcher measured digital inequalities in terms of access, digital literacy, intensity and purpose of using Internet. The analysis demonstrated that the effect of Internet on academic performance was not direct but mediated by variables such as interest of student in extending, sharing and discussing the knowledge, the extra motivation of using the Internet in class rooms, the time set aside for academic tasks, addiction to Internet and its psychological consequences.

Rice and Katz (2003) identified salient characteristics of digital divide in the US pertaining to Internet and mobile phone. The digital divide was observed from a nationally representative telephone survey conducted in 2000. The study explored three kinds of digital divide for both Internet and mobile phone – users/non users, veteran/ recent and continuing/drop out - and similarities and differences among those digital divide based on demographic variables. The study showed that the gap between Internet users and non users was associated with income and age, but not with gender and race, once other variables were controlled. The gap between mobile users/non users was associated with income, work status and marital status. Researchers also diagnosed that the veteran/recent Internet gap was predicted by income, age, education, having children and gender, etc. The factors like age, work status and marital status were strong predictors of mobile phone digital divide. This study identified a variety of usage divides within and across the Internet and mobile phone users.

Sociologists of technology proposed that, for studying the social implications of technologies, researchers have to consider not only a technological artefact as such, but also the pattern of use of the technology. Hence Zillien and Hargittai (2009) examined the impact of socio-economic status and context of online activities of people. For the study, the researchers used the data on Internet usage from the Allensbacher Computer and Technology Analysis 2004 (ACTA) administered by Institut für Demoskopie Allen's batch. They analysed the demographic characteristics as well as measure of people's socio-economic status. They also found that the most popular activity included was e-mail communication, followed by looking up travel information. The findings of the study suggested that people's socio-economic status raised different forms of "Internet in practices". It also described that people from high economic status were much more likely to employ in the so called capital enhancing online activities in comparison with their lesser privileged counterparts. The study stressed on the fact that digital disparity might be reduced by promoting people's Internet access.

The relationship between culture and Internet usage was exposed by Recabarren, Nussbaum and Leiva (2008). They demonstrated that abilities and performance of Internet uses differ due to the cultural differences of users. The researchers developed an exploratory research method to explain the different subcultures existed within a country and that membership in a particular subculture influences their Internet knowledge. On the basis of previous studies, which showed the existence of subcultures within a country, an experiment was designed and conducted based on the Hofstede cultural model and Tiwana's expert knowledge model to expose how social differences affect the Internet usage of first year university students at Universidad Catolica de Chile. The results indicated that two groups of students i.e., state subsidised and private, differed significantly in both Hofstede variables (power distance, uncertain avoidance, masculinity, individualism and long term orientation) and their knowledge and use of Internet. Researchers described that abilities and performance on Internet use differ among subcultures not only because of digital divide but also because of cultural differences.

The regional dimensions of the digital divide in Germany were studied by Schleife (2010). The researcher conducted an empirical method to identify the determinants of home Internet use in Germany on the levels of counties as well as on the level of individuals by merging two large data sets: the SOEP which provided the detailed information on individuals and INKAR (Indikatoren und Karten zur Raumentwicklung) which comprised a wide range of official regional figures for Germany regarding structure of population, employment, levels of education etc. At individual level, the study focussed on network effect that was the impact of local proportion of experienced Internet users on the access probability of individuals. The result at regional level indicated that regions with higher rates on educated employees and students exhibited a higher proportion of Internet users, which provided the evidence of the important role of education with regard to the use of new technology.

It also supported the hypothesis that a greater rural divide was related to a lower Internet use rate. One of the major realisations of the study was that different compositions of individual characteristics between rural and urban people account for regional digital divide.

Under-age groups form the coming generation in the digital world. They are being affected by so many external factors such as family, educational environment and friendship in accessing and using the Internet. Digital divide among under-age individuals in connection to Internet use was presented by Emmanouil and Evgenia (2009). The study was based on the findings of a secondary research. The methodological part of the study concerned that the EU was divided into three groups such as Northern, Central and Southern Europe. Data for the study have been taken from Eurostat 2009. The proportion of under-age individuals who used the Internet in the years 2006, 2007, and 2008 on a regular basis was taken as a variable to analyse. The outcome of the analysis revealed significant differences in the use of the Internet by minors among Northern, Central and Southern Europe. The findings reflected the existence of digital divide among minors which give support to the present study.

The differences in Internet use among university students in Ecuador and the relationship between the income of the student's family and Internet use were studied by Torres-Diaz and Infante-Moro (2011). They tried to find out the influence of university students' income on their intensity of use of Internet tools and resources. Forty universities in Ecuador were surveyed to understand the technological infrastructure, institutional policy and level of use of online tools for gathering information by students for education. A total of 4897 students formed the sample. The study described that the level of the students' family income influences the use and intensity of use of Internet tools, and hence there was a digital divide that corresponds to socio-economic reality. The study also concluded that income level falls mainly on the variables that define the access possibilities. This study is helpful in the sense that it explores how the socio-economic status of the student contributes in variation in Internet use.

Digital divide problems among rural and urban children in China, on the basis of educational and social correlates were disclosed by Li and Ranieri (2013). They selected four schools; involving 658 students aged 10-14. The selected schools were representative of urban, rural and migrant schools in the current Chinese educational system. The analysis of data showed that student's Internet access at home was better than at schools and teachers had more positive influence on student's Internet behaviour than their parents. The results also showed that Internet inequality indicators of students from rural schools were lower and hence the Internet usage status became low as compared to their urban peers. It also supports a positive relation between the level of education of parents and students' Internet use. The study explored the digital divide issues among students from social and economic perspectives in a developing county and it is very relevant in the present study to know the social and economic correlates of Internet inequalities among university students.

By analysing the differences of the use of Internet, Brandtzæg, Heim and Karahasanovic (2011) made an attempt to know the digital divide in Europe. They identified the participation and acceptance among European Internet users with respect to different user types and analysed the digital divide in terms of a user typology divide. The study used the data from European Community Survey (Eurostat) on ICT usage in household and by individuals from 2004 to 2006.

Representative sample consisted of 12666 people in five dissimilar European countries (Norway, Sweden, Spain, Austria and UK). From the results, it was clear that sixty per cent of the population seemed to be either non-users or sporadic users. This result proved that a great digital divide across Europe. By using the logistic regression, the study identified the predictors that account for variation in the use of Internet. It was found that the age of the participant forms the most salient predictor in Internet access, while gender and household found to be less relevant. The output of the study helps to understand the digital divide in multi-complex variations among individuals and countries.

The digital divide amongst university students was investigated by Kassangoye, Jager and Rugimbana (2013) by making a generalisable profile that would characterise the Internet usage behaviour of students in the Tshwane region of South Africa. They conducted a descriptive research using data obtained through questionnaire distributed among 300 university students. The findings showed that there exist differences in ICT access, digital literacy, intensity and purpose of use of Internet between the students. Thus the study revealed the digital inequalities among the students from two different settings/institutions. Here the research outcomes are limited in sample generalisability and situation generalisability and it excluded the demographic and psycho-graphic profile of university students. The results can be compared with many other studies carried out abroad, in order to ascertain the differences and similarities in ICT access and use.

Some researchers highlight the point that disparity in the use of the Internet is prevalent among youth even in developed countries. By taking UK as an example, Livingstone and Helsper (2007) established this fact. Existence of digital divide in terms of age, gender and socio-economic status has been reported in their analysis of the Internet use by children and youth aged between nine and nineteen from a national survey. They also observed quality of Internet access and use of the Internet. Researchers conducted a survey through an in home computer assisted interview of the participants selected using random location sampling across the UK. Even though there were very few children with no Internet use, there indeed existed inequalities in the quality of access to and use of the Internet. Further the study revealed that those who made little use of Internet did not understand the benefits it could bring to them, contributing to their apparent lack of Interest.

Even when the students are provided with adequate ICT infrastructure, there can be variations in their use of Internet. This was examined by Hargittai (2010) by evaluating the digital inequalities among students by controlling two of the most important variables- age and education and tried to show that considerable variation existed in various aspects of the Internet use among students, even from fully wired colleges. The population of the study included entire first year college of urban public research universities. Questionnaires were distributed among 1060 students. The outcome of the survey suggested that even when Internet access and experience were controlled, students differed in their online activities and abilities. In this study researcher exposed the positive relationship between skills and diverse Internet use. The data presented in this survey didn’t support the premise that young adults are universally knowledgeable about the web.

After reviewing the studies on differences in use of the Internet, the researcher concluded that the second level of digital divide can be observed in terms of intensity or diversity of use of the Internet. There can be differences in time devoted to Internet use, purpose of use, ability and attitude towards e-resources, etc, which can also lead to the second level of digital divide. Home Internet access, computer and Internet self efficacy, attitudes towards technology and parental support had a direct relation with the effective use of Internet among students. Here the researcher also summarised that socio-economic status, gender and geographical factor also led to differences in Internet use. There is also a positive relationship between digital skills and diverse Internet use.

2.5 Socio-economic Factors

Students do not have equal ways of accessing digital technologies in their living environment. Access to new technologies depends on family income, social status and educational level of parents. Access to computer and the Internet depends up on socio-economic status of people. According to Bozionelos (2004), socio-economic background has direct positive relationship with computer experience and an indirect negative relationship with computer anxiety. In a Dutch survey, Van Dijk (2000) observed that income was the most important predictor for physical access to computer, followed by age, and education. Chou and Shieh (2011) commented that use of computer was high among people with higher incomes than with middle and low-income categories. A serious digital divide with related to Internet access at home between poor students and affluent students were reported by Hohlfeld et al. (2008). All these studies cited revealed the importance of socio-demographic factors in contributing to the digital divide. This aspect is further discussed in the following studies.

Although the racial differences in the society became declined during the last two decades, there exist differences in accessing and using ICT in the modern world to a great extent. The differences in computer access between Whites and African American in United States were studied by Hoffman and Novak (1998). They examined whether any race differences in access and use can be explained in terms of differences in income and education. They also observed how the access of computer and Internet impacted on the use. The analysis was based on primary data from the spring 1997 CommerceNet/Nielsen Internet Demographic Study (IDS), a nationally projectable survey of Internet use among Americans. Analysis of data indicated that an increase in the level of household income and education increases the likelihood of owing computers and computer access regardless of race. However, in the case of students, race almost always made a difference. Whites, who lack a home computer, appear to find an alternative method of accessing Internet than African Americans students. The result of the study was also an indication that if access is promised use can follow.

One of the emerging issues that cause the digital divide among students is the unstable quality of technology integration in rural schools as compared with the schools in urban area. Wang (2013) organized a study to explore the disparity existing between rural and urban schools in integrating the technology. The study was based on the Will Skill Tool Model. The differences in the availability of technology between rural and urban schools were assessed in this study. The researcher also inspected the variation in attitude, competency and experience in technology integration among students and teachers in rural and urban schools. Survey method was adopted with 275 teachers and 293 students as participants of the study. The outcome of the study revealed that there were significant differences in the availability of ICT infrastructure between rural and urban schools. Also there existed wide dissimilarity in teachers' over all high-tech integration level between those from rural and urban schools. The result also illustrated that teachers in urban school had higher ICT competency as compared to the teachers in the rural schools. A slight difference in teachers' and students' experience and preferences in integration of technology can also be observed from the result.

Hess and Leal (2001) determined the extent of digital divide in urban schools in America i.e., why some schools in urban districts provide more class room computer access than others. The study considered the role played by the racial and ethnic composition, education, and income of local population. The data used for the study were from the 1995 national survey of 85 urban school districts conducted by the Council of Urban Board of Education. The variables measured were the African American percentage of the student population, the Latin percentage of the student population, the income of local families and educational level of the adult population. The study convinced that districts with a higher percentage of African American students provided fewer computers per student. However, there was no evidence that community education, community income, or Latino population affected class room computer provision. On the other hand, districts with more African American students reported recent decrease in the student-to-computer ratio, and comparison with previous research suggested that the magnitude of digital divide had decreased.

The extent of digital divide and inequality among digital natives in Gauteng, South Africa were explored by Tustin, Goetz and Basson (2012). They investigated social and economic forms of digital divide and inequalities that reflect on quantity and quality of the Internet usage. A survey was conducted among 1050 young people between the age of 12 and 21 years enrolled at secondary schools. Researchers used questionnaire as the data collection tool and revealed that gender, socio-economic status and cultural differences were creating differences in access to and use of the Internet. It was also realized from the results that there were significant differences within cohorts of young people in terms of use of new technologies, preferences and skills. However, the research failed to measure youth's skills in dealing with technology and also in critically assessing information. In the present study the researcher tried to explore the students' digital skill divide also.

Many research outputs evidenced that access to ICT among households and children are strongly dependent on their socio-economic status. The digital inequalities among financially disadvantaged families in Australia were investigated by McLaren and Zappalâ (2002). They selected 3,404 households and 6,874 children from low socio-economic (status) backgrounds, to know their access and usage of computers and Internet. The data for the survey collected from official records of the students and families on The Smith Family's (TSF) Learning For Life (LFL) program. Results of the study revealed that above half of the sample had home computer access while only near one third of them had the Internet connections at home. A strong association between level of parental education, ICT access and use can also be observed from the results. They highlighted that although almost half of a comparable Australian population had home Internet access, most of the students did not use the Internet at home. The study explored the point that the students' use of computer and Internet depended on their socio-demographic factors.

Although the rural areas have enjoyed the ICT facilities to some extent, the regional divide in ICT can be most commonly observed with in developing countries. India, though a developing country, exhibits a remarkable growth in ICT. But the benefit of ICT is found to be slow among rural people when compared to the urban people. A study was carried out by Dubey, Jeevan Jyoti and Devanand (2011) to realize the factors that lead to digital divide in Jammu and Kashmir region. The tool used for data collection was questionnaire and interviews. People were selected from rural as well as urban areas with convenient sampling method. The results interpreted that people were unaware of the facilities provided by the government for Internet access. The cost of telecommunication system and lack of proficiency in the English language also widened the digital divide in the Jammu & Kashmir region. The finding also convinced that work place was found to be the most common place for the Internet access. Thus the study highlighted the importance of collaboration among researchers, social scientists, technologists, etc. to improve the ICT to met local requirements. The main limitation of this study was the small sample size taken and the convenient sampling method used.

Some research studies had highlighted existence of digital inequalities in developing countries, that too among teenagers, in connection with gender, socio-economic status and school type. Socio-cultural differences in Internet use (digital divide), usage scenarios and research competences among 14 year old Austrian pupils were examined by Parycek, Sachs and Schossbock (2011). The study examined the online search behaviour and Internet use of the students in secondary school (gymnasium) and secondary middle school (Hauptschule). The study included an online survey, a questionnaire and a close test. The final sample consisted of 379 pupils. The results showed that the students who attended gymnasium had higher chances to gain relevant skills in Internet use and they were more likely to produce quicker surf routes in relation to the overall sample. The girls were less active in searching information than the boys. Low social status of pupils also had a negative influence in using technology. All these were the evidence that a digital divide in Austria existed among teenagers in relation to gender, socio-economic status and school type.

The relationship between the Internet use and gratifications gained within the context of the digital divide framework was explored by Cho et al. (2003). They also narrated how the pattern of the Internet use and gratifications reveal notable variations across subcategories defined by the demographic variables of age and socio-economic status. The data analysed for the study were collected as part of the Pew Internet and American Life study in 2000. Telephone interview were conducted with a probability sample of 43,224 adults which were selected randomly. Result of the study detailed that those who were young and high in SES were more likely to use the Internet to satisfy their motivation strategically and to gain the desired gratifications. But those who were young and had low SES were more likely to employ consumptive use of the Internet to attain connection gratification. Here the researchers also summarised that even as gaps in access were closing, gaps in usage and gratifications gained seemed to persist in term of SES.

Connection between determinants of the global digital divide and processes of economic, technological and social developments in Cambodia were discussed by Wijers (2010). The study was limited to ethnographic case study on the situation in Cambodian Ministry of Environment and was used to illustrate how the determinants of digital divide interact in post-conflict Cambodia. The researcher identified economic and technological determinants of computer and Internet use such as per capita income, electricity production and institutional determinants. Social determinants included years of schooling, illiteracy rates, educational level and demographic factors.

The study suggested that in each instance, the distinct nature and context of what was considered digital unpreparedness must be taken in to consideration in order to understand the problem and its solution. The study concluded that it was important as the digital divide seemed to limit developing countries in fully using the potential of Internet for poverty eradication and economic growth. The study covered the economical, technological, Institutional and social determinants of digital divide. All these dimensions are analysed in the present study also.

Brännström (2012) tried to expose the relationships between gender and digital divide by charting sex and social discrepancies in access and use of some pivotal ICT technologies, literacy, ICT costs, and poverty. The data were collected from international reports and statistical database for the year 2000-2008. Special attention was given to women's access to and use of the new technologies in two divergent low income economies in sub-Saharan Africa, Kenya and Somalia. The study revealed that official statistics on sex discrepancies or the gender divide in access, use and benefits of telecommunications were still almost lacking for the countries even after 15 years. But the digital divide in Kenya was reduced quite rapidly at the end of the period. Official statistics from Somalia were difficult to comprehend due to the absence of official data and lack of evidence based technology.

By analysing the conceptual drawbacks of studies on digital divide, many investigators focused on various uses of the Internet rather than access to the Internet. By noticing the theoretical weakness in this field of research, Peter and Valkenburg (2006) contrasted two theoretical approaches to digital divide phenomenon, the disappearing digital divide approach and emerging differentiation approach. They tried to improve theory formation by empirically studying the validity of predictions that the two opposing theoretical frameworks made. Observers practically examined the validity of their forecasting about the use of Internet by adolescents and their tendency towards Internet by surveying 749 Dutch, adolescents between 13 and 18 years of age. The findings showed that the use of the Internet as a medium of information and communication can be explained on the basis of unequal access to socio-economic and cognitive resources. As usual, the study revealed that the participants who possessed greater socio-economic and cognitive resources utilized the Internet usually for information and rarely for entertainment than those with lower socio-economic and cognitive resources. A similar result can be noticed among adolescents about their tendency towards the Internet. The investigators concluded that the emerging digital differentiation approach explained the current scenario of digital divide better, than the disappearing digital divide approach.

The relationship between demographic variables such as age, income, gender, and education and the likelihood of making a purchase over the Internet was explored by Akhter (2003). The study mainly focussed on how those demographic variables affect the Internet shopping. The study examined the phenomenon of digital divide among participants from an intra-ethnic perspective. The research showed that demographic characteristics and their psychological correlates significantly influenced the likelihood of purchasing tickets over the Internet. The survey suggested that men in contrast to women, younger people in contrast to older, highly educated in contrast to less educated and wealthier people in contrast to less wealthy were more likely to use Internet for purchasing symphony ticket.

Challenges of rural people to reduce the digital divide in the globalized world were studied by Akca, Sayili and Esengun (2007) by taking Turkey as a representation. The aim of the study was to understand the relevance of Internet for rural dweller, their skills and knowledge with respect to ICT, and barriers facing during implementation of ICT in rural areas. The study also explained what could be learned from other countries for ICT implementation and proposed a model to develop rapid adoption and deployment of ICTs by rural people to reduce the digital divide between rural and urban areas. Finally, the researchers analysed web pages in Turkey that were active in that time, and revealed that more than seven hundred villages had web pages and followed rapid development in the field of communication although many urban units were not integrated with developed world in terms of ICTs. They concluded that Turkey had faced some obstacles like low population density, during the deployment of the ICTs in rural areas at the beginning stages of ICT implementation.

Many factors that influence the digital divide between emerging democracies from Eastern Europe and developed countries from Western Europe were analysed and evaluated by different researchers. Dragulanescu (2002) described the social impact of the digital divide in Central Eastern European Countries (CEE) which provided a comprehensive study of different digital divides existing between emerging democracies from Central and Eastern European as well as between them and industrialised developed countries (Western Europe, USA etc.). The investigator categorized the digital divide existed in CEE countries in various forms such as between the most industrialised countries of the world, between CEE countries and between different groups of populations. The study also pointed out that the earlier influencing factors like the scarcity and low quality of the former telecommunication infrastructure, the low teledensity rate, lack of education and training, cost of infrastructure and lack of competitive market were the main reasons for East-West digital divide in Europe.

The reviews on the digital divide stressed on the point that there is a need to focus on the participation of some groups in digital world, who were habitually under represented i.e. from low socio-economic status and rural areas. Gündüz (2010) assessed the digital divide level of students according to their socio-economic level and also inspected the influence of digital divide on academic success of students in elementary schools in Sakarya city centre in Turkey. The influence of digital divide on academic success was measured based on their level assessment exam (STS), success rank and social grades. Deliberate sampling method was used and data were collected by questionnaire. The result implied that the students who ranked top ten in the level assessment exam, had computer and Internet connection in their home, whereas those who ranked in last ten did not possess the computer and Internet connection in their homes. The study concluded that there existed a digital divide between students from primary schools. The investigator also summarised that when the socio-economic status of students increases, there is also a corresponding increase in the adoption of computer and the Internet at home. In addition, the study noted a simultaneous increase in the use of computer for educational and entertainment purposes. Here the researcher highlighted the point that economical and social factors are to be considered while measuring digital divide among the students.

Issues of the digital divide in technology use and its impact on the academic performance were explored by Sun and Metros (2011). The researchers addressed the issues of socio-economic disparity, its relationship with technology use, and the impact of these factors in academic performance. The discussion was based on a theoretical framework. The investigators reviewed the articles and theories based on Bonnet's social equity framework. The findings reported that proper use of technology by students increases their academic performance outcome. It was stated that socio-economic status and social capital affected not only the students' access to resources from institutions but also their opportunities to use technology. The study was inconclusive in the sense that whether technology was going to affect students' academic performance in all subjects, but found that at least mathematics and science were positively linked to technology use.

Developing countries have started so many initiatives to bridge the digital divide. By taking Tanzania as an example, Sedoyeka (2012) tried to find out the challenges faced by the ongoing initiatives to bridge the digital divide in that place. The study used different data collecting techniques such as questionnaire, group discussions, interviews and site visiting. The study pointed out six main angles such as economic capital, technical means, habits, social capital, and cultural capital and finally the institutional reforms led to digital divide. The result of the study revealed how financial power formed a key source for the digital divide, hampering bridging initiatives. The geographic location has also played a significant role in contributing to the digital divide, which led many people turning to Internet cafes in urban areas, whilst those in rural areas were completely unconnected. In Tanzania, the willingness of people to adapt the use of Internet still remained a challenge. Thus the study explained cultural, social and habitual issues and their effects on Tanzanian local communities whilst emphasising the role of institutional reforms.

In order to improve the use of IT among youth, it must be introduced early in their lives. The importance of use of IT in education has been studied by many investigators. Race and gender differences in the intensity and nature of IT use among children were evaluated by Jackson et al. (2008). They also studied the role of socio-demographic characteristics in predicting the intensity and nature of children's IT use. Further, they explored the connection between the nature of children's IT use and their academic performance. The sample for the study consisted of 515 children. Analysis of data reported that there were race and gender differences in the intensity and nature of IT use and parents' socio demographic characteristic predicted the use of IT. It also conveyed that the intensity of use of IT was also a positive predictor of academic performance. Here investigators discussed digital divide based on the interaction of race and gender.

Ahn (2011) examined the social networking site (SNS) participation of teenagers in the United States and outlined how the term digital divide has been used in research literature of past decades. The discussion also highlighted how scholars had moved from questions of mere access to computers to current issues of social participation in technologies. The study utilised a nationally representative survey from Pew Internet & American Life (PIAL) project to check whether access and participation divides persisted in teens' use of SNS. PIAL included a national representative sample of 700 teenagers and their parents. The study examined the relationship of social, demographic and technology variables with youth involvement in SNS. The findings reported that traditional divide indicators such as Internet access or parent education were not significant predictors of SNS use. Youth tried to find out a way to become connected by using cell phone, computer blog etc. The study provided deeper understanding of the social and cultural factors related to the participation in new technologies by youth population.

Gender differences in term of computer access, computer use, computer self efficacy and the actual performance characteristics of 48 students (25 male, 23 female) at University of Frankfurt, Germany has explored by Imhof, Vollmeyer and Beierlein (2007). Participants were provided with a computer diary to record duration and type of computer use, a questionnaire on computer use and self efficacy. They were also assigned a computer task for performance measure. Results indicated that gender gap was closing as far as computer access and self-efficacy were concerned. However, male students spent more time at computer for personal purposes and they outperformed female students at computer tasks. The main suggestion made by the study was to plan computer requirements carefully to minimize the gender differences in computer usage. Here the investigators mentioned that the gender difference in computer use is narrowing in developed countries.

In King Abdulaziz Universities (KAU), Saudi Arabia, the first order digital divide is almost vanished as most of the people had access to ICT in the campus. Alsaleh and Rashad (2012) focussed on the second order digital divide (divide in use of ICT) in KAU. They tried to identify factors that prevent people from using ICT other than the availability of access. The study also ascertained whether type of access was affected by gender and education level (demographic factors) and to what extend lack of proficiency in English language was an obstacle in using ICT. Survey method was used in the research and questionnaire used as a data collection tool. The sample taken for the study consisted of 558 students and professors located in KAU. The analysis of data indicated that there was no digital divide in terms of access to Internet in universities, but the divide exists in society. It revealed that gender and education had no relation with the Internet use. Further English language was not an obstacle in using ICT.

Lee, Park and Hwang (2015) sought out the scope and magnitude of the digital divide between the haves and have not's of wired and/or wireless broadband connections and smart phone. Another aspect disclosed in the study was the group differences in demographic characteristics; Internet usage (device ownership, Internet availability and frequency of use) and communication competency (instrumental, creative, and networking skill) between people who had wired/wireless broadband connection and smart phone. The national online survey data was collected by administrating a stratified quota sampling in Korea including 935 people. The result of the study showed significant differences in group with different network connection types across demographic characters, different level of Internet use and different communication competencies. The result also revealed that smart phone use was more influential factor affecting digital divide than wired or wireless broadband access. Age and income were the main socio-economic factors affecting wide gap in different types of broadband connection.

Vandoninck and Roe (2008) made an attempt to establish whether the digital divide persisted in Flanders. They also examined the extent and main contours of digital divide. The sample for the study included 200 inhabitants taken randomly. The result indicated that digital divide has diminished somewhat, in terms of computer and Internet access. Despite this, a significant bipolar digital divide persisted, i.e. one half of respondents used computer intensely while one third claimed that they never used computer and 38 per cent still reported having no or restricted computer skill. Results revealed that although the signs of digital divide were diminishing, it was structured along socio-demographic line such as gender, age, level of education and occupation status. Here the results indicated that access to ICT alone did not alleviate the digital divide and there may appear digital divide in another form.

Lupáč and Sládek (2008) analysed the contemporary state of the digital divide in Czech Republic and tried to contribute to the knowledge that has already been gathered about digital divide issues. Their basic goals were to question the evidence of digital divide deepening in Czech Republic. The analysis was structured according to the model of successive access elaborated by Van Dijk (2005). Data for the study were taken from Czech branch of the World Internet Project, Czech Statistical Office Reports, and the Information Literacy Research commissioned by the ministry of Informatics. The socio-demographic distribution of physical access and its development showed that major parts of Czech society were seriously lagging behind in information acquirement. It included especially aged people, people with low education, and people from low income households and people having insufficient social contacts. Thus the study substantiated that the digital divide was deepening in Czech Republic.

From the reviews, it is clear that the Internet adoption and usage patterns differ in terms of household demographics. Observers can then give possible clarification for this difference. Such a study was reported by Goldfarb and Prince (2008) by surveying 18439 Americans to know the adoption of Internet and its usage pattern. They showed that the pattern of Internet adoption and usage indeed differed by demography. They found that people with high income and good education were more likely to adopt the Internet, but they also spent considerably less time online. The investigators examined four possible reasons for that pattern, such as differences in the opportunity and cost, differences in the usefulness of on-line activities, differences in the duration of leisure time and finally the selection. Their results suggested that the pattern can be explained by differences in the opportunities, cost, leisure time and help to determine the potential effects of Internet access subsidies.

Hohlfeld, et al. (2017) studied the levels of digital divide in Florida schools, extending the model by Hohlfeld et al. (2008). The researchers determined the levels of digital divide in schools compiling state-wide data related to ICT access, frequency and purpose of use of ICT across schools of different socio-economic status (SES). They analysed equitable access to ICT within each school type (elementary, middle, and high) in Florida between high and low SES and also the impact of SES on the frequency and purpose of use of ICT by students and teachers. The data collected by the Florida Department of Education over seven years (2008-2009 to 2014-2015 academic years) were used for the study. In order to assess the trends in ICT integration in the state of Florida by SES in each school type, different statistical methods applied. The results indicated that even though Florida has improved on parameters related to digital divide, there existed some important differences in the ICT integration. Further, it revealed that low-SES students used software mainly for computer-directed activities like drill and practice, but their high-SES counterparts were using the software mainly for student-centred activities like creating educational content with or communicating through ICT. The outcome showed that digital divide existed even in developed countries.

Much of the discussions of the digital divide in the above mentioned studies highlighted, how the differences in socio-economic status is contributing towards access and use of ICT. The primary elements contributing to the digital divide are income, employment and education. Parental education and income are the primary factors that influence educational experiences of the youth and their access to ICT (Looker & Thiessen, 2003; Oyedemi, 2012; Schreckenberg, 2004). Studies highlighted the point that socio-economic status acts as an important factor in contributing to the digital divide.

2.6 Psychological Factors

Even though the hindrance of getting physical access to ICT has overcome, attitude of the users can play an important role in influencing their desire to learn more about the emerging technologies and to become experienced user. Attitudinal barriers like lack of interest and lack of perceived usefulness which hinder the use of the Internet were studied by Donat, Brandtweiner and Kerschbaum (2009). Attitudes towards computer and the Internet have been emphasised in terms of its belief and usefulness regarding positive and negative effects of technology in the life of human beings. Many researchers have completed their study on gender differences in attitude towards technology. Findings from their studies were supporting to the relationship between gender differences and attitude towards using technologies. Many research outputs showed the gender differences in computer use, where males have higher level of computer self-efficacy, express more positive attitudes and have less anxiety than female counterparts (Broos, 2005; Chou, 2001; Losh, 2004). In this section, the researcher covered the important studies about the psychological aspect of digital divide.

The digital divide is not only about the differences in hardware and software, but also about the diversity of attitudes people possess towards ICT use. The provisions of resources that support the physical access do not ensure the digital equalities as the key to solving digital inequality lies inside the people. The psychological factors (internal forces) that hinder the people within community from incorporating ICT into their lives were presented by Partridge (2007). The psychology of digital divide is analysed by applying Social Cognitive Theory of Bandura (1986). Population of the study composed of the 488 members from San Jose Community in California. Internet self efficacy and Internet outcome expectancy were measured to find out socio-cognitive factors. The researcher identified that socio-economic factors were not a remarkable predictor of Internet use. But the Internet self efficacy was seen to be the significant predictor of Internet use by the members. In addition, outcome expectancy, education and age were also remarkable predictors of Internet self efficacy. This was the first study that combined the socio-economic and socio-cognitive factors in the research design and utilized the members of general population in data collection process while exploring the digital divide.

A contribution regarding the existence of digital divide between students and lectures in three Nigerian universities was given by Nwokeocha (2011). The researcher also explained whether attitude played any role in contributing to digital divide. In this study attitude was measured in terms of perceptions and interest of students and lecturers in using ICT. The study also ascertained the factors that motivated and disposed in the use of ICT by students and lecturers. Structured questionnaires were distributed among randomly selected sample. The analysis of the data concluded that there was significant digital gap between students and lecturers in terms of their ability and interest to use ICT. The results also conveyed that the students exhibit more interest in the use of ICT and were favoured by factors that encourage the use of it, though the lecturers seem to be better aware of the role of ICT. This study explained how attitude plays a significant role in creating digital divide.

Some researchers recommended that the educational practitioners and policy makers should consider the attitude towards ICT in low SES children and their notion of computer literacy in order to provide suitable interventions to advance their positive attitudes. Lebens, Graff and Mayer (2009) identified that children with a lower socio-economic status were over represented in general secondary schools in Germany, and aimed to examine the impact of children's SES on attitudes towards computers. The result implied that children from low SES households expressed feelings of threat and tension when they think of using computer or when witnessing computer related talk. However, children from low SES households recognised the importance of computers and ICT skills as an essential component for their future educational and occupational prospects. The study also substantiated the established notion that mere provision of ICT resources does not alleviate the digital divide.

The evidence for the digital divide based on gender was examined by Cooper (2006). The study was an overview of research published in the last 20 years drew the conclusion that women remained disadvantageous relative to men in their opportunity to learn computers and other devices. The evidence showed that the digital divide affected the women of all ages and across international boundaries. The researcher theorised that the digital divide was fundamentally a problem of computer anxiety and the roots of which were deep in the socialisation pattern of boys and girls and that the interaction with computers was like toys for boys. Researcher presented a model of the digital divide to examine gender stereotype, attribution patterns, and stereotype threat as antecedents of computer anxiety which in turn, leads to differences in computer attitude and performance. The study also generalised that the negative attitude had adverse impact on the computer performance of girls. Researcher also opined that schools should make it possible for girls to interact with computers either in small same sex groups or alone.

A detailed conceptual understanding of people's non use of computers was sought out by Selwyn (2006), based on household survey data collected from a systematic, stratified sample of 1001 adults in England and Wales followed by in-depth interviews with 100 of these respondents. The study considered in detail why certain individuals limited or completely excluded from computer use in their day to day lives. Investigator also examined the motivations of the participants and consequences of not using ICT in the contemporary information society. The study identified hierarchies in the use of computers such as non user, lapsed user, rare user and those use a computer at least fairly often. The result showed that individual socio-economic status was a significant factor in choosing the use of computer during their life time. Non-use of computers also resulted from compounded effects of factors like lack of interest or need, lack of knowledge barriers (lack of time, old age, poor health) or no access to a computer. This research explained the various dimensions of digital divide like socio-economic and psychological dimensions which gives support to the present study.

A better awareness of students and staff perception towards technologies will allow the concerned authorities for taking more informed decisions about the implementation of educational technologies in higher education institutions. Waycott et al. (2010) reported qualitative findings from a study that investigated perception of staff and student from Australian University towards use of current and emerging technologies in their daily lives and in teaching and learning contexts. Forty six first year students and 31 teaching and supporting staff from three Australian universities took part in interview. Findings revealed that in the context of technology use, staffs were more likely to comment on the place of technology in family life while students used the technology to organise their social lives. The overall findings suggested that staff and students were likely to experience the same technologies very differently in the university context though both of them possessed a positive attitude towards technology. The study also portrayed that the staff were more resistant to using new technologies while younger students remained more likely to embrace them. The researcher also pointed out the need to develop a more sophisticated understanding about the role of technologies played in the lives of students.

Wilbon (2003) analysed the moderating role of technology environments in shrinking the digital divide in US and observed that due to insufficient number of women and minorities entering engineering and science related fields, there appeared a lack in demand for IT workers in US. The researcher made a framework for the study to show the antecedents and consequences of personality composition (motivation, self-esteem, etc.) as well as variables showing moderate relationship between personality composition, academic performance, and IT environment (economic background, family make up and literacy, access to technology etc.). Research could provide scientific insight into the environmental conditions that would stimulate interest in IT related fields among students in grade K12. The investigator gave some propositions, such as internal laws of control, self esteem, analytical learning style or alternative learning strategies and cognitive thinking were positively supporting the decision to pursue an IT major among students from technologically sophisticated environments.

By using the scales of computer anxiety and computer attitudes, Chou and Shieh (2011) tried to investigate the domestic digital divide regarding the impact of on-line learning on the unemployed adult population in Taiwan. A total of 183 subjects were taken from the trainees of an online computer training programme. It was an empirical study to assess online learning performance, computer attitude and computer anxiety in terms of gender, age and educational level. In their experimental findings, gender difference and age difference were not significant in online learning performance, while both were significant in their attitude towards computer use. The researchers observed that male and the young adults were found to be more positive towards computer use, while the subjects with a medium performance perceived a higher level of computer anxiety.

The motivational, affective, and cognitive correlates of the Internet use were distinguished by Jackson et al. (2001). Further, they checked out whether these correlates of the Internet use could describe the racial digital divide. A survey was carried out among a random sample consisting of European American and African American students. Analysis indicated the existence of racial digital divide among students who apparently have equal access to the Internet. It also concluded that racial differences in Internet use were small and were limited to differences in e-mail use. Researchers established the importance of motivational factors in Internet use. They also described how the affective factors like computer anxiety minimised the use of web. Computer anxiety was found to be higher among African Americans than European Americans. Finally, the investigators showed that the respondents with higher cognitive factors like computer self confidence, familiarity and trust reported a higher Internet use.

While disclosing the digital divide phenomenon, some observers commented that psychological barriers like lack of motivation and interest in using ICT have equal importance as socio-demographic factors. Broos and Roe (2006), in their study employed the social cognitive and self efficacy theories of Bandura (1986) and the Locus of Control Construct of Rotter (1966) in order to detect some psychological correlates of digital divide in Belgium. A self administered survey was conducted in schools with random sample of 1145 Flemish adolescents and assessed the general self efficacy, general locus of control and computer locus of control. The result explored that the adolescents who had a high assessment of their ability to use computers and who had strong expectations of successful computer control were more likely to use computers. The result also illustrated that the Internet use among girls were both psychologically and socially somewhat complex affair than it was for boys. Thus the study pointed out that the computer locus of control and ICT self-efficacy supplement socio-demographic explanations of digital divide and also that attitude plays an important role in gender specific digital divide.

The intention of using virtual class room technologies to overcome the digital divide has an idyllic proposal but it remains to be challenges for many students. Irons, Jung and Keel (2002) investigated the satisfaction in learning experience in virtual class of graduate nursing students. The study compared student satisfaction inside classes that required little web component to virtual classes that publish course materials on the web, integrating new forms of virtual interactivity. It also analysed design issues and interactivity. The research tools included questionnaire and observation of virtual classrooms. The analysis showed that students in courses with a web requirement expressed low degree of satisfaction with learning experience when compared to those in courses without a web requirement. However, when the geographic location was controlled, separating data from urban and non urban settings, the findings revealed that students attending class with a web requirement in urban settings were more likely to express positive degree of satisfaction than their counterparts in non-urban setting.

Theoretical attempts to know the change behind forming digital inequalities are scarce. By chasing the literature on digital divide, Ghobadi and Ghobadi (2015) studied the different types of access such as motivational access; material access, skill access and usage access interact together in shaping the digital divide. A qualitative methodology, Revealed Casual Mapping (RCM) was used to identify respondent's cognitive structure regarding access barriers and their interrelations in shaping the digital divide. The RCM demonstrated interactions and linkages between different access gaps. The results gave a theoretical account of the dynamics behind shaping digital divide and generated insights into extending the concept of the access gap. The study also explained how several individuals, social, national factors, for e.g. technology phobia, high level costs of getting access to ICT regulations (governmental rules) intersected to impact each other and in turns affected digital divide. The centrality of motivation related factors such as lack of interest in IT-related things and lack of motivation to learn modern technology and skill related factors also explained in this study.

The role of computer anxiety in effecting the female college students' attitude towards Web 2.0 applications for learning was explained by Huang, Hood and Yoo (2013). They described a gender digital divide. The study tried to find out the college students' possession of different perceptions towards using Web 2.0 applications for learning, based on their gender as explained by Unified Theory of Acceptance and Use of Technology (UTAUT) situated in the gender digital divide framework. The examiners employed an online survey at a public Midwestern University in United States. The survey explained certain significant differences between gender on six Web 2.0 applications such as blog, wiki, social networking tools, video sharing tools, games and immersive virtual environment. The female students appeared more anxious towards Web 2.0 applications for learning than male students. The suggestion by Cooper (2006) that providing a good social support for women on computer-related learning tasks might lower their anxiety levels was also highlighted in this study.

The role of attitude to predict the Internet usage and digital divide was identified by Donat et al. (2009). They tried to answer the reasons for usage and non-usage and general attitude towards Internet. They analysed the demographic factors, technophobia and planned purchase of an Internet access from a collected representative sample of Austrian population consisted of 529 people. Participants were selected using simple random sampling. The study presented a data from a 2007 telephone survey in Austria. The definition of attitude i.e. cognitive component, the affective component and connotative component served as a useful heuristic in structuring the analysis. The result indicated that there were significant differences in attitude towards Internet between users and non-users of Internet. Internet usage depended on the user's age, education, region and migration background. The study concluded that even if the initial obstacle of getting online was overcome, there existed the influence of an affective component, i.e. feelings which lead to the second order digital divide.

An analysis of technological self-efficacy and attitude towards the technologies form an important factor while determining the digital divide. For giving a comprehensive measure to the second level digital divide, Zeng (2011) analysed the attitude towards the Internet and Internet self efficacy along with the different factors that contribute to the second level digital divide. Researcher came up with the hypothesis based on three theoretical frameworks of Knowledge Gap Theory, Use and Gratification Theory, and Self -efficacy and Attitude Theory. The hypothesis was that parental educational level, place of residence and expertise of students affect their Internet use. Researcher collected survey data from 335 respondents in Jinan Universities in Guangzhou, China. The findings reported that the sensibility factors of the Internet use including attitude towards Internet and Internet self efficacy had significant positive effect on the Internet usage level including the time of the Internet use and the index of Internet use about studying and working.

In an effort to understand the psychological aspect of the digital divide, Eastin and LaRose (2000) developed a new measure of Internet self-efficacy which was built on past research. Survey data were collected from 171 undergraduate students from Midwestern University using convenience sampling to develop a reliable operational measure of self efficacy and to examine its construct validity. The findings of the study highlighted that prior Internet experience, outcome expectancies and Internet use were significantly and positively related to Internet self efficacy statements while Internet stress and self disparagement were negatively related to it. The measure and conceptualization of Internet self efficacy in the study helps to know about the psychological factors concerning digital divide.

Chipeva et al., (2018) investigated the digital divide in Bulgaria and Portugal from the perspective of the individual acceptance of ICT in which personality components, like eagerness to adopt the technology, were analyzed. They studied individual pattern of acceptance and use of ICT on the basis of the extended unified theory of acceptance and use of technology (UTAUT2) and five personality traits (openness, extraversion, agreeableness, conscientiousness, and neuroticism). Survey method using questionnaire was adopted to collect data from individuals. The results explained that performance expectancy remained the strongest predictor affecting the technology adoption while openness was a significant predictor of behavioural intention to use technology. The factors like openness, extraversion, and agreeableness were significant predictors of usage behaviour. The researchers also explored the country-wise differences, in which effect of motivation on behavioural intention and the effect of behavioural intention on usage was stronger predictor of technology use in Portugal (than that in Bulgaria). At the same time effect of performance expectancy, habit, agreeableness, and neuroticism on behavioural intention, as well as the effect of age on usage, were stronger for Bulgaria. Thus the study identified the psychological drivers which influence technology adoption at an individual level.

Studies related to digital divide unambiguously identify that youth are more technology savvy than aged people and also that they adopt new forms of ICT much faster than their aged counterparts. Salajan, Schönwetter and Cleghorn (2010) examined the digital native–digital immigrant differences in perceptions towards the execution of digital learning technologies in syllabus by taking the example of students and faculty members from University of Toronto, Faculty of Dentistry. A self-reported data using survey method was adopted for the study. They analysed the user perception regarding the impact on learning of software like email, web browsers, online e-texts and also digital devices like desktop computers, laptops and MP3 players. The research assessed Blackboard, the learning management system implemented by the parent university in the academic year 2006–

2007. The result revealed that there existed minute differences, in the perceived usefulness and importance of digital technologies for learning and teaching, between teachers and students. However these differences had no universal applicability. The study focussed on the point that attitudinal differences can be observed even in higher educational institutions.

Attitudes towards ICT usage have been defined as a person's general evaluation or feeling towards ICT and specific computer and Internet related activities. The above reviews strike the point that once initial barriers of getting online is overcome, psychological variables like self efficacy, attitude, anxiety, technophobia, lack of interest and likeness play a crucial role in determining the degree of Internet access, use, issues related to perceptions of Information Technology and related affective, cognitive, and interpersonal dynamics that may contribute to the digital divide. Reviews also showed that the relationship between sociological factors and psychological factors in the use of ICT.

2.7 Conclusion

An extensive review of relevant literature pertaining to the digital divide and peripheral information that affect the study was covered in this section. Some reviews highlighted an interesting result, that digital divide still persists even in developed countries. This fact support the study in the sense that as India is a developing country, huge differences in ICT access and use can be observed in different state level. On the basis of literature reviews, the researcher firmly propounds that while worldwide use of the Internet (or digital resources) is rapidly growing; many people are being left behind from digital revolution due to different factors.

From the reviews, the researcher can understand that much of the study on digital divide has been survey oriented and shed light on the extent of the ICT adoption and diffusion. It can also help to understand that how and why the digital divide continues to persist even when people are provided with free access to the technology. It is uncertain that access alone will be sufficient to bridge the digital divide. Structural divides concerning digital skills and usage will constitute the second level digital divide. For getting additional insight into the digital divide, there is a need for intensive research that looks not only at the access level of information technologies, but at other factors as well.

Reviews also revealed that socio-cultural factors and psychological factors also affect the Internet use of students even though they have free access to the Internet. In most of the survey oriented studies, questionnaire was the main tool for data collection and SPSS packages was use for data analysis. Thus the studies reviewed about digital divide enable the researcher to conclude that:

1) Most of the digital divide studies were based on socio-demographic characteristics of population.

2) Majority of researchers focussed on either individual factor leading to digital divide or combination of those factors.

3) In-depth studies on digital divide among students in universities are comparatively low.

Thus the literature review revealed that additional study of the digital divide in the context of the university students is important and needed. The literature review also indicated that there is only limited information is available related to digital divide among University students in Indian context. Kerala is among one of the most literate states in India. Here the universities are provided with sufficient computer and Internet connection to most of its departments. Still there is a demand to assess the existence of digital divide among students who enter higher education; because the studies on this area showed that mere provision of ICT access does not guarantee the quality use of modern technologies.

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Chapter 3

METHODOLOGY

3.1 Introduction

The notion of digital divide emerges as a major phenomenon in the digital era due to the rapid spread of information revolution. Hence it gains an increased interest for scrutiny from researchers and policy makers. Researches on the digital divide differ in their focal point and methodology employed. The intention of this study was to investigate the existence of digital divide among the students and to study its contributing factors like socio-economic status and psychological elements. First the investigator focussed on the bibliographic review to describe the variables used for the study. Then the researcher made a methodological framework to understand digital inequalities among the students. The approach to this study was a quantitative research method and objectives of the study were accomplished by conducting a survey with a closed ended questionnaire. This section presents the method and data analysis techniques employed in the study. Further, it includes general and specific procedural information on the sample selection, data collection and a brief description of the questionnaire used.

3.2 Variables

The variables used for the study are broadly classified into two, namely, independent and dependent variables. The following part deals with the variables undertaken for the study.

3.2.1 Independent Variables

Independent variables taken for the study were geographic area, gender, discipline, university and education level as well as income of parents.

3.2.1.1 Geographic Area

New technologies are usually adopted first by people living in central parts of more populous cities and then slowly disperse into its peripheral regions and finally to rural areas. The major issues in providing new technologies, involving computers and the Internet, to rural areas are the high infrastructure costs, lower average wages and lower likelihood of jobs. Among the urban population, the usage of the Internet is significantly higher than those in rural areas. In this study, the investigator tried to understand whether the geographic area of residence (rural or urban) has played any significant role in contributing to the digital divide among the students.

3.2.1.2 Discipline

In some researches, investigators examined the dimensions involving discipline of students to check whether there exist any discipline-wise differences in access and use of technologies. McNaught, Lam and Ho (2009) reported the access diversity and skill difference in the use of a range of technology-based strategies along a variety of disciplines. The application of information technology is higher in Science subjects as compared to other subjects. Here the researcher broadly classified disciplines into Science, Humanities and Social Science, and used as a variable to explore the possible differences in students' access and use of digital technologies as well as their attitude towards ICT.

3.2.1.3 Gender

During the end of 20^{th} century, researchers were quick to realise that girls tend to be latecomers to the digital world when compared to boys. As a result, a new technology was popularly portrayed as male dominant. Previous studies stated that gender specific differences had their inception in the fact that women underestimated their actual skills and remained less proficient in their digital skills to use ICT (Hargittai & Shafer, 2006; Hilbert, 2011) and nurtured a negative attitude towards ICT. Fallows (2005) noticed that men were much interested to use technology than women, and they were also more tech savvy. The investigation tried to analyse whether gender differences can be observed among the students in terms of their access to ICT, digital competency, Internet use and attitude towards ICT.

3.2.1.4 Income and Education

Income has been the most important factor in determining access to ICT. In low income families, the access and use of ICT is limited in general. Students' socio-economic situation correlates with their birthplace, education level of their parents and other family-related socio-economic backgrounds. Looker and Thiessen (2003) explored whether parental education level was one of the key measures that showed a direct relationship with youth's educational experience and access to ICT. Here the researcher tried to analyse the students' socio-economic status by gauging their parents' income and education and checked whether there exists any significant relation between the students' access to ICT, digital competency and the Internet use with their socio-economic factors. The study also analysed whether there exists any significant relation between socio-economic status of the students and their attitude towards the use of ICT.

3.2.1.5 University

Another independent variable selected for the study was university. Differences may exist in the provision of ICT infrastructure in different universities. The modes of Internet connections may also vary in different universities. So there is a possibility of inequalities in Internet usage among the students of different universities. The investigator also attempted to analyse the inequalities existing in the availability of digital devices, Internet connections and also in the use of the Internet by the students from their respective universities.

3.2.2 Dependent Variables

The dependent variables were access to ICT, digital competency of the students, Internet usage level, socio-economic status of the students and their attitude towards ICT.

3.2.2.1 Access to Information Communication Technology

A dichotomous view of the digital divide by Ferro, Helbig and Gil-Garcia (2011) described the digital divide as a simple division between 'haves' and 'have nots': 'Have' denotes those who have access to computers and the Internet and 'have nots' implies those who have not access. Hoffman and Novak (1998) gave the explanation of the term 'access'. According to them, the term access is more than being able to get connected to the Internet. It can also be determined by the speed of a computer or associated hardware which determines the quality of Internet access that can be acquired. The disparity of access should be seen as a range of differences along the dimensions like hardware, software and mode of Internet connection. Access to ICT used in this study refers to all sorts of new technologies that could be used by the academic community. These technologies include computers, mobile devices, the Internet connections, projectors, interactive whiteboards, etc. The study tried to understand the infrastructure divide among the students in their access to ICT from their homes as well as universities. Socio-economic factors and psychological factors may enhance the access of ICT.

3.2.2.2 Digital Competency

While studying the digital divide, the notion of digital competency/digital skills is commonly used in the present scenario. Digital competency is vital for a better use of technology. Digital competency means skills and competence in the use of digital technologies, such as ICT skills, technology skills, Information Technology skills, 21st century skills, information literacy, digital literacy, and digital skills (Ilomäki, Kantosalo, & Lakkala, 2011). Even though the ICT infrastructure facility is made available, some of the students may fail to use modern technology due to their lack of digital competency. So the investigator wishes to know the differences in digital competency (second order divide) of the students which lead to digital divide.

3.2.2.3 Internet Usage

The first level of digital divide denotes the differences in access to digital communication technology. The second level of digital divide can be observed in terms of intensity or diversity in ICT use. Differences can be seen in the time devoted to Internet usage, frequency of Internet use and purpose of Internet use, which also can drive the second level of digital divide. Students' Internet use may be varying according to the social status of their family, due to differences in access to technology available to them, their varying digital experience and also their status specific interests (Zillien & Hargittai, 2009). The aim of this variable was to examine the differences in the Internet use among the students from universities in Kerala. Digital competency level, socio-economic factors, psychological factors, etc. act as contributing factors in Internet usage divide.

3.2.2.4 Socio-Economic Status

Digital inequality is an extension of social inequality. In other words technology accessibility of students depends on their parental income, education, and their support. The nature of the Internet access in relation to social inequalities in the society also shows the presence of high levels of digital inequalities. Those who have ICT access tend to belong to certain groups in a society like well educated, wealthy or privileged (Oyedemi, 2012). Parental education and income are some of the key measures that have been shown to relate with the educational experiences and access to ICT of students. Parents' educational qualification also influences the home access to computer technology among youths (Vigdor, Ladd, & Martinez, 2014). Hence the investigator tried to understand the relationship between socio-economic status of the students and their digital inequalities. Socio-economic status of the students is gauged on the basis of their parental income and educational qualifications.

3.2.2.5 Attitude

Understanding the psychological features (motivation, affective and cognitive components) concerning why the students choose to use or not to use digital technologies are fundamental aspects in determining the digital divide. Psychological affirmation provides a source of personal comfort, consolation and emotional support in the use of ICT. Lack of computer knowledge and Internet skills among students can result in the creation of inexperienced users of technology. So they may be anxious about going online. This anxiety may affect negatively their use of computer and the Internet (Weiser, 2001). Many educators reminded that one of the major issues in the digital divide is connected to the lack of interest in the use of computers and Internet among the students. Here the researcher made an attempt to understand whether the students' psychological factors like lack of interest, motivation, comfort, enjoyment and the overall attitude contributing to the digital divide. This variable also aims to find out the level of attitude towards ICT among university students.

3.3 Sampling Design

The potential population of the study comprises of post-graduate students from state universities in Kerala. There are currently thirteen state universities in Kerala approved by UGC. They are APJ Abdul Kalam Tecchological University, University of Calicut, Cochin University of Science and Technology, Kannur University, Kerala Agricultural University, University of Kerala, Kerala University of Fisheries and Ocean Studies, Kerala University of Health Sciences, Kerala Veterinary and Animal Sciences University, Mahatma Gandhi University, National University of Advanced Legal Studies, Sree Sankara University of Sanskrit and Thunchat Ezhuthachan Malayalam University ("State Universities", n.d). Out of the thirteen universities, the investigation confines to a sample of four universities, namely University of Kerala, Mahatma Gandhi University, University of Calicut and Kannur University. These are the dominant universities in the state of Kerala offering courses belonging to Science, Social Science and Humanities disciplines. Further, these universities represent three regions of the state viz. south, centre and north. The geographical locations of the selected universities are expected to make the population representative of the entire post-graduate students studying in university campuses in Kerala.

The total strength of the students from the four universities was obtained from respective university authorities and also from annual report and diary of concerned university. The researcher also made a discussion with the authorised personnel in the departments wherever clarification was needed. The population of the students from the universities was too large. Hence the size of sample was set following the US National Education Association Statistical Table prepared by Krejcie and Morgan (1970). It is a very commonly used statistical table in Social Science in order to estimate the sample size of a given population. In the article "Small Sample Techniques," the research division of the National Education Association has published a formula for determining sample size which is given below,

$$S = \frac{\chi^2 \, NP(1-P)}{d^2(N-1) + \chi^2 \, P(1-P)}$$

where

S = required sample size,

χ^2= the table value of Chi-square for 1 degree of freedom at the desired confidence level (3.841),

N = the population size,

P = the population proportion (assumed to be 0.50 since this would provide the maximum sample size) and

d = the degree of accuracy expressed as a proportion (.05).

Following to Krejcie and Morgan (1970), there is no need to calculate sample size by applying above equation directly. Only the table proposed by them has to be considered while deciding the sample size. As per the Morgan table, sample size for population up to

100000 is 384. The investigator has taken a representative sample from the population by ensuring adequate representation using two-stage stratified random sampling. First, the researcher considered university-wise strata for taking the sample and then identified the subject-wise/discipline-wise categories of the students, which was taken proportionately from Science, Humanities and Social Science disciplines making the size of the sample 700. Here, Colon Classification (6^{th} edition) was used as a base to categorise the subjects into the three disciplines. Table 1 detailed the total post-graduate students and the sample size chosen from the universities.

Table 1

Sample Size of the Study

Universities	Students	Sample Size	Response (%)
University of Kerala	1378	214	176 (82.2)
University of Calicut	1179	183	145 (79.2)
Mahatma Gandhi University	743	115	111 (96.5)
Kannur University	1207	188	162 (86.2)
Total	4507	700	594 (84.9)

The total strength of full time post-graduate students from these universities was found to be 4507. After obtaining the sample size of the students from the selected universities, following the Krejcie and Morgen table, 700 questionnaires were distributed among the students. The researcher distributed 214 questionnaires to the students from University of Kerala, 183 to those from University of Calicut, 115 from Mahatma Gandhi University and 188 from Kannur University. Out of these, 644 students returned the filled up questionnaire. However, on examination the researcher found that only 594 questionnaires were properly filled by the participants.

Thus the study consisted of 594 students sampled primarily from the four universities in Kerala. This gives a response rate of 84.9 per cent.

3.4 Distribution of the Students

The general profile of the participants is given in table 2. Six independent variables were chosen for the investigation, which include gender, university, discipline, home area and monthly income and educational level of parents. During the data collection, the researcher noticed that female students were highly dominating in number as compared to male students in all the selected universities which may be an indication of the disproportionate gender-wise distribution of students in universities in Kerala. As a result, the researcher got a higher proportion of female students (362) compared to male students (232) in the sample of 594 students.

In the case of universities, about 30 per cent of the responses were from University of Kerala, about 28 per cent of the responses were received from Kannur University and about one fourth of the responses (24.4 %) were from University of Calicut. The number of respondents from Mahatma Gandhi University was low (18.7%) when compared to other universities as its population was small. The table also illustrates the discipline-wise categorisation of responses of the students. As can be seen from the table, the researcher got 207 respondents from Social Science, 194 from Science and 193 responses from Humanities, totalling 594. Another demographic variable selected for the study includes rural-urban division. As shown from the data, the number of participants who live in rural area was higher (429) when compared to that in urban area (165). So clearly, the sample overwhelmingly represents rural population.

Table 2

General Profile of the Respondents

Variables	Category	Frequency (%)
Gender	Male	232 (39.1)
	Female	362 (60.9)
University	University of Kerala	176 (29.6)
	University of Calicut	145 (24.4)
	Mahatma Gandhi University	111 (18.7)
	Kannur University	162 (27.3)
Discipline	Science	194 (32.7)
	Humanities	193 (32.5)
	Social Science	207 (34.8)
Home area	Rural	429 (72.2)
	Urban	165 (27.8)
Monthly income	Below 10000	120 (20.2)
	10000-20000	150 (25.3)
	20001-30000	162 (27.3)
	30001-40000	61 (10.3)
	40001-50000	44 (7.4)
	Above 50000	57 (9.6)

The table also gives the information regarding the income-wise classification of the respondents. As can be seen from the table, the participants were classified into six income groups. In the case of income of parents above a quarter of the respondents (27.3%) came under the range of monthly income Rs. 20001-30000. Analysis also shows that one fourth of the students came under the income category of Rs. 10000-20000 and about 20 per cent of the respondents were identified under the lowest range of income i.e. below Rs. 10000. From the results, it is also understood that only about 28 per cent of the students possessed family monthly income above Rs. 30000.

Parents influence the students' access to digital technologies at personal level. If the parents are better educated, they can better nurture and guide their children. Lack of parental guidance due to their low education level is a factor which may influence the digital inequality among students. Hence educational level of parents is taken as a factor that conditions the students' access to technologies. Thus education level of parents was also taken as an independent variable.

Table 3

Distribution of the Respondents Based on Educational Status of Parents

Educational Level	Frequency (%)	
	Father	Mother
Below SSLC	155 (26.1)	132 (22.2)
SSLC or +2/Pre-degree	317 (53.4)	324 (54.5)
Degree	83 (14)	104 (17.5)
Post-graduate	28 (4.7)	23 (3.9)
Above post-graduate	8 (1.3)	8 (1.3)
Late	3 (0.5)	3 (0.5)
Total	594 (100)	594 (100)

Data based on the educational level of parents are shown in the table 3. As detailed in the table, above half of the parents had SSLC/Pre-degree level of qualification. In the class 'below SSLC', above one quarter of fathers (26.1%) and only over one fifth of mothers (22.2%) were grouped. The number of parents who had degree level of qualifications was also low (14% and 17.5% for father and mother, respectively). A very limited number of parents possessed above degree level qualifications.

3.5 Data Collection Tools

Much of the investigation on the digital divide has been survey oriented. The study also used the survey method of research which is very suitable to collect representative data from a large population. The study used a well structured questionnaire for the data collection. Observation and interaction with the students and administrative staff were used to gather additional information. The questionnaire with a covering letter briefly described the topic and assured the respondents that the information provided by them will be kept strictly confidential. Questionnaire was divided into five different sections. Each section was designed, paying attention to each variable of the research. Based on prior study items and newly formulated ones, a basic pool of possible questions (and possible answers) was formed. First, the researcher designed a preliminary version of the questionnaire consulting the supervising teacher. This version was given to other experts in the field. Comments from the experts on formulation, syntax, and the number of items handled were taken into account and researcher made minor changes to the questionnaire. These were re-examined by experts and corrected accordingly. Finally, a 27-item questionnaire was prepared and presented in proper format (Appendix 1).

Majority of questions were asked employing the Likert Scale, as it is the most commonly used scale in survey research and enables the participants to specify their feeling and intensity to use technologies. The close ended questionnaire was split into five sections. Section A was quite general and demographic in nature. The first part (Section A) aimed at gathering students background information including gender, universities, subject of the study, residential area, parents' income and educational level, and students' experience in the use of computer. It also covered questions on whether they had undergone any technology related courses and their approximate monthly cost for Internet access.

In part B, students were asked to provide the information about their accessibility to computer and other digital devices at personal level and the nature of their ownership of computer and other digital devices at home. The researcher also tried to know about the availability of digital devices in their departments of study. Further this section included questions about the students' access to Internet connections and their use of different software. Questions regarding the level of barriers faced by the students to acquire and use the ICT were also covered in this section.

Third part (Section C) was designed to gauge the digital competency of the students. In this part, students were asked to indicate the sources for learning digital skills and their expertise in handling various digital devices. Kjølseth (2008) analysed the digital competency on the basis of eight ICT areas operationalised with 34 types of skills. These ICT areas are: defining information needs, access to information, technological self-reliance, information management, information assessment, integration of information, communication and information sharing and creating information. Following Kjølseth (2008), the researcher included problem solving capacity also as an ICT area in order to measure the digital competency. The survey was not based on test, but more of a self assessment type. The respondents were asked to denote their level of expertise with regard to common ICT processes and areas of use. For each of the 37 measurement skills, respondents were requested to give an answer on a scale from 0 to 4.

The fourth section (Section D) was composed of questions related to Internet usage. In this section researcher asked the questions about the period and frequency of the Internet usage, the intensity of the Internet use (differences in the time of use) and the locations from where they access the Internet. Next part of questions considered the frequency of use of the Internet related activities, e-resources and the purposes of use of the Internet by a five point scale (0 = Never, 4= Always).

The final part of questionnaire (Section E) contained questions related to the attitude of the students towards ICT. It consists of 38 items covering four attitude domains: (1) an anxiety or fear, (2) confidence in one's ability to use or learn about ICT; (3) a liking or enjoyment of working with computers and other digital devices; and (4) perceived usefulness of technology in present or future work. It is in the 'Likert' format and the response alternatives being strongly disagree, disagree, neutral, agree and strongly agree. The subcategories of the attitude scale were based on Loyd & Gressard (1984) Computer Attitude Scale (CAS) for measuring attitude towards computers. Finally, the questionnaire also contained an open question to the students for their suggestions to improve the access and use of ICT.

3.6 Data Collection Procedure

A few questionnaires were distributed as part of a pilot study in order to ensure that the students had no difficulty in understanding the precise meaning of the constructs and grammar used. Further, the pilot study also helped the researcher to determine the validity of the questionnaire, applicability of the scales used and clarity of statements. The pilot study did not show any major difficulties in answering the questionnaire. However, some minor corrections were applied to make the questionnaire more readable.

The research design used a self-administrated survey approach whereby the paper based questionnaire was distributed among the students from the universities. After taking due permissions from concerned university authority, the researcher approached the students directly and distributed the questionnaire. Clarifications were given to the students as and when necessary, even though instructions were provided in the questionnaire itself for filling it. Questionnaires were administered in such a way that the students from different disciplines got enough statistical representation. The filled up questionnaires were collected by the researcher for data analysis.

3.7 Tools and Techniques for Data Analysis

The collected data were segregated and consolidated with Microsoft Excel. Statistical Package for Social Sciences (SPSS), version 21 was used to do the statistical analysis. After coding, the data were imported from Excel to SPSS. Various statistical tests were performed with SPSS and the results were indicated through tables and graphs with proper interpretations. Pie diagrams and bar charts were used to indicate the data in graphical representation. The researcher used the following statistical techniques at different stages to draw the findings and conclusions.

- Simple Percentage method: It was used to consolidate the whole collected data.
- Arithmetic Mean: It is the value of the variable obtained when the values of all the observation are added and the sum is divided by the number of observation.
- Standard Deviation: It is an average distance from the mean of the observations in a data set (Iversen, 1997).
- Correlation Analysis: The statistical technique that can be used to study the degree of relation between two variables is the Correlation Analysis. Two variables are said to be

correlated if the change in one variable results in a corresponding change in the other variable. Correlation can be defined as “the tendency of two or more groups or series of items to vary together directly or inversely. Coefficient of correlation can be calculated by applying the methods like Karl Pearson’s and Spearman’s method (Potti, n.d.).

- Kolmogorov-Smirnov Test: It is a non-parametric test used to compare a sample with a reference probability distribution or to compare two samples. This test can be modified to test the goodness of a fit as well.

- Chi-square test: It is an inferential statistical test that is used to examine relationships or association between two variables with nominal or ordinal data. The Chi-square value measures the discrepancy between the observed frequencies and expected frequencies. The larger the Chi-square score, the larger the discrepancy, and the more likely that the two variables being studied are related. If the calculated value of Chi-square is less than the table value, it indicates that the difference between actual and observed frequency is due to chance of variation and can be ignored.

- ANOVA: It is an inferential statistical test used to determine if the differences among three or more sample means are statistically significant. ANOVA test can be applied only if: a) the sample group are randomly and independently selected b) the data are of interval or ratio type c) there is normal distribution in the population from which the sample is selected and d) the variability within groups are fairly similar (Vaughan, 2009).

- Kruskal Wallis ANOVA: It is a non parametric test used when the assumptions of one-way ANOVA are not satisfied. It can be applied on more than two groups of scores that are considered independent (Kothari, 2004).

- Mann-Whitney U Test: It is also a non parametric test used to compare two sample means that come from the same sample. The application of this test is to check whether two sample means are equal or not.

- Duncan's Multiple Range Test (DMRT): This test is applied as a multiple comparison procedure to compare samples by using their means.

- Z-test: This test is based on the normal probability distribution. The test is applied for justifying significance of several statistical measures, especially the mean. It is usually applied for comparing the mean of a sample to some hypothesised mean for the population in case of large sample, or when population variance is known (Kothari, 2004).

3.8 Conclusion

In this unit, research design has been presented in detail. This research design is helpful in order to minimize the errors in data collection and analysis. Here the investigator discusses the methodological approaches that are made to find out the phenomenon of digital divide among the students. These methodological approaches elaborated the dependent and independent variables, population and sample of research, sampling design, data collection tool and the process of data collection. The researcher also gives a short narration of different statistical techniques used in the study for making description and generalization. A detailed report of data analysis and interpretation of collected data in descriptive form is explained in the next chapter.

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Chapter 4

ANALYSIS AND INTERPRETATIONS

4.1 Introduction

The collected data were analysed to unravel information regarding the existence of digital divide among the students. Here the researcher has analysed data by taking different aspects enclosed in the questionnaire regarding the differences in ICT access, digital competency and the Internet use. The investigator also analysed whether socio-economic status and psychological factors contribute to the digital divide among the students. Once the filled questionnaires were gathered from the students, data were coded and entered into a spreadsheet and were subjected to analysis with SPSS. Several statistical procedures are used in the study.

In this chapter, the investigator expounds the results of analysis and interpretation of primary data collected from 594 students of the selected universities for identifying the nature and spread of the digital divide among the students. The data analysis was done by applying both descriptive and inferential statistics. For analysing the categorical variables, the researcher used descriptive statistics like frequencies, percentages, and cross-tabulations. Inferential statistics like Chi-square, ANOVA, Correlation, Mann-Whitney U Test and Z-test were also used for testing the hypotheses. The analysis is presented in tabular forms and also in diagrams wherever necessary. As already mentioned in the previous chapter, the data are interpreted in a descriptive manner.

4.2 Access to ICT

Technological access is a fundamental requirement for ICT use that describes one's accessibility to the digital world. Those who have easily attainable access to ICT infrastructure are more likely to involve in digital activities. A large number of studies examined the divides in the physical access to digital devices, especially personal computers as well as the Internet among various demographical categories. Chikati (2013) mentioned that access to ICTs from home and schools is essential for satisfying the digital need of students and to improve their capacity to use various ICT devices and programs. According to Hargittai (2002), people who had access to quality computers with fast Internet connections at home or at work were much more poised to possess high levels of experience, when compared to those without access to such digital resources. According to the researcher, the possession of better hardware, software and faster connection of the Internet are important basis for accessing all that the Web has to offer. So access to digital technologies is an important component while determining the digital divide. Studies on physical access explain the issue of little or limited availability of Information Technology which is noticeably an important element in alleviating the digital divide. Access to ICT in this context refers to the availability and accessibility of technological devices couple with an Internet connection.

4. 2.1 Access to Digital Devices at Personal Level

The world is experiencing different economic crises and in this situation it is noticeable that every parent cannot afford the cost of expensive digital equipment for their children. Although computers are available to students from their educational institutions, many students do not have sufficient access to the same. So access to ICT is limited in some students, while in some others it is greatly unrestricted due to various socio-economic factors. Hence the investigator first attempted to explore students' level of accessibility to a range of technological devices at personal level. Students were asked to indicate their level of access to digital devices. Here, the unrestricted access denotes the availability of digital devices to the students whenever necessary and restricted access indicates the limited access to digital devices. The results are presented in table 4.

Table 4

Type of Access to Digital Devices at Personal Level

Devices	Frequency (%)		
	Unrestricted (Free) Access	Restricted (Limited) Access	No Access
Desktop Computer	213 (35.9)	209 (35.2)	172 (29)
Laptop Computer	243 (40.9)	139 (23.4)	212 (35.7)
Netbook/Notebook Computer	25 (4.2)	52 (8.8)	517 (87)
Tablet	84 (14.1)	58 (9.8)	452 (76.1)
PDA	10 (1.7)	23 (3.9)	561 (94.5)
Land Phone	158 (26.6)	97 (16.3)	339 (57.1)
Mobile Phone (With Internet)	411 (69.2)	129 (21.7)	54 (9.1)
Digital Camera	118 (19.9)	91 (15.3)	385 (64.8)
MP3/MP4 Player/IPOD	179 (30.1)	72 (12.1)	343 (57.7)
Printer	71 (12)	93 (15.7)	430 (72.4)
Scanner	45 (7.6)	72 (12.1)	477 (80.3)
E-book Reader	52 (8.8)	46 (7.7)	496 (83.5)

The table sheds light on the differences in access to various digital devices among the students at personal level. It highlights that a high proportion of the students (69.2%) have unrestricted access to mobile phone with the Internet connection. The data show that over one third of the participants have unrestricted access to laptop (40.9%) and desktop computer (35.9%). It can also be seen that the percentage of students that lacked laptop and desktop computer is 36 and 29, respectively. At the same time, a reasonable number of the students (35.2%) have limited access to desktop computer whereas in the case of laptop, nearly one fourth of the students (23.4%) hold only a limited access. Considering the Personal Digital Assistant (PDA) and netbook computer, a vast majority of the students (94.5% and 87%, respectively) replied that they have no access to these devices. A relatively high proportion of the students also do not have access to digital devices like e-book reader (83.5%), scanner (80.3%) and tablet (76.1%). In the case of land phone, only above one fourth of the students enjoyed unrestricted access while above half (57.1%) of them had no access to a land line connection. The table also shows, though not surprisingly, that a great majority of the students have a minimum level of access to devices like printer and camera.

The result of the analysis emphasised the lack of homogeneity among the students with regard to their access levels of different digital devices and an inherent digital divide may be presumed to exist among them. A similar trend was illustrated by Kennedy et al. (2008) by determining the extent to which Australian students' level of access to digital technologies. While some respondents have embraced the modern digital devices of 'Net Generation', this is not reflected in the universal student experience. As inferred from the table, access to a mobile phone with Internet connection was higher among the students in comparison with the land line connection. This supports the fact that in most countries, mobile phones quickly outnumber land phones. It is one of the most positive ways to bridge the digital divide due to easy availability of mobile phones and affordability of its services as well as applications. Still there exist small differences in its access. Lack of access to desktop computers and laptop at personal level is still a major problem among the students. The output of the analysis also described that the devices like netbook computer, tablet, printer, scanner and MP3 player have a minimum level of access among the students.

Based on the result presented in table 4, the researcher made a score for access to digital devices for knowing the divide in overall level of access at the students' personal level. It was calculated by adding the scores of access to each ICT device. The researcher classified the devices in to three categories i.e., for each device if there is no access, a score of zero was given, for restricted access a score of one was given and for non-restricted access a score of two was given. As there are 12 devices listed in table, a total score of access to digital devices ranges in between 0 and 24. As mentioned above, this range is divided into three groups like low access group with scores ranges in between 0 to 8, medium access group with scores ranges in between 9 to 16 and high access groups with scores ranges in between 17 to 24. Classification of devices according to the level of access is given in table 5. This table is taken as a basis for further analysis to find out the relationship between access to digital devices and different socio-economic factors.

Earlier studies on digital divide generally stick on stress in the physical access (first order digital divide) to ICT. As Dewan and Riggins (2005) stated, the first level of digital divide is inequalities in accessing ICT. Here the investigator attempted to seek first order digital divide in terms of level of access (high, medium and low) to digital devices at a personal level.

Table 5

Level of Access to Digital Devices

Level of Access	Frequency (%)
Low	382 (64.3)
Medium	183 (30.8)
High	29 (4.9)
Total	594 (100)

As the percentages in table 5 indicate, vast majority of the students (64.3%) has a low level of access to overall digital devices and about one third of the students (30.8%) have a medium access to technological devices. Meanwhile only a small number of the students (4.9%) were seemed to be well versed with technological devices. So the result can be interpreted as a clear divide existing among the students in terms of access to digital devices at a personal level. Here the researcher established the fact that digital divide is often recognized in terms of a 'hardware divide' appearing due to the lack of access to ICT resources as stated by Lebens, Graff and Mayer (2009). The result also justified the assertion by Van Dijk (2012), who mentioned that physical access divide still persists in developing countries. However, as one would imagine, it is not prominent in developed countries.

4.2.1.1 Gender-wise Differences in Access to Digital Devices

The different levels of access to ICTs are related to individuals and their characteristics like level of income and education, nature of employment, age, gender, and ethnicity. Digital divide is an extension of social inequalities or it is a modern manifestation of social inequalities. Some of the most important variables that remain as prominent background characteristics are income, education, occupation, gender and age of the participants. High gross income is almost always an essential prerequisite for having physical access to digital resources followed by age and education (Martin, 2003; Van Dijk & Hacker, 2003). As the population of the study is the student community, the investigator decided to analyse the physical access divide in terms of socio-economic or socio-demographic factors like gender, place of residence (rural and urban) and the levels of their parental income. In other words, three factors were processed by the researcher to find the dynamics of the physical access: gender, rural versus urban and income of parents. Table 6 exhibits gender-wise differences in the level of access to digital devices among the students.

Table 6

Gender-wise Differences in Level of Access to Digital Devices

Level of Access	**Frequency (%)**	
	Male	**Female**
Low	113 (48.7)	269 (74.3)
Medium	98 (42.2)	85 (23.5)
High	21 (9.1)	8 (2.2)
Total	232 (100)	362 (100)
Mean ± SD	9.17 ± 5.12	6 ± 4.27
Chi-square = 44.120**; p-value < 0.001		

*** Significant at 0.01 level*

The table demonstrates that, above half of the male students have either medium (42.2%) or high (9.1%) access to digital devices when compared to female students, as only one fourth of the female students have the same levels of access. Similarly female students also exceed the male respondents in the case of low level access to digital devices. Therefore, a considerable difference prevailed between male and female students concerning their access to digital devices at a personal level.

In order to assess the statistical significance of the difference in mean values, Chi-square test was performed. The test returned a p-value of less than 0.001 which shows a statistically significant difference at one per cent level between male and female students in their level of access to digital devices. The mean score obtained by male students for access to digital devices is 9.17 (SD=5.12) while that for female students is 6.00 (SD=4.27) indicating that former are better positioned towards access to digital devices than the latter. The situation here is as described by Hilbert (2011), where women appear late comers in the digital world and contribute significantly to the gender bias. The same pattern has been reported by Teo and Lim's (1997) in Singapore and stated that there was a differential access between boys and girls in terms of technology.

4.2.1.2 Access to Digital Devices and Place of Residence

Another independent variable that is frequently used in the literature of digital divide is geographic distinction (rural and urban) of respondents. Historically, students from rural areas had limited access to computers and the Internet compared to those from urban area. This difference can also be seen among schools located in rural and urban areas. Scott (2010) pointed out that rural secondary schools have worse infrastructure than their urban counterparts in

South Western Nigeria. Here the researcher decided to check whether students from rural and urban areas show any notable division in their access to digital devices at personal level. The findings are presented in table 7.

Table 7

Level of Access to Digital Devices among Rural and Urban Students

Level of Access	Frequency (%)	
	Rural	Urban
Low	285 (66.4)	97 (58.8)
Medium	126 (29.4)	57 (34.5)
High	18 (4.2)	11 (6.7)
Total	429 (100)	165 (100)
Mean ± SD	6.92 ± 4.74	8.05 ± 5.11
Chi-square = 3.609^{ns}; p-value = 0.165		

ns non-significant at 0.05 level

The distribution of the level of access to digital devices among the respondents is shown as a function of their place of residence in the table. It can be seen that, out of 429 students from rural areas, 18 have high level, 126 have medium level and 285 have low level of access to devices. In the case of 165 urban students, the numbers are 11, 57, and 97 respectively. As a reflection of the digital divide, the table reveals that the proportion of urban students exceeds in medium and high levels of access to digital devices, while that of rural students outnumber in the low level access category. In a trial to find out an association between place of residence of the students and their level of access to digital devices, Pearson Chi-square is evaluated. As the p-value is found to be 0.165, the result indicates that there is no association between place of residence and access to digital devices among the students. So it can be concluded that the association between place of residence and access to digital devices among the students are statistically non-significant. Even though the result is statistically non-significant, the table shows that the mean value obtained for access to digital devices for urban students (8.05) is higher than that for their rural counterparts (6.92). Hence it appears that the urban students possess a slight edge over the other ones, even though the differences in the mean values for different classes are statistically non-significant. Thus the researcher reported that the digital divide in terms of personal level access to digital devices was not significantly different between the students who live in rural and urban areas. Historically the students in rural areas have limited access to computer than their urban counterparts. Hindman (2000) noted that a high per cent of urban residents have adopted and used different information technologies than the rural residents. But the result showed that now the situation has changed to some extent as the students from rural and urban areas did not reflect any notable differences in access to digital devices.

4.2.1.3 Income and Access to Digital Devices

It is a truth that, the home environment forms an important factor in cultivating student's approach towards new technologies. Another factor that definitely influences the level of ICT access among the students is the gross income of their parents, as it emphasises the extent to which a parent can afford the cost of digital technologies. In many studies, it has been proven that income is not only a vital factor for physical/material access to ICT but also specifies limits of ICT usage. Hence the investigator tried to check whether there is any change in the access to digital devices as the income category changes by the Kruskal Walli's ANOVA (table 8) test. The test statistic Chi-square value was found to be significant as the p-value is less than 0.001. This shows that there is a significant difference in the access to digital devices as the income status changes. Hence, Mann Whitney U test was also done in order to compare pair wise differences. Results show that participants in the 'Below 10000' group have significantly lower access compared to all other groups, as the group had the lowest value for the mean. It can also be seen that the mean value systematically increases with increasing income, except for the last two (highest income) groups. As already mentioned no significant difference in the digital access was found between the groups '40001 to 50000' and 'Above 50000' groups. The correlation coefficient of income with access to digital devices was found to be 0.628 which is positive and significant at 0.01 level. That also confirms the fact that as the income increases the level of access to digital devices also improves.

Table 8

Association of Access to Digital Devices with Income Level

Income level	**Mean**	**Std. Deviation**
Below 10000	3.27^{a}	2.36
10000-20000	5.53^{b}	3.52
20001-30000	7.42^{c}	4.04
30001-40000	10.16^{d}	4.62
40001-50000	12.57^{e}	4.56
Above 50000	12.32^{e}	4.59
Chi-square = 237.217** p < 0.001		
Correlation of Income with access to digital devices = 0.628** p< 0.001		

*** Significant at 0.01 level*

The means having same letter as superscript are homogeneous

OECD (2001) reported that income distribution is important early in the penetration of a new technology, with higher income groups possessing ICTs early and leading the uptake. In that report, it was found that household or individual income is a determinant of the presence of PCs and the extent of the Internet access from homes. A matching result can be observed in the current study.

4.2.2 Internet Access

The Internet enhances remarkably the individual collective capacity to store information, search through huge amount of information rapidly and retrieve required content quickly. Access to the Internet is an important resource and hence disparity in the Internet access can be an important public policy issue. Previous researches on digital divide (e.g. Van Deursen & Van Dijk, 2011) established that individuals with a higher level of access to the Internet possessed better ability/skill to use the Internet. Inequality in access to the Internet among individuals is attributable to the poor condition of ICT infrastructure in society. This is an indication of existence of first level digital divide.

When observing the Internet divide in Macao, Jin and Cheong (2008) found that Internet access divide was the largest one among the other digital divide indexes (Internet penetration rate, use time divide, e-mail usage divide, etc.) from the survey data bank over a period of six years (2001 to 2007). In the current study, the investigator tried to understand the availability of the Internet to the participants at a personal as well as university levels. Individual and home Internet connections (personal level) provide a big advantage as it offers a great flexibility and opportunities for regular usage without any hindrances (Oyedemi, 2012). In the case of Internet access in universities, students may not enjoy the Internet facility when they move out of campus. Several studies revealed that students with digital access both in their houses and schools do better scholastically than those who had access only in schools (e.g. Lei & Zhou, 2012).

To know the infrastructural facilities available in campuses for Internet connections, the researcher discussed and interacted with the students as well as officials in charge of these facilities in the universities. It was found that the University of Calicut, Mahatma Gandhi University and University of Kerala had both Wi-Fi and Ethernet connections in the campus. In Kannur University, only the Palayad campus had Wi-Fi Internet connection. However, the other campuses were not even connected by the Ethernet. Even though Wi-Fi connections were available in all universities, there were regions or departments where Wi-Fi signals were weak or absent. Similarly there were variations in the level of availability of computers connected to the Internet in different departments. So a lack of adequate ICT infrastructure facilities in university campuses also contributes to digital divide among the students.

4.2.2.1 Personal Access to the Internet

Next, the investigator exposed the differences in individual access to the Internet among the students. Ownership to fixed and mobile communication technologies and high-speed Internet connectivity are one of the major aspects of digital divide (Lee, Park & Hwang, 2015). It is a basic essential for reducing the second and third level digital divide. Table 9 puts its emphasis on the personal level access to the Internet. The respondents were asked whether they have access to the Internet at personal level.

The responses shown in the table indicate that a large number of the students (81.6%) had access to the Internet while only a few of them (18.4%) lacked it. Further, detailed analysis revealed a gender-wise difference in accessing the Internet. A vast majority of the male students (90.5%) said that they have access to the Internet at personal level while the same was true for three fourth of the female students (76%). However, lack of access to the Internet among female respondents was higher when compared to their male counterparts. This is an indication of imbalance in physical access to technology among male and female students especially in terms of Internet access.

Table 9

Personal Access to the Internet

Level of Access	**Frequency (%)**		
	Male	**Female**	**Total**
Have access	210 (90.5)	275 (76)	485 (81.6)
No access	22 (9.5)	87 (24)	109 (18.4)
Total	232 (100)	362 (100)	594 (100)
Chi-square = 19.979**; p-value < 0.001			

*** Significant at 0.01 level*

Then the researcher tried to find out whether any significant differences between male and female participants in their access to the Internet at personal level. The result of Chi-square test disclosed that the variations in access to the Internet among male and female respondents are statistically significant at 0.01 levels with a Chi-square value 19.979, and the corresponding p-value being less than 0.001. Again the result proved that one of the most surviving technological disparities is the gender divide. A similar finding has been established in many ways by various researchers (Cooper, 2006; Livingstone & Helsper, 2007), where women lag behind men in accessing the technologies due to multiple factors. According to their description, men own as well as use computers and the Internet more than women.

4.2.2.2 Modes of Access to the Internet

Advancements in the technology over the years changed rapidly the types of Internet connections and speed with which the students connect to the Internet. The earlier connection of the Internet was dial up using land phone lines coupled with an external modem. Then broadband connection with higher speed with the same telephone line became popular. Now broadband connections are available through fibre optic connections also. At the same time developments in mobile technology resulted in Subscribers Identity Module (SIM) based Internet connections shifting the world of fixed access to a mobile access to the Internet. In the table 10, an attempt is made to describe the types of Internet connections enjoyed by the students.

Table 10

Modes of Access to the Internet

Mode of Internet Access	**Frequency (%)**		
	Unrestricted (Free) Access	**Restricted (Limited) Access**	**No Access**
Dial up	6 (1)	13 (2.2)	462 (77.8)
Broadband (cable/wiFi)	131 (22.1)	88 (14.8)	262 (44.1)
USB-Dongle	77 (13)	93 (15.7)	311 (52.4)
Mobile Internet	261 (43.9)	191 (32.2)	31 (5.2)

Here the mode of Internet access was categorized in to three: Unrestricted, restricted and no access. The unrestricted access to Internet was used to refer the type of access which is possible whenever they needed. Table shows that a large fraction of the students enjoy the mobile Internet with 43.9 and 32.2 per cent in the unrestricted and limited classes respectively. This is followed by broadband Internet access with 22.1 and 14.8 per cent in the unrestricted and restricted classes, respectively. From the survey it can also be seen that a few respondents use USB dongles for Internet connection, while the least popular one is the dial up connection.

An observation of data on table 10 indicates that mobile phone overtook the computers as most students access the web using it. A corresponding prediction was made by Gartner (2010). Srinuan, Srinuan and Bohlin (2012) opined that the advantage of mobile Internet as an alternative for reducing the digital divide is very vivid, especially in developing countries. Another important subset of the digital divide debate concerns the broadband access. A comparatively low level of access to broadband can be seen from the data. In short, the table shows that great variations exist among the students in accessing the Internet. There are differences in the access technologies (dial-up, cable, wireless) also, which in turn, indicate the differences in the quality of Internet connection the students enjoyed.

For understanding the overall divide in different modes of Internet connection among the respondents, the investigator categorised the access into three classes; high, medium and low (table 11). A score for access to the Internet was calculated by adding the scores of access to each mode of Internet connection. For each type of connection, if there is no access, a score of zero was given, for restricted access a score of one was given and for non-restricted access a score of two was given. As there are four modes of Internet connection, this ensures that a total score of access to the Internet ranges between 0 and 8. This range is divided into three groups: 1. Low access group with scores range between 0 and 2, medium access group with scores ranging between 3 and 5 and high access groups with scores from 6 to 8. Classification according to the level of Internet access is given in table 11. This classification is taken as a basis for analysing the contribution of socio-economic/socio-demographic factors towards the mode of Internet access.

Table 11

Level of Access to the Internet

Level of Access	Frequency (%)
Low	363 (61.1)
Medium	202 (34)
High	29 (4.9)
Total	594 (100)

Regarding the level of access to the Internet, the data revealed that only 29 (4.9%) of them enjoyed a high level Internet access with different modes of Internet connection. The data also show that above half of the students (61.1%) have low level access. Concerning the medium level access, 34 per cent of the students come under this category. The result again supports the existence of a first level digital divide among the students in terms of Internet access. Here the researcher supposes that the students with high access to different types of Internet connection may utilize it better when compared to those from the other categories. To enjoy the advantages of the Internet sufficiently, personal and household forms of access provide the best platform (Oyedemi, 2012). The researcher also mentioned that the method (how) and the place (where) participants access the Internet have implications on their ability to reap its benefits. So a personal level high Internet access is considered very important for alleviating types of inequalities that may arise in digital skill and usage.

4.2.2.3 Gender-wise Differences in Internet Access

Reviews related to digital divide researches explored that gender, socio-economic status, race, and age act as key factors that contribute to disparities in the access to the Internet (Gündüz, 2010; Oyedemi, 2012; Tustin, Goetz & Basson, 2012). Works that observed the association of various socio-economic variables to Internet access have proved that some differences certainly exist in the Internet access among population segments in different countries. Among these variables, gender divide is one of the social factors that affect Internet access. The data in the table 12 display the gender-wise differences in the level of Internet access. When the level of Internet access with regard to gender is examined, the percentage of male students exceeds in both categories (high level access and medium level access) than female students, and not surprisingly, the latter dominate in the class of low level of access. Then Chi-square test was run to find out whether any significant difference existed in the level of Internet access across gender. The difference was found to be statistically significant at the level of 0.01, as the p-value is less than 0.001. The mean value for the male students is also higher than female students. Hence the male students have significantly higher level Internet access than their female counterparts.

Table 12

Gender Differences in Access to the Internet

Level of Access	Frequency (%)	
	Male	**Female**
Low	120 (51.7)	243 (67.1)
Medium	93 (40.1)	109 (30.1)
High	19 (8.2)	10 (2.8)
Total	232 (100)	362 (100)
Mean ± SD	2.76 ± 1.73	1.92 ± 1.64
Chi-square = 18.157**; p-value < 0.001		

*** Significant at 0.01 level*

A similar pattern of access divide has been seen in the case digital devices (table 6). The outcome of the analysis exhibits the inequalities in the nature and quality of Internet access among male and female students that are comparable to the findings of Livingstone and Helsper (2007). According to their result, boys have enjoyed more quality of Internet access than girls. Chen and Wellman (2004) also reported that gender affects access to the Internet in a significant way. They opined that ladies were less likely in accessing the Internet than gents.

4.2.2.4 Rural-Urban Divide in the Internet Access

Although the number of broadband connections increased significantly, variations in access, the so-called geographical digital divide persisted in the world, especially in developing and underdeveloped countries. Greenstein and Prince (2007) put forward that many studies dealing geographical digital divide were centred on the gaps in Internet access between urban and rural areas. Hence, this study also tired to seek whether any differences exist among the respondents in the level of access to the Internet according to their place of residence (rural and urban).

Table 13

Rural-Urban Divide in the Internet Access

Level of Access	**Frequency (%)**	
	Rural	**Urban**
Low	276 (64.3)	87 (52.7)
Medium	136 (31.7)	66 (40)
High	17 (4)	12 (7.3)
Total	429 (100)	165 (100)
Mean ± SD	2.13 ± 1.69	2.56 ± 1.79
Chi-square = 7.715*; p-value = 0.021		

** Significant at 0.05 level*

With regard to the level of Internet access, table 13 discloses that the respondents from urban area have more access in the cases of high and medium access levels, when compared to rural ones. On the other hand, the fraction of students coming from rural area is overwhelming in the case of low level Internet access when compared with their urban counterparts. A minute difference in the mean values is also obtained in this case. Additionally, this study employed a Chi-square test to analyse the association between two variables; the level of Internet access and place of residence. Result implied that there is an association between the prescribed variables at 5 per cent level of significance as the p-value is equal to 0.021. In other words, students living in urban areas are significantly more likely to have Internet access than the students living in rural areas. Here the findings reiterate the result of Hindman (2000) that the urban population seems to enjoy high Internet diffusion rate and that they adopt and use various forms of ICT faster than rural population.

4.2.2.5 Association of Family Income with the Internet Access

Wise (2013) reported that financially disadvantaged people had lower access to home broadband, mobile Internet and smart phones. Hence the economically weak groups are more likely to fall under the disadvantaged side of the digital divide (McKenzie et al., 2014). As already mentioned, income is a major source that acts as a determining factor in the personal level access to various modes of Internet connections. Accordingly, the researcher analysed whether there is any change in the access to Internet connection as the income category changes, by applying Kruskal Walli's ANOVA (table 14).

Table 14

Internet Access and Income Level

Income level	Mean	Std. Deviation
Below 10000	0.81[a]	0.88
10000-20000	1.47[b]	1.26
20001-30000	2.56[c]	1.55
30001-40000	3.07[d]	1.29
40001-50000	3.84[e]	1.52
Above 50000	4.33[e]	1.31
Chi-square = 258.03** p < 0.001		
Correlation of Income with access to Internet = 0.658** p< 0.001		

*** Significant at 0.01 level*

Means having same letter as superscript are homogeneous

Like in the case of access to digital devices and income relationship (table 8), the test statistic Chi-square value is also found to be significant as the p-value is less than 0.001. The result implied that there is significant difference in the access to the Internet as the income status changes. Therefore, Mann Whitney U test was done for pair wise comparison of different groups. Results confirmed that the families in the 'Below 10000' class had significantly low level Internet access when compared to all other groups. It is also evidenced that up to the group that come under rupees '40001 to 50000', a significant increase in the access was noted as the income level increases. However there was no significant difference in the Internet access between the groups '40001 to 50000' and 'above 50000'. The linear correlation coefficient of income with access to the Internet is found to be 0.658 which is positive and significant at 0.01 level. It also establishes the fact that as the income level increases; access to better Internet connections also improves. In support to this result, Emmanouil and Evgenia (2009) reported that household with higher income are more likely to access the Internet than those who had low levels of income.

4.2.3 Level of Access to ICT

The term digital divide had been primarily recognised as the establishment of groups of people with and without computers and Internet. Recently these words have been succeeded with the new forms of ICT, like laptops and smart phones. Lack of access to these technologies is a primary factor that contributes to the digital divide. As Koss (2001) noted, lack of access to these technologies can have an adverse effect on the youth's effective participation in the society even in developed countries. Therefore, it is essential to analyse whether any significant variation exists among the students in the overall access to ICT at personal level. The result of the analysis is shown in table 15.

Table 15

Level of Access to ICT

Level of Access	Frequency (%)
Low	368 (62.1)
Medium	201 (33.8)
High	25 (4.2)
Total	594 (100)

Here the researcher measured the overall access to ICT among the students by adding the scores of access to various digital devices as well as access to various modes of Internet connections. Altogether there are 16 items (twelve digital devices and four types of Internet connections), giving a total score of access to ICT ranging between 0 and 32. Further, this range is divided into three groups. The first one classified as low access group with scores ranging between 0 and 10, and second one categorised as medium access group with scores ranging from 11 to 21 and the third group of highest access with scores ranging between 22 and 32. Classification according to the level of access to ICT is given in table 15.

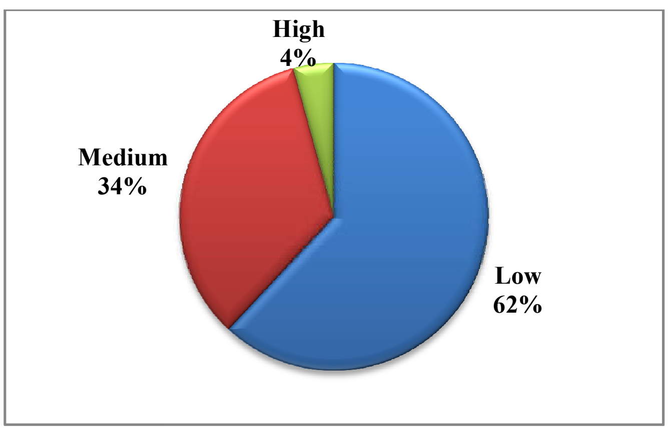

Figure 2. ICT Access Divide

As can be seen from the table and figure 2, majority of the students (62.1%) fall under the low technology access group. About one third of the students claimed a medium level of access, while the number of students came under the class of high access to technologies was extremely low. Hence the investigator interpreted the result as the reflection of the existence of a gap between the students with effective access to ICT and those with very limited or no access at all (Loan, 2011; Ukpebor & Emojorho, 2012). It depicts the disparities in the level of physical access to technologies among the students. The research thus reminds that smooth access to the Internet and quick adoption of new technologies are very important for exploiting the benefits of ICT and to alleviate the disadvantages arising from the digital divide.

4.2.3.1 Gender Bias in ICT Access

In contrast to developed countries where women's ICT access and usage often overreaches that for men, there exists a pronounced gender digital divide in developing countries (Antonio & Tuffley, 2014). The earlier results in this area of study revealed that there exists a significant disparity along gender line in the level of accessibility to digital devices and Internet connections. Hence the researcher attempted to understand whether any gender disparity existed among the respondents in their overall access to ICT.

Considering the gender differences in the overall access to ICT (table 16), it can be observed that girls systematically lag behind boys. Around half of the male students (46.1%) remain in the low level of ICT access, while it is close to three fourth for the girls (72.1%). For the medium access level about half of the boys (44.8%) lie in this class, but only one fourth of the girls (26.8%) does that. It is further observed that the percentage of the students in the high level of access is really small for both male and female students; even though the former exceeds the latter. The result confirmed the presence of a gender difference among the students in their level of access to technology at personal level.

Table 16

Gender Bias in ICT Access

Level of Access	**Frequency (%)**	
	Male	**Female**
Low	107 (46.1)	261 (72.1)
Medium	104 (44.8)	97 (26.8)
High	21 (9.1)	4 (1.1)
Total	232 (100)	362 (100)
Mean ± SD	11.94 ± 6.26	7.91 ± 5.49
Chi-square = 50.203**; p-value < 0.001		

*** Significant at 0.01 level*

Gender-wise differences in the overall access to technologies were explored by Chi-square test. It showed a significant difference in the level of access to ICT between male and female respondents at one per cent level, as the p-value was less than 0.001. The mean score obtained for male students (11.94) is also found to be greater than that of female students (7.91) which indicate that the former has significantly higher access to ICT than the latter. It could be seen clearly from the above result that male respondents take a leading position in overall access to ICT and female students, in general, lag behind them. Further this result confirms the existence of first order digital divide in terms of gender in the sampled universities. In fact, this gender divide is old news by now. But some researchers (e.g., Imhof, Vollmeyer & Beierlein, 2007; Codoban, 2005) suggested that the gender divide was closing in as far as the technology access was concerned. However, gender is still affecting the ICT access among the students.

4.2.3.2 Discipline-wise Access to ICT

Mahmood (2009) mentioned that public policy gives more importance and funding to develop Science and Technology and ignores Humanities. This was cited as a reason for the low level of access to technology among the students from Humanities discipline in the University of Punjab, Lahore. A discipline-wise analysis is inevitable in the case of access to ICT, due to the nature of subjects in Humanities, which does not need as much of ICT equipments as compared to Science and Social Science disciplines. The current investigation, thus also analysed the discipline-wise access to ICT by the students.

Table 17

Level of Access to ICT in Different Disciplines

Level of Access	Frequency (%)		
	Science	Humanities	Social Science
Low	113 (58.2)	127 (65.8)	128 (61.8)
Medium	76 (39.2)	59 (30.6)	66 (31.9)
High	5 (2.6)	7 (3.6)	13 (6.3)
Total	194 (100)	193 (100)	207 (100)
Mean ± SD	9.84 ± 6.04	8.98 ± 5.65	9.62 ± 6.60
Chi-square = 6.861^{ns} p-value = 0.143			

ns non-significant at 0.05 level

In the discipline-wise analysis, table 17 shows the distribution of the students in three disciplines (Science, Humanities and Social Science). In all the classes, high proportion of the students was found to be struggling with low level access to ICT. In the medium level of ICT access, the fraction of Science students were slightly higher (39.2) when compared to the other two disciplines (30.6% and 31.9% for Humanities and Social Sciences, respectively). At the same time, the Social Science students appeared to possess a slight advantage in the high level ICT access. The mean values for the students from the three disciplines fall close to each other. However, Science (9.84) and Social Science (9.62) students obtained marginally higher score than that for the students from Humanities (8.98). Chi-square test was run on the data to seek more details about the differences in access to ICT among the students from the disciplines. The researcher found that respondents from different disciplines had statistically non-significant differences in access to ICT. That means there was no significant variation among the students from the three disciplines in their level of overall access to ICT. As opposed to this result, McNaught, Lam and Ho (2009) reported the variations in access to digital technology among the students in the Chinese University of Hong Kong in the dimensions of different disciplines.

4.2.3.3 Rural-Urban Difference in ICT Access

As stated earlier, geographic location of a user is one of the factors that affect in accessing ICT. It was noticed that there was no significant difference among the students who live in rural or urban areas in terms of access to digital devices; meanwhile they did exhibit a difference in accessing various types of Internet connections. So the researcher wished to explore whether any geographic differences existed among the students in their overall access to ICT at a personal level. It is observed (table 18) that higher fraction of the students from rural area have low level of access to ICT as compared to those from urban area. A similar per cent of the participants exhibited a medium level access in both categories;

whereas the fraction of students from urban area displayed a high level access to ICT than that for pupils from rural area.

Table 18

Rural-Urban Difference in ICT Access

Level of Access	**Frequency (%)**	
	Rural	**Urban**
Low	273 (63.6)	95 (57.6)
Medium	144 (33.6)	57 (34.5)
High	12 (2.8)	13 (7.9)
Total	429 (100)	165 (100)
Mean ± SD	9.05 ± 5.94	10.62 ± 6.46
Chi-square = 8.052*; p-value = 0.018		

** Significant at 0.05 level*

The Chi-square test for knowing the differences in access to ICT among the students from rural and urban areas suggests that there exists a statistically significant association at 5 per cent level (p-value = 0.018). The mean value found for urban respondents (10.62) is slightly higher than that for rural students (9.05), which reveals that the students from rural area have significantly lower level of access to ICT. The statistics shows the geographic gap among the students in accessing technology. Ganesh (2016) reported that the state of Kerala is also among those states having high rate of Internet subscription in India. Concerning geographic areas in India, Singh (2010) pointed out that in the states like Kerala, a gradual narrowing of digital divide could be observed. But in this study, the researcher could realize a geographic inequality in access to ICT among the students.

4.2.3.4 Association of Family Income with ICT Access

Economic factor plays a significant role in uniformity and quality of access to technologies. As stated earlier, students from low income families have low level of access to digital devices and the Internet. Here the investigator examined whether there is any change in over all access to technologies as the income category changes. It was tested by the Kruskal Walli's ANOVA and the result is displayed in table 19. The test statistic Chi-square value was found to be significant with a p-value less than 0.001. The result implied that there is significant difference in the access to technologies as the income status changes. Therefore, Mann Whitney U test was done in order to compare pair wise differences among the groups.

Table 19

Association of Family Income with ICT Access

Income Level	Mean	Std. Deviation
Below 10000	4.08^{a}	2.85
10000-20000	7.01^{b}	4.20
20001-30000	9.98^{c}	4.96
30001-40000	13.23^{d}	5.33
40001-50000	16.41^{e}	5.16
Above 50000	16.65^{e}	5.07
Chi-square = 279.45** p < 0.001		
Correlation of Income with access to digital devices = 0.684** p< 0.001		

*** Significant at 0.01 level:*

Means having same letter as superscript are homogeneous

The results reveal that the respondents in the 'Below 10000' group have significantly lower ICT access than those from other groups. It is also seen that a significant increase in access was noted as the income level increases, up to the group that come under '40001 to 50000'. However, the financial income ceases to play a significant role in the ICT access, at least among the top two income groups ('40001- 50000' and 'Above 50000') in the analysis. Correlation of income with access to technologies was found to be 0.684 which is positive and significant at 0.01 level. This result also confirmed the fact that as the income increases, access to technology becomes better.

Undoubtedly, the findings proved that the income inequality has implication for access to modern technologies. Previous researchers disclosed that income is a key determinant affecting technological access of individuals in different sections of the society (Hoffman & Novak, 1998; Cuervo & Menéndez, 2006; Lee, Park & Hwang, 2015). Thus the overall findings concluded that income acts as a primary factor that contributes significantly to the first level digital divide among the students. Personal access to technology is very essential for reducing the digital divide, especially among youth. But the financial inequality does affect their ability to access technology at personal level. Lack of or limited access to these digital technologies has the power to expand the existing inequalities, which in turn brings in the unequal participation by people in a society.

4.2.4 Nature of Ownership to Digital Devices

In the exploration of students' ownership to digital devices, the researcher wished to explore two things; i) identify the number of students who own digital devices personally and ii) those who share the devices within their family. Ownership to computers and other digital devices allow the students to use the medium whenever they need it. The importance of ownership to computer was illustrated by Fairlie (2005) and found that large disparities in computer ownership existed among different races. In this section, the investigator examined the nature of ownership to digital devices and tried to identify whether the participants possessed digital devices or not. With regard to the nature of ownership to digital devices, table 20 depicts that majority of the students (72.4%) own smart phones, which assist the finding from table 4 that the level of access to mobile phone with Internet connection were higher among the participants.

Table 20

Nature of Ownership to Digital Devices

Devices	**Frequency (%)**	
	Family	**Your own**
Computer	277 (46.6)	174 (29.3)
Smart Phone	106 (17.8)	430 (72.4)
Tablet	76 (12.8)	54 (9.1)
E-book reader	38 (6.4)	23 (3.9)
Printer	93 (15.7)	19 (3.2)
Scanner	58 (9.8)	13 (2.2)
Digital Camera, Netbook	1 (0.2)	1 (0.2)
Internet modem	1 (0.2)	2 (0.4)
TV	3 (0.5)	-
I Pad	1(0.2)	1(0.2)
Ordinary mobile Phone	43(7.2)	35(5.9)

Data in table 20 indicate that the students had a relatively low per cent (about 30%) of computer ownership, which includes both desktop and laptop computers. It can also be seen that only about half of the respondents (46.6%) have computers in their own family. Teo et al. (2002) suggested that home computer ownership confers several benefits, as IT access has become an essential part of learning. They opined that frequent home computer usage permits students to become more experienced in acquiring computer self efficacy. Kim & Bagaka (2005) gave a similar opinion that home computer access represents a measure of digital divide. In the study, a low level of ownership to computer can be found. The ownership to other digital devices (like tablet, e-book reader, printer and scanner) was found to be very low. The result conveyed that digital divide is a serious problem especially in terms of home access to technology.

In the context of this study, ownership to digital devices was taken as a key indicator of digital access divide in home environment. Overall, the students have relatively a low rate of access to digital devices as their own is clear from the result. A similar observation was also explored by McNaught et al. (2009). According to the researchers, students vary in their level of ownership to digital technologies. This study too, summarises that a huge difference persisted among the students in terms of their ownership to devices which is an indication of the first order digital divide among the respondents.

4.2.5 Access to Digital Devices in Universities

Universities are believed to host environments where technological advancements are initiated or adopted. The availability of suitable digital devices in adequate number and high quality Internet connections are hence necessary in universities for reducing the digital divide among students. The unequal access to ICT in educational institutions impacts many students, especially those who lack personal access to digital technologies and remain disadvantaged in a society. Even though, universities in Kerala are provided with computers, LCD projector, etc., there may be variations in the students' access to these digital devices among universities. Access to various digital devices from the selected universities is given in table 21.

Table 21

Access to Digital Devices in Universities

Devices	Frequency (%)				
	University of Kerala	University of Calicut	Mahatma Gandhi University	Kannur University	Overall
Computer	170 (96.6)	134 (92.4)	106 (95.5)	131 (80.9)	541 (91.1)
Laptop	35 (19.9)	44 (30.3)	33 (29.7)	33 (20.4)	145 (24.4)
Printer	54 (30.7)	26 (17.9)	42 (37.8)	33 (20.4)	155 (26.1)
Scanner	42 (23.9)	13 (9)	28 (25.2)	15 (9.3)	98 (16.5)
LCD Projector	100 (56.8)	67 (46.2)	64 (57.7)	80 (49.4)	311 (52.4)

Questions were asked to the respondents in order to gauge the access to different digital devices from their respective departments. Table 21 summarises the results. Most of the respondents (91.1%) confirmed the availability of desktop computers in their departments, while only one fourth of them (24.4%) had access to laptops. Above half of the students (52.4%) reported that they had access to LCD projector. A smaller fraction (26.1%) had access to printers while the least (16.5%) were provided scanners in their departments. Overall survey responses from the participants suggest a very similar pattern with minor differences in the percentage of access to different digital devices among the students from different universities. Kannur University had the lowest level of access to desktop computer when compared to other three universities. In the provision of laptops, very similar pattern could be noticed among University of Kerala (19.9%)

and Kannur University (20.4%). In the case of access to printers and scanners, both University of Calicut and Kannur University remain at the bottom of the table. The accessibility towards LCD projector to the students may be considered roughly the same in all universities even though University of Kerala and Mahatma Gandhi University show marginally higher penetration. The result indicates that computer penetration in the universities has not reached the maximum and the availability of other digital devices to participants too was limited. As indicated in earlier, the Internet penetration is not fully achieved in all universities. This reflects the fact that universities have to further improve their ICT infrastructure facilities.

4.2.6 Use of Software

The equitable access to hardware, software, Internet connection, and technology support within educational institutions or at home is usually a starting point for research related to the first order digital divide among students (Attewell, 2001). The students normally tend to explore different software if they are provided access. Lack of access to computers with relevant software keeps the students away from using technology meaningfully. This study also investigated the use of software by the participants in order to understand whether any gender-wise differences existed in the use of different software. Data presented in table 22 details the use of different software by the students. Internet explorer was found to be in the first position, which was used by approximately the whole sample (98.1%). Next, the most common software used by the students was Text Processor (77.1%) followed by presentation software (73.2%). A relatively high proportion (60.1%) of the students also used the spreadsheet applications. Half of the students in the sample had used anti-virus software, but perhaps more notably, half had never done this.

Table 22

Gender-wise Use of Software

Software	Frequency (%)			Chi-square value	p-value
	Male (n=232)	Female (362)	Total (n=594)		
Text Processor (Eg. MS Word, Libre Office)	203 (87.5)	255 (70.4)	458 (77.1)	23.304**	< 0.001
Spreadsheet (Eg. MS Excel)	164 (70.7)	193 (53.3)	357 (60.1)	17.799**	< 0.001
Presentation (Eg. MS PowerPoint)	187 (80.6)	248 (68.5)	435 (73.2)	10.552**	0.001
Movie/Animation (Eg. Adobe Flash)	99 (42.7)	72 (19.9)	171 (28.8)	35.799**	< 0.001
Graphics (Eg. Photoshop)	113 (48.7%)	102 (28.2%)	215 (36.2%)	25.804**	< 0.001
Internet Browser (Eg. Firefox, Chrome, Internet Explorer)	231 (99.6%)	352 (97.2%)	583 (98.1%)	4.228^{ns}	0.400
Antivirus (Eg. Avira, McAfee)	152 (65.5%)	145 (40.1%)	297 (50%)	36.665**	< 0.001
Programming Language (Eg. Python, Java)	58 (25%)	45 (12.4%)	103 (17.3%)	15.584**	< 0.001
Database (Eg. MS Access)	62 (26.7%)	55 (15.2%)	117 (19.7%)	11.885**	< 0.001
Statistical Packages (Eg. SPSS)	34 (14.7%)	16 (4.4%)	50 (8.4%)	19.214**	< 0.001
Any other	7 (3%)	12 (3.3%)	19 (3.2%)	0.040^{ns}	0.841

*** Significant at 0.01 level: ns non significant at 0.05 level*

Considering the applications like animation and graphics, relatively low percentage of the participants (28.8% and 36.2% respectively) used it. A substantial proportion of the students have not used software like programming language, database and statistical packages. The researcher could also find that some of them used the software like R, DBMS, Android, C, C++, Qbasic and PDF reader. In summary, there exists a great variation among the students in using different software. Hohlfeld et al. (2008) noted that one of the reasons for differential use of software may be due to the unequal availability of resources at educational environment or from home for developing their basic ICT skills. In other words, it could be deduced that the first order digital divide accelerates growth of the second order digital divide among the students.

While considering the gender-wise use of different software, it was undoubtedly noticed that male participants were outnumbered by female students in the use of all software listed in the table. The Chi-Square test was applied for further discussion to know whether these gender differences were statistically significant. The test revealed that there exist statistically significant gender differences in the use of 9 out of the 10 items; Text Processor, Spreadsheet, Presentation software, Movie/Animation, Graphics, Anti-virus, Programming Language, Database and Statistical Packages at one per cent level as the corresponding p-values are less than or equal to 0.001. However, the difference is not significant in the usage of Internet Explorer. Findings confirm statistically significant differences between male and female students in the use of different software. The analysis thus implies that there is difference in the use of software between male and female students and the male students possess a higher level of computer software use than the female students. The outputs of the analysis are similar to the findings from earlier study reported by Looker and Thiessen (2003). In their analysis they found that boys were more likely to use spreadsheet, programming language, graphics, etc., when compared to girls.

4.2.7 Barriers in ICT Access/Use

The discussion on the digital divide has shifted beyond the simple notion of a literal gap in access to modern digital technologies to a multifaceted approach in identifying access involving cognitive and social elements that may ultimately lead to the reasons that drive the digital divide. The individual resources like attitude and skill used to access the ICT are classified as the cognitive elements. The social elements refer to the social resources, like parental support and income level that assist the access to ICT (Dixon et al., 2014). There are certain barriers/hindrances that inhibit students in smooth access to and use of the digital technologies which include the cognitive and social elements. Limited access to computers and the Internet, poor or slow Internet connections, stringent filtering or blocking applied to the network, etc., can pose significant barriers in the use of ICT. The level of barriers the students faced while acquiring and using ICT is represented in table 23.

According to the table, insufficient number of computers with the Internet connection in the department or library (29.3%), lack of enough money (25.4%), poor or no connection to the Internet at home (24.7%) and poor network coverage in the university campus (20.4%) posed as the extreme barriers in acquiring ICT. Lack of support from teachers, restrictions to use the Internet, lack of proficiency in English language and lack of parental support appeared least affecting factors towards the ICT use among the students.

Table 23

Barriers in ICT Access/Use

Obstacles/Barriers	Frequency (%)			Index	Rank
	Extreme	Moderate	Not a Barrier		
Lack of support from parents	54 (9.1)	162 (27.3)	378 (63.6)	22.5	12
Not having an Information Technology background in family	73 (12.3)	220 (37)	301 (50.7)	31.0	11
Poor or no connection to the Internet at home	147 (24.7)	226 (38)	221 (37.2)	44.0	3
Restrictions to use the Internet at home	59 (9.9)	148 (24.9)	387 (65.2)	22.5	13
Lack of support from teachers	46 (7.7)	105 (17.7)	443 (74.6)	16.5	17
Restrictions to use the Internet in university/library	45 (7.6)	133 (22.4)	416 (70)	19.0	15
Lack of personnel to maintain ICT equipment in the department	102 (17.2)	241 (40.6)	251 (42.3)	37.5	6
Insufficient number of computers with Internet connection in the department/ library	174 (29.3)	224 (37.7)	196 (33)	48.0	1
Slow speed of the Internet connection at the department.	104 (17.5)	228 (38.4)	262 (44.1)	36.5	7
Poor network coverage in the university campus	121 (20.4)	225 (37.9)	248 (41.8)	39.5	4
Complexity of new technologies	79 (13.3)	240 (40.4)	275 (46.3)	33.5	9
Lack of training	89 (15)	293 (49.3)	212 (35.7)	39.5	5
Lack of enough money	151 (25.4)	238 (40.1)	205 (34.5)	45.5	2
Lack of competency (Knowledge and Skills)	67 (11.3)	256 (43.1)	271 (45.6)	33.0	10
Lack of time	87 (14.6)	229 (38.6)	278 (46.8)	34.0	8
Lack of proficiency in English language	41 (6.9)	169 (28.5)	384 (64.6)	21.0	14
Lack of need (No need)	38 (6.4)	148 (24.9)	148 (24.9)	19.0	16

The index for barriers, shown in table 23, was worked out by using the formula given below.

$$Index = \frac{(2f_1+1f_2+0f_3)}{2N} \times 100,$$

where f_1 = Number of participants responded as extreme

f_2 = Number of participants responded as moderate

f_3 = Number of participants responded as not a barrier

and N = Total number of respondents.

As per the ranking, it was noted that lack of insufficient computers with Internet connection in the department/library forms the most prominent barrier for the students in accessing ICT, followed by insufficient money for procuring ICT. Analysis showed that lack of the Internet at home and poor network coverage in the university campus occupied the third and fourth ranks respectively in the level of barriers to use technologies. It can also be seen that lack of support from teachers and the lack of proper need to use ICT were among the weakest barriers to use ICT.

The outcome of the analysis revealed that the provision of ICT facilities in university campus remains inadequate, which affects particularly those from the socially disadvantaged groups of students. Hohlfeld et al. (2008) pointed out that equitable access to hardware, software and ICT infrastructure within educational environment was a beginning point for the research related to the first level digital divide among students. They also reminded that this divide was measured on the basis of the student-to-computer ratio, teacher-to-computer ratio, various types of Internet access and support from technical personnel in educational institutions. But this study established the fact that lack of support from teachers and restrictions to use Internet facilities were not extreme barriers for ICT use, whereas lack of adequate ICT infrastructure, lack of technical expert in maintaining ICT infrastructure and poor network coverage in the campus act as a top level barriers in accessing ICT. In general, inadequate ICT infrastructure facility in departments can affect the accessibility of Internet related services. Departments require the assistance of an ICT skilled staff to solve immediate technical problems.

Parental support and influence are other elements that may affect students' access to and use of ICT at personal level. Perhaps younger generation has to be faced more restrictions and parental control affecting their online activities. Livingstone and Helsper (2008) opined that parents may be anxious about the Internet safety while their children use the Internet. In the study above half of the students reported that the factors like lack of support from parents and not having IT background in their families were not major barriers to access and use ICT. The barriers related to individual level ICT use consist of lack of ICT training, lack of time and lack of digital competency. Results show that lack of ICT training was moderately affected around half of the students. Absence of opportunities for ICT training is a barrier that affects the students' ICT competency so that the students fail to acquire necessary ICT skills and knowledge. Lack of competency and time moderately act as barriers around 40 per cent of the students to use ICT. Thus the digital divide is influenced by many factors which are similar to the findings of Mosha and Bea (2014) where they identified the key barriers like inadequate access to computer, lack of skill and training in using the e-resources and poor Internet connectivity to use Internet related resources in higher learning institutions.

In order to gauge the level of hindrances and difficulties faced by the students to access and use ICT, an attempt to attribute a score to the overall barrier was done by adding points to each constituent barrier. For each barrier a score of 0, 1, and 2 was given if the response is 'not a barrier', 'moderate' and 'extreme', respectively. As there were seventeen barriers, the maximum score ranges from 0 to 34. This range is divided into three groups. Participants who got a total score between 0 and 10 were put in the low level barrier group and those who got a score between 11 and 22 were put in the medium barrier group while the high barrier group scored points from 23 to 34. Classification according to the level of barriers is given in table 24.

Table 24

Level of Barrier in ICT Access/Use

Level of barrier	Frequency (%)
Low	303 (51)
Medium	270 (45.5)
High	21 (3.5)
Total	594 (100)

The table shows that only a small fraction (3.5%) of the students experienced tough resistance to get and use ICT. The other two groups are distributed roughly equally among the students. In other words, 51 per cent of the students fell in the group of low level barriers, while 45.5 per cent experienced hindrances in enjoying ICT at a medium level. It is very interesting to note that only a few students faced high level barriers to access and use ICT. The analysis on the barriers faced by the students in ICT access and use concluded that lack of Internet access, non-affordability of computers and the Internet, low income, lack of computer skills, and poor ICT infrastructure were prominent barriers causing the digital divide. The same observations were also made by Tayo, Thompson and Thompson (2016) by analysing the digital divide among twenty low income community members in Nigeria.

4.2.7.1 Discipline-wise Differences in the Level of Barriers in ICT Access/Use

The level of requirement of ICT among the students from different disciplines may be different. The students from different disciplines may experience hindrances to access and use of ICT at different levels. The result of the discipline-wise analysis in the level of barriers is depicted in table 25. Majority of the respondents from Science discipline (60.8%) felt a low level of barriers in accessing ICT. In medium level, the highest percentage is shown by students from Humanities (54.4%).

Table 25

Discipline-wise Differences in the Level of Barriers

Level of Barrier	Frequency (%)		
	Science	Humanities	Social Science
Low	118 (60.8)	74 (38.3)	111 (53.6)
Medium	75 (38.7)	105 (54.4)	90 (43.5)
High	1 (0.5)	14 (7.3)	6 (2.9)
Total	194 (100)	193 (100)	207 (100)
Mean ± SD	9.52 ± 5.26	12.38 ± 6.73	10.64 ± 5.88
Chi-square = 28.352**; p-value < 0.001			

** *Significant at 0.01 level*

The table also showed that only a small fraction of the students across all disciplines felt high level barriers to acquire ICT, the highest level being 7.3 per cent scored by the students from

Humanities. Chi-square test was performed to determine if there was a significant difference in the level of ICT barriers faced by the students from different disciplines. The test produced a p-value of less than 0.001 which shows a statistically significant difference at one per cent, in the level of barriers faced by the students from the three disciplines. It is also seen that the mean value obtained for the students from Humanities (12.38) is higher than those from Science (9.52) and Social Science (10.64) disciplines. This means that the respondents from Humanities faced significantly higher level of barriers to access and use ICT when compared to students from the other two disciplines. Thus the findings suggest that the students from Humanities suffered greatly in terms of barriers like home environment, university support and certain internal factors (e.g. lack of confidence) for procuring and to use ICT. So an increased level of barrier could also affect the students' ICT use as well as the competency level they attain, which in turn ends in the digital divide.

4.2.7.2 University-wise Differences in the Level of Barriers to ICT Access/Use

Following the general barriers faced by the participants to access and use ICT, the researcher separated out the obstacles from the university side to check whether any university wise differences can be observed in accessing or using ICT. For the purpose, mean score for each obstacle was worked out by giving a score of 0, 1, and 2 for the responses 'not a barrier', 'moderate' and 'extreme', respectively. Then, these mean scores among the four universities were analysed by the Kruskal Walli's ANOVA test. The results of the test are given in table 26.

Table 26

Comparison of Barriers among Different Universities

Dimensions	University of Kerala	University of Calicut	Mahatma Gandhi University	Kannur University	Chi-square
Lack of support from teachers	0.38	0.32	0.29	0.32	0.788[ns]
Restrictions to use the Internet in university/ library	0.39[b]	0.24[b]	0.27[b]	0.56[a]	27.46**
Lack of personnel to maintain ICT equipment in the department	0.64[b]	0.74[b]	0.65[b]	0.95[a]	19.58**
Insufficient number of computers with Internet connection in the department/ library	0.85[b]	0.88[b]	0.79[b]	1.28[a]	36.27**
Slow speed of the Internet connection at the department.	0.59[b]	0.68[b]	0.59[b]	1.03[a]	37.10**
Poor network coverage in the university campus	0.60[c]	0.77[b]	0.74[bc]	1.03[a]	27.09**

*** Significant at 0.01 level; ns non significant at 0.05 level*

Means having same letter as superscript are homogenous

The results conveyed that test statistic Chi-square in the Kruskal Walli's ANOVA was found to be non significant in the case of lack of support from teachers. This implied that the lack of support from the teaching community is almost at the same level in all universities. It was found that the mean scores are less than one for all universities, which denotes that lack of support from teachers was not a barrier to use ICT in all universities. In the case of restrictions to use the Internet in the university, Chi-square value was found to be significant at 0.01 level. This shows that there were differences in restrictions to use the Internet among the students from four universities. Hence the universities were compared pair wise with the Mann Whitney U test and it showed that the Kannur University is significantly different from all other universities. However, no significant difference was found between University of Kerala, University of Calicut and Mahatma Gandhi University. The high mean score in the case of Kannur University is an indication of the fact that the restriction in the use of the Internet is higher in the university when compared to all other universities.

Following the same analysis, similar trends could be seen in all other cases, except in the case of poor network coverage in the campus. That means the barriers like lack of personnel to maintain ICT equipment in departments, insufficient number of computers with Internet connection and slow speed of Internet connection were significantly higher in Kannur University when compared to other universities. In the case of poor network coverage in campuses, mean score for barrier is significantly higher in Kannur University as compared to the other three universities. No significant difference in the barrier of poor network coverage was found in the case of University of Calicut and Mahatma Gandhi University and also between University of Kerala and Mahatma Gandhi University. However, University of Kerala is having significantly less barriers compared to University of Calicut also. Thus the overall analysis can be interpreted as the students from Kannur University faced higher levels of barriers to acquire and use ICT in university campus as compared to other three universities. A similar type of comparison was made by Osunkunle (2006) in access to ICT among different South African Universities and identified the variation in ICT access among the universities.

4.3 Digital Competency

For an effective utilization of technologies, the students have to possess adequate ICT knowledge and skills. As noted earlier, digital divide frame work was propounded by Dewan and Riggins (2005). Wei et al. (2011) described two levels of digital divide, the first and the second. The first level digital divide referred to the inequalities in access to ICT in home and educational institutions whereas the second level divide denoted the digital capability divide (skill divide) to exploit ICT. In this study the researcher also examined the digital skill divide or competency divide which could result in the digital divide. In digital era, digital competence has become an important concept in examinations on the kind of skills and understanding students need in the knowledge society. As mentioned earlier, digital competency can have many meanings and can be associated with various concepts. However, basically it incorporates the capacity to use the technology effectively. Students in universities exhibit a different level of expertise in the use of ICT.

As far as this study is concerned, competency means the level of knowledge and skills that student has in the use of various digital devices and ICT applications. For enjoying the maximum benefits from technological advancement, students must possess the skills and confidence to use these technologies. In the study, the investigator identified and presented the digital competency in a self assessment manner by the students. Under this objective, the researcher analysed whether the students had attended any ICT related courses, the sources they depended to become digital competent and their experiences to use computers. Further, the study went on to measure their (self reported) expertise in handling different digital devices and using varieties of ICT applications.

4.3.1 Experience in the Use of Computers

Prior experiences with technologies are likely to affect students' use of ICT. Experience promotes the use of ICT on a routine basis. Lack of experience may lead to a skill deficiency which often forms an important factor hindering the effective use of ICT, especially the computers and the Internet by students. Mutchler et al. (2006) found that students' with previous computer experience were able to perform more ICT related tasks successfully than those with less experience. They also opined that experience would enhance students' knowledge of computers and sense of mastery or self-efficacy with computers. Similarly, Hargittai (2002) found a positive relationship between online skills and experience with the technology among the people from New Jersey. Therefore, the study sought to investigate the respondents' experience with the use of computer.

Table 27

Experience in the Use of Computers

Experience (years)	**Frequency (%)**		
	Male	**Female**	**Total**
Less than one	3 (1.3)	17 (4.7)	20 (3.4)
1 – 3	13 (5.6)	45 (12.4)	58 (9.8)
4- 6	57 (24.6)	68 (18.8)	125 (21)
7 – 9	41 (17.7)	49 (13.5)	90 (15.2)
More than 9	118 (50.9)	183 (50.6)	301 (50.7)
Total	232 (100)	362 (100)	594 (100)
χ^2 = 15.460**; df = 4; p-value = 0.002			

*** Significant at 0.01 level*

The data in table 27 demonstrates that half of the students (50.7%) have more than nine years' of experience in the use of computer. At the same time above one fifth of the students (21%) exhibited 4-6 years' of experience in the use of computer. A very few of them responded that they had experience in using computer less than three years.

There may be differences between boys and girls in their experience in the use of computer. The survey result shows that the fraction of male students with experience less than three years (classes 'less than 1 year' and '1-3 years') was low in comparison with their female counterparts. In the classes '4-6' and '7-9', the male students systematically dominate, however, there was no major difference between the percentages of the boys and girls in the class with experience more than 9 years. Chi-square test revealed that the gender-wise differences of their experience in the use of computer are statistically significant at one per cent level as the p-value is equal to 0.002. As in the case of access to technologies, male students are significantly dominant over the female participants in their use of computer. The result confirmed the statement of Kennedy, Wellman and Klement (2003) that women's experiences with technology have historically been limited and dominated by men.

4.3.2 Participation in ICT Related Courses

There is a need to provide training for the students in the use of technology. There are many ICT related courses at all levels, for beginners and beyond. Courses related to technology (e.g. DCA, PGDCA, Office Management) may help students to improve their skills to use advanced digital applications along with their digital competency. Hence a question was raised to find out the percentage of the participants who had attended any ICT related courses. Among all the participants of the study, majority of the students (64.8%) had attended ICT related courses, whereas over one third of the respondents (35.2%) had never attended any ICT related courses. The responses are displayed in table 28. By conducting a gender-wise analysis in attending the ICT related courses, it was noted that 68 per cent of the male students reported having participated in ICT related courses while that for female students was around 63 per cent. About 32 per cent of the boys and 37 per cent of the girls reported that they had never taken any ICT related courses.

Table 28

Participation in ICT Related Courses

Attended	Frequency (%)		
	Male	Female	Total
Have	158 (68.1)	227 (62.7)	385 (64.8)
Not Have	74 (31.9)	135 (37.3)	209 (35.2)
Total	232 (100)	362 (100)	594 (100)
Chi-square = 1.805^{ns}: p-value = 0.179			

ns non-significant at 0.05 level

Chi-square test is applied for further discussion. From the result, no significant gender difference was established regarding their attendance in ICT related courses as the p-value is 0.179. As detailed earlier, one of the barriers that affected the effective use of ICT was lack of training. Attending the different ICT courses help the students receive good training. Kjølseth (2008) reported, in a digital competency survey, that some of the Norwegian population claimed to develop their digital skills through participation in courses.

4.3.3 Sources of Acquiring Digital Skills

Digital skills are essential for students to become digitally competent. Skills related to ICT are growingly taken for granted in all facets of academic activities of a student. However, there exist many ways for students to acquire technological skills, though all may not result in the same level of digital competency. The researcher also wishes to know the sources which the students depends upon for being digitally competent.

Table 29

Major Sources for Acquiring Digital Skills

Sources	Frequency (%)
By attending courses	385 (50.5 %)
From friends/teaches	415 (69.9 %)
Self learning with manuals and handbooks	264 (44.4 %)
From family	5 (0.9 %)

The students were asked to mention the sources from which they acquired skills to use digital technologies and their responses are indicated in table 29. They were asked to select all the options that applied to them. Most of the students (about 70%) depend on their friends or teachers to acquire skills related to ICT, followed by attending courses related to ICT (51%). A reasonable number of the students (44.4 %) mentioned that they managed the skill themselves with the help of manuals and handbooks.

Rae (2005) tried to find out how the students acquire their skills for working with computers and the Internet in open universities in UK. Majority of those students replied that they were self taught about computer and the Internet while a good number of the students depended on their friends or families for acquiring ICT skills. However, in this study students possessed the digital skills mainly through their friends/teachers, followed by attending courses. Ferro, Helbig and Gil-Garcia (2011) commented that informal and self learning was also important as formal training course in the process of basic IT skills acquisition.

4.3.4 Expertise to Use Digital Devices

The ability of students to use the right digital devices for the right purposes, which include the technical skills in handling various tools and understanding their potential and limitations, denotes their expertise in the area. When analysed the expertise to use various digital devices (table 30), the statistics revealed that a higher per cent of the students answered that they were ‘excellent’ (52.7%) or ‘good’ (34.3%) in using mobile phone with Internet access. The result is further augmenting the fact that most of the students possess Smartphone with Internet connection. It may be a reason for higher expertise to use mobile phone.

The percentage of the students, who reported that they were “good” to use computer, was 48.3 whereas 42.1 per cent marked the same for laptop computer. Data indicates slight differences in expertise to use computers and laptops in all the five levels. It is also apparent from the table that only a very few of the participants marked their expertise as ‘not good’ or ‘not at all’ in both devices. Against this result, nearly half of the students marked the same in the use of netbook computers. In the cases of printer, scanner and multimedia projector, most of the students fall under the categories of average or below average in their expertise level. Around one third of the students reported either excellent or good to use tablets.

Table 30

Expertise to Use Digital Devices

Devices	Frequency (%)				
	Excellent	Good	Average	Not Good	Not at all
Computer	91 (15.3)	287 (48.3)	194 (32.7)	20 (3.4)	2 (0.3)
Laptop Computer	87 (14.6)	250 (42.1)	195 (32.8)	43 (7.2)	19 (3.2)
Netbook/Note book Computer	27 (4.5)	110 (18.5)	178 (30)	159 (26.8)	120(20.2)
Tablet	75 (12.6)	135 (22.7)	166 (27.9)	132 (22.2)	86 (14.5)
Mobile phone (with Internet access)	313 (52.7)	204 (34.3)	53 (8.9)	19 (3.2)	5 (0.8)
Printer	52 (8.8)	125 (21)	170 (28.6)	140 (23.6)	107 (18)
Scanner	34 (5.7)	85 (14.3)	152 (25.6)	178 (30)	145 (24.4)
LCD/ Multimedia Projector	56 (9.4)	116 (19.5)	174 (29.3)	140 (23.6)	108 (18.2)

The result pointed out that the expertise to use different digital tools was varying among the students. It also verified that access to ICTs is a strong predictor of expertise to use ICT, as majority of the students exhibited above average level of competency in mobile phones, desktop computer and laptop which are commonly available to students as compared to other devices like printer, scanner and LCD projector in which they reported a low level expertise. Ziefle and Schaar (2010) discussed the aspect of technological expertise. Considering some ICT devices, they found significant correlations between expertises and ease of use ratings as well as frequency of usage. They made a summary that for common ICT devices, frequency of usage and ease of use rating exhibited a correlation with their expertise in technology. Closing the gap in skills to use these digital devices is important for promoting economic opportunities as more and more jobs rely on the digital expertise to use these devices.

After analysing the competency of the respondents in handling digital devices, the researcher made a score to the level of expertise which was obtained by adding the scores of level of expertise in each device. For each device, a score of 0, 1, 2, 3, and 4 was given to the responses 'not at all', 'not good', 'average', 'good' and 'excellent', respectively. As there were eight devices, the total score of expertise ranged between 0 and 32. This range was divided into three groups, i.e., low expertise group with the scores ranges in between 0 to 10, medium expertise group with the scores ranges in between 11 to 21 and high expertise groups with the scores ranges in between 22 to 32.

Table 31

Level of Expertise to Use Digital Devices

Level of Expertise	Frequency (%)
Low	92 (15.5)
Medium	342 (57.6)
High	160 (26.9)
Total	594 (100)

In table 31 the classifications according to the level of expertise in digital devices are given. With respect to the classification based on the level of expertise to use digital tools, it could be noticed that a higher rate of the participants (57.6%) come under the medium expertise category. At the same time, above a quarter of the students (26.9%) represented in the high expertise class and remaining participants (15.5%) lied in the low expertise group. Overall, most of the sample believed that they have a moderate level of expertise in handling digital devices. One must possess at least basic level ICT skills to function effectively in a digital society.

The result revealed that some students fail even in acquiring basic level skills in operating digital devices. Digital divide exists among the students in terms of expertise to use digital devices. Ala-Mutka (2011) mapped the digital competency and gave a conceptual understanding of the term. According to the researcher, mastering of basic digital tools is the first step towards advanced knowledge, skills and attitudes in digital technologies. So the investigator pointed out that expertise in the digital devices gradually results in improved competency to use various ICT applications and which in turns increase the use of ICT.

4.3.4.1 Gender Differences in the Expertise to Use Digital Devices

Further, Kolmogorov-Smirnov test was done for testing the normality of the variable expertise in digital devices. Kolmogorov-Smirnov test statistics Z was calculated to be 1.303 and p-value is 0.067 which is greater than 0.05. This shows that the observation of expertise variable follows normality assumption. Hence, the parametric tests were applied for testing the influence of demographic variable on the expertise in using digital devices.

Table 32

Gender-bias in the Expertise to Use Digital Devices

Group	Mean	SD
Male	22.24	4.87
Female	14.12	5.12
Z-value	19.201**	
p-value	< 0.001	

***Significant at 0.01 level*

Digital competency to use ICT may exhibit gender differences. Saha and Zaman (2017) reported that male students were more efficient to use ICT than their female counterparts in University of Barisal, Bangladesh. Here also, the researcher compares the level of expertise in digital devices between male and female participants and indicated in table 32. For the comparison of expertise among male and female respondents, independent Z-test was carried out. Z-value was found to be significant at 0.01 level. This shows that there is a significant difference in the level of expertise in handling digital devices between male and female respondents. Mean score was higher in the case of male students which show that they have significantly higher expertise to use digital devices when compared to their female counterparts. The gender differences are evident in the expertise in handling digital devices.

Researchers have tried to give explanations for the gender divide in competency. They claimed that those gender specific differences had their root in the fact that ladies underestimated their technology skills which lead to lower self efficacy to use ICT (Hargittai & Shafer, 2006). While some others (e.g. Hilbert, 2011) commented that, men were more interested to use ICT than women and they were more technophile.

4.3.4.2 Discipline-wise Differences in Expertise to Use Digital Devices

The requirements of ICT devices for various applications are different for different academic disciplines. So there is a possibility of various level of expertise to use digital devices among the students from different academic background. In addition to gender differences, the investigator liked to examine whether any significant differences existed in the expertise to use digital devices among the participants from different disciplines. Discipline-wise comparison of expertise to use digital devices by the students is illustrated in table 33.

Table 33

Discipline-wise Comparison of Expertise to Use Digital Devices

Group	Mean	SD
Science	16.47[b]	6.39
Humanities	17.02[b]	6.13
Social Science	18.31[a]	6.59
F-value	4.427*	
p-value	0.012	

** Significant at 0.05 level*

ANOVA was done for comparing the expertise in digital devices among the respondents from different disciplines. The p-value is found to be less than 0.05; hence the F-value is significant at 0.05 level. So pair wise comparison was done by DMRT. Results show that there is no significant difference among the respondents from Science and Humanities in their expertise to use digital devices. But surprisingly, Social Science students were found significantly different from the other two groups. Mean score for the expertise was higher for the Social Science students; hence the study suggests that the Social Science students have significantly higher expertise to use digital devices as compared to the other two groups.

Cuckle, Clarke and Jenkins (2000) commended that there may be more apparent uses of ICT for more numeric subjects like Sciences and Mathematics than less numeric subjects such as Humanities and Languages. They also opined that in the subjects like Sciences, Mathematics and doubtlessly Social Science, the use of ICT will be a useful extension of traditional working while in the Arts and

Languages the extent of use of ICT may not be so evident. An increase in the use of ICT may lead to attaining higher expertise in handling digital devices. However, a notable result obtained in this study is that the students from Social Science discipline appeared to possess a higher level of expertise in handling digital devices than those from Science and Humanities, though at a lower significant level. It is also surprising that pupils from Humanities also have the highest mean value when compared to the Science students.

4.3.5 Expertise in ICT Activities/Processes

In this area, the researcher tried to gauge the proficiency of the participants in the basic components of digital competency. This comprised of hardware and software applications, network applications and other elements of digital technology. Council (2006) recommended key competencies for lifelong learning. Digital competency was one of the competencies recommended by them. It defined the digital competency as confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is a foundation for basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet. A similar foundation for basic skills in ICT applications was measured by the investigator.

In the current study, the investigator measured the digital competency of the students within nine separate areas which have been worked out through 37 statements related to digital skills. Eight areas were conceptualised following Kjølseth (2008) report on the digital competency measurements on Norwegian population. These areas included information needs, access to information, technological self-reliance, information management, information assessment, integration of information, communication and information sharing and creating information. In addition to these the researcher included a few questions regarding the digital skill related to problem solving capacity. For each of the 37 measurement skills, respondents were requested to give an answer on five point scale from 'excellent' to 'not at all'. An analysis of cross tabulation of self reported digital skills acquired by the students was carried out. For the expertise of digital skills, the classes of 'excellent' and 'good' were grouped together and represented by 'high expertise' or 'very proficient' class. This process was repeated for the classes 'not good' and 'not at all', which was denoted by 'low expertise'. The class 'average' was put in the intermediate category, thus effectively reducing the five point scale into a three point one, in order to attempt a meaningful and concise interpretation of the results. The following tables (table 34-42) narrated the students' proficiency in various ICT areas.

4.3.5.1 Expertise to Define Information Needs

Ferrari (2013) gave a framework for developing and understanding the digital competency in Europe. The author explained the five dimensions of digital competency; information, communication, content creation, safety and problem solving. In the area of information, the researcher pointed out that articulation of information needs is the basic component in digital competency. In order to be proficient in exploring the digital world, one has to acquire the ability to define their information needs clearly. Hence the investigator tried to address the self reported ability of the respondents in defining their information requirements and is presented in table 34.

Table 34

Expertise to Define Information Needs

Activities/ Processes	Frequency (%)				
	Excellent	**Good**	**Average**	**Not Good**	**Not at all**
Determine what kind of information you need and that can be retrieved from the Internet.	156 (26.3)	292 (49.2)	127 (21.4)	17 (2.9)	2 (0.3)
Use search engines (Eg., Google) on the Internet	233 (39.2)	275 (46.3)	72 (12.1)	12 (2)	2 (0.3)

The survey results reflected that majority of the students (about 75%) considered them very proficient in determining their information needs that can be retrieved from the Internet, as they fall under either ‘good’ or ‘excellent’ classes. Only very few students (3.2%) responded that their proficiency in determining their information needs remained very low. Secondly the researcher attempted to analyse the students’ capacity to use search engines effectively. The responses suggested that, like in the case of determining information need, a large majority of the participants (85%) were in ‘good’ or ‘excellent’ classes in the use of search engines. Following a similar trend with the previous case (of determining information need), only 2 per cent said that their knowledge in the use of search engine was poor. In the dimension of defining information need, about one fourth of the students responded an average or below average skills in determining their information need, whereas most of the respondents marked high proficiency to use search engines.

4.3.5.2 Expertise to Access Information

Kjølseth (2008) describe the access to information as knowing how and where to find and collect information with the aid of ICT. It is necessary for the students to know where to search for and how to collect or retrieve information they need from the Internet. Table 35 describes the students' ability to locate and navigate through websites of their choice for retrieving information.

Table 35

Expertise to Access Information

Activities/ Processes	Frequency (%)				
	Excellent	**Good**	**Average**	**Not Good**	**Not at all**
Locate websites that contain the information you need	116 (19.5)	300(50.5)	140 (23.6)	32 (5.4)	6 (1)
Navigate through different websites	115 (19.4)	220 (37)	173 (29.1)	64 (10.8)	22 (3.7)

In locating websites containing specific information, 70 per cent of the students fall under the 'good' or 'excellent' classes, while only six per cent considered themselves weak as they felt to be either in 'not good' or 'not at all' classes. However, the distribution of responses regarding their capacity to explore through different websites showed that about 56 per cent remained in the 'good' or 'excellent' classes, while about 30 per cent considered them in the average class. Hence the result indicates that considerable number of the students does not have sufficient navigation skills.

4.3.5.3 Expertise in Technological Self Reliance

Technological self-reliance means undertaking technological operations independently (Kjølseth, 2008). Questions were asked to the respondents in order to gauge their level of expertise in technological self reliance, through a sample set of questions pertaining to simple tasks like creating an email account to relatively tougher ones like independent use of a computer language. The survey results are provided in table 36.

Table 36

Expertise in Technological Self Reliance

Activities/ Processes	**Frequency (%)**				
	Excellent	**Good**	**Average**	**Not Good**	**Not at all**
Create an e-mail address	269 (45.3)	231 (38.9)	64 (10.8)	22 (3.7)	8 (1.3)
Create an account in social networks (Eg., Facebook, Twitter)	277 (46.6)	184 (31)	70 (11.8)	42 (7.1)	21 (3.5)
Print a computer document/ file	151 (25.4)	194 (32.7)	144 (24.2)	79 (13.3)	26 (4.4)
Install software (Eg., MS Office) in a computer	111 (18.7)	142 (23.9)	134 (22.6)	151 (25.4)	56 (9.4)
Use a security software or tool (Eg., Antivirus)	119 (20)	170 (28.6)	141 (23.7)	115 (19.4)	49 (8.2)
Use a computer programming language (Eg., Java)	38 (6.4)	67 (11.3)	109 (18.4)	222 (37.4)	158 (26.6)
Use GPS to navigate	74 (12.5)	99 (16.7)	128 (21.5)	164 (27.6)	129 (21.7)

From the table, it can be seen that while a higher proportion (84%) of the students felt that they belong to the classes above average (high expertise) in creating an email account, only 17 per cent reported that they were confident (high expertise) to use a computer programming language independently. On the other hand, only a few (about 10%) of the participants felt being below average (low expertise) in their skills to open an account in the social media, but the fraction rose close to 50 per cent in the case of their confidence to use GPS to navigate.

Over 40 per cent considered themselves highly proficient in their skills to install software in a computer, while around 35 per cent fell in the low expertise classes. Printing a computer document appeared relatively an easy task, as more than half of the participants replied that they possessed either 'excellent' or 'good' skills, whereas around 18 per cent of the respondents associated themselves with low expertise group. A similar pattern is observed to use antivirus software with around 50 per cent of the students feeling in the 'excellent' or 'good' classes while over one fourth (27.6%) considered themselves in low expertise classes. From the analysis it is clear that a great majority of the respondents have good competency in creating accounts in e-mail and social networks. At the same time a large number of the students reported a weak expertise level in the use of computer programming language and GPS.

4.3.5.4 Expertise in Information Management

In the digital competency framework by Ferrari (2013), the dimension of information included information management (storing and retrieving information) area and it was defined as the manipulation and storing of information/content for easy retrieval. It also involved the organization of information and data. Table 37 shows the distribution of the responses by the students indicating their level of expertise in the information management.

Table 37

Expertise in Information Management

Activities/ Processes	Frequency (%)				
	Excellent	Good	Average	Not Good	Not at all
Create a folder and save a file downloaded from the Internet in to it	276 (46.5)	182 (30.6)	95 (16)	30 (5.1)	11 (1.9)
Arrange collected information into lists and tables	179 (30.1)	191 (32.2)	136 (22.9)	67 (11.3)	21 (3.5)
Use of storage devices (i.e., Hard disk, CD/DVD, Pen drive)	232 (39.1)	195 (32.8)	102 (17.2)	46 (7.7)	19 (2.2)
Transfer photos/video from a digital camera to a computer	204 (34.3)	159 (26.8)	102 (17.2)	86 (14.5)	43 (7.2)
Take backup of a computer	88 (14.8)	131 (22.1)	159 (26.8)	140 (23.6)	76 (12.8)

It is apparent from the table that creating a folder and saving a file appeared the easiest task as above three fourth (77%) of the students felt themselves to be experts and only a small group (7%) found the task difficult. Along the same lines, a large number of the students (over 70%) reported that they were highly proficient in the use of storage devices whereas a few (10%) had low expertise. The percentage of the students who were proficient and weak in arranging collected information into lists or tables were around 62 and 15 per cent, respectively. In the case of exchange of photos and videos between camera and computer, a relatively high fraction (61%) of them exhibited high expertise and about 21 per cent felt their competency below average. The task that maximum number of the students found difficult was taking backup of a computer, as close to one third (36.4%) responded being below average while around same per cent of the pupils (36.9%) felt being highly proficient. In short, a good number of the students pronounced sufficient level of expertise in the area of information management.

4.3.5.5 Expertise in Information Assessment

The Internet is considered as the information super high-way, with rich content on anything and everything being added every second. However, the attempts to judge the quality of data are rather poor. One needs to have proficiency in assessing the worthiness of each and every piece of information reaching her/him. Abdollahyan, Semati and Ahmadi (2013) reported the skills needed for media literacy and in which evaluating ability of user refers to their ability to judge and evaluate the credibility of information. The present study also attempted to quantify the ability of the participants to assess the quality of information they receive.

It is seen that nearly one third of the students possessed average and below average skills apiece in assessing the quality of information received from the Internet (table 38). The fraction of the students who felt above average ability in assessing the quality was around 37. Internet with its vast information content, not only provides huge opportunities to the user, but also poses great threat to the user through loss of personal information. The latter could result in a simple loss of data from computer to loss of vital data exploiting the end user's ignorance in raising the security level of their systems.

Table 38

Expertise in Information Assessment

Activities/Processes	Frequency (%)				
	Excellent	Good	Average	Not Good	Not at all
Assess the quality of information that you find on the Internet, for Eg., whether it is old, biased or trustworthy	60 (10.1)	157(26.4)	201 (33.8)	126 (21.2)	50 (8.4)
Configure the security settings of the Internet tools/devices/utilities (Web browser, E-mail, Social Networking Sites, etc)	95 (16)	186(31.3)	175 (29.5)	95 (16)	43 (7.2)

The survey explored the possibility of gauging the participants' ability to set the level of security of their connection while using the Internet or communicating via email. Below half of the participants (47.3%) believed that they had high proficiency in configuring security settings of their system while connecting to the Internet. There were about one fourth of the participants (23.2%) under the class of low expertise. Thus in the case of information assessment, the number of students reported highly proficient is not large.

4.3.5.6 Expertise in Integration of Information

Youngren et al. (2004) in U.S. defined the key items of ICT literacy, in which integration of information denoted interpreting and representing information, such as by using ICT tools to synthesize, summarize, compare and contrast information from multiple sources. Once the authenticity of the data accessed is evaluated, it is necessary for the user to make sense of the data, through intelligent and efficient compilation or presentation. Hence the researcher evaluated the level of expertise in integration of information and provided the results in table 39.

Table 39

Expertise in Integration of Information

Activities/Processes	Frequency (%)				
	Excellent	Good	Average	Not Good	Not at all
Write and edit text in a text processor (Eg. MS Word)	214 (36)	203 (34.2)	127 (21.4)	39 (6.6)	11 (1.9)
Use spell checkers/ dictionaries	223 (37.5)	210 (35.4)	117 (19.7)	38 (6.4)	6 (1)
Insert images/symbols in text documents	225 (37.9)	204 (34.3)	109 (18.4)	49 (8.2)	7 (1.2)
Include an animation or movie inside a presentation document (Eg., MS PowerPoint)	164 (27.6)	159 (26.8)	158 (26.6)	81 (13.6)	32 (5.4)
Sort data using spreadsheet	106 (17.8)	183 (30.8)	175 (29.5)	104 (17.5)	26 (4.4)
Use functions/Formulae inside a spreadsheet	86 (14.5)	167 (28.1)	167 (28.1)	140 (23.6)	34 (5.7)

The survey highlighted that majority of the participants enjoyed high level of mastery in text processing as over 70 per cent claimed high proficiency in different facets of word processing like editing, spell checking and inserting images or symbols. Further, only less than 10 per cent students put themselves in below average classes for all operations related to text editing. Over half of the students (54.4%) felt being technologically highly competent in including animations inside a presentation, while about 20 per cent reported poor in handling the same. Nearly half of the students (48.6%) were found to be proficient in sorting data using spreadsheets and about one fifth

(21.9%) were seen weak in the same. Close to 30 per cent of the students reported below average proficiency to include functions or formulae inside a spreadsheet and about 40 per cent of the students responded being highly expertise in it. The result illustrates that most of the respondents were experts in text processing, but weak in using spreadsheet.

4.3.5.7 Expertise in Communication and Information Sharing

In the digital competency framework of Ferrari (2013), communication was denoted as the activities involving communication in electronic environments, sharing of resources through digital tools, linking with others and collaborating through online tools as well as interacting with and engaging in communities and networks. In this study, the researcher went through the students' efficiency in communication and information sharing using digital tools. In table 40, the responses from the participants on their level of expertise in communication and information sharing is depicted.

A close look at the table reflected that the participants have high proficiency in the use of mobile phones for connecting to the Internet and for sending and receiving e-mails, as close to 80 per cent believed being in classes above average. Only a very small proportion (below 10 per cent) of the students fell under the low expertise category. In the earlier section, the researcher had found that majority of the students enjoyed personal access to mobile phones. Hence the result may be emphasising the fact that better access to digital technologies may lead to higher expertise to use the technologies. However, Multimedia Messaging Services (MMS) did not enjoy that much popularity among the participants as only around 60 per cent appeared in the high proficiency classes.

Table 40

Expertise in Communication and Information Sharing

Activities/ Processes	Frequency (%)				
	Excellent	Good	Average	Not Good	Not at all
Connect to the Internet using mobile phone	306 (51.5)	168 (28.3)	77 (13)	31 (5.2)	12 (2)
Send/receive e-mail	306 (51.5)	181 (30.5)	76 (12.8)	18 (3)	13 (2.2)
Send/receive MMS messages from a mobile phone	205 (34.5)	164 (27.6)	115 (19.4)	76 (12.8)	34 (5.7)
Send/receive files (Eg. Image, Video) using Bluetooth	344 (57.9)	165 (27.8)	48 (8.1)	26 (4.4)	11 (1.9)
Upload contents (Eg. Video, Audio) to a website to be shared	188 (31.6)	159 (26.8)	118 (19.9)	92 (15.5)	37 (6.2)
Use the Internet to make telephone call (Eg. Skype)	182 (30.6)	143 (24.1)	114 (19.2)	113 (19)	42 (7.1)
Participate in social networks (Eg. Facebook, Twitter)	259 (43.6)	166 (27.9)	76 (12.8)	51 (8.6)	42 (7.1)
Online booking of tickets (Eg., For travelling or film reservation)	108 (18.2)	132 (22.2)	139 (23.4)	126 (21.2)	89 (15)

The table also explored that file sharing with Bluetooth seemed to be highly popular among the youth. Among the different tasks explored in table 40, maximum students (85.7%) were in the high proficiency classes to use the Bluetooth. Only a few of them (6.3%) fell in the below average categories. A simple majority of the respondents (58.4%) felt highly proficient in uploading audio and video contents to the Internet, while nearly 55 per cent reported the same level of expertise in making Internet telephone calls.

The use of social networking is increasing day by day especially among the youth. The output of this analysis also showed that a high proportion of the students (71.5%) appeared in high proficient classes in their participation in social networks. A small fraction of the participants (15.7%) remained in the poor expertise group for the same item. Lenhart et al. (2015) communicated that the use of social networking was very high among American youth. So the researcher tried to interpret the result as the use of ICT application increases, there is also a corresponding increase in digital competency. The result of online booking of ticket fell among the least popular activities, as the percentages of the participants who believed highly proficient and poor were close to 40 and 36, respectively.

4.3.5.8 Expertise in Creating Information

Abdollahyan, Semati and Ahmadi (2013) described information creating ability as the users' ability to produce new contents and not merely be consumers (becoming "prosumers") in using different media like Internet. Here the researcher analysed the students' level of competency in creating information and is given in table 41. When considering the cases of create a website and blog, a higher fraction of the students (around 62%) expressed that they were low proficient, whereas only a few of the students (around 17%) exhibited 'excellent' as well as 'good' expertise in both items.

Table 41

Expertise in Creating Information

Activities/ Processes	Frequency (%)				
	Excellent	**Good**	**Average**	**Not Good**	**Not at all**
Create a website	37 (6.2)	66 (11.1)	124 (20.9)	197 (33.2)	170 (28.6)
Create a blog	34 (5.7)	64 (10.8)	128 (21.5)	194 (32.7)	174 (29.3)
Use information from the Internet without violating copyright	70 (11.8)	144 (24.2)	165 (27.8)	129 (21.7)	86 (14.5)

In the digital environment, copyright has great importance because the information is easily accessible from anywhere in different digital format. So there is a possibility of copyright violation and the plagiarism become severe. The researcher raised a question related to the participants' use of information from the Internet without violating copyright. The findings pointed out that just above one third of them (36%) have high capacity to use information without violating copyright. A corresponding per cent of the students have low capacity in the same process. Comparing to other areas, the students exhibited a low expertise in the area of creating information.

4.3.5.9 Expertise in Problem Solving Capacity

In Ferrari's (2013) framework, problem solving was one of the areas of digital competency. Problem solving implied that solve the problems through digital means. Here the researcher analysed the expertise in problem solving capacity with two items which is presented in table 42.

Table 42

Expertise in Problem Solving Capacity

Activities/ Processes	Frequency (%)				
	Excellent	**Good**	**Average**	**Not Good**	**Not at all**
Connect a new device to a computer and install it (Eg. Printer)	99 (16.7)	101 (17)	129 (21.7)	169 (28.5)	96 (16.2)
Install an operating system (Eg. Windows, Linux)	64 (10.8)	72 (12.1)	143 (24.1)	180 (30.3)	135 (22.7)

In the basic analysis, it is seen that above half of the students (53%) experienced low expertise in installing an operating system and about 45 per cent expressed low level of competency in connecting a new device to a system and installing it. A lower fraction of the respondents (22.9%) had either excellent or good classes with respect to installing an operating system. But about one third of them (33.7%) had high expertise in the case of connecting a new device to a computer and installing it. Considering the dimension of problem solving capacity, the competency appeared to be limited among the students.

On the whole, the researcher interpreted that there were fairly wide variations with regard to the different types of ICT skills. Figure 3 gives an overview of how the students scored on all 37 measures of skills. The red line in the figure indicates average digital skills among the students (62.84). The students scored highest in using Bluetooth (84), which is followed by sending and receiving e-mail (81.5).

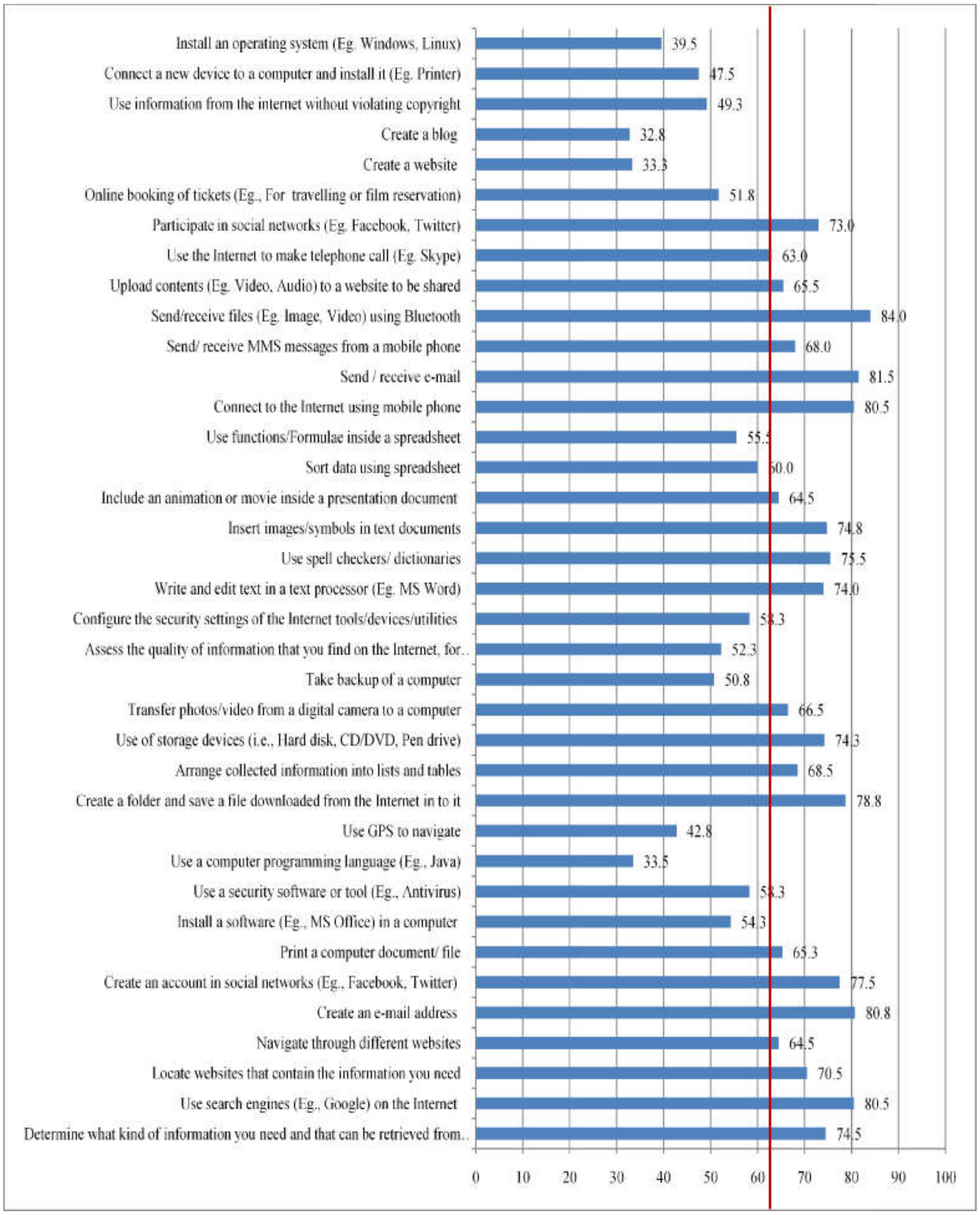

Figure 3. Competency in Various ICT Applications

A higher level of competency (about the score 81) can be noted in the cases of creating an e-mail account, using search engine and also in connecting to the Internet with mobile phones. The students also showed relatively good level of skills in creating folders and saving files, creating an account in social network, using spell check/dictionary applications, determining their information need, using text processor, using storage devices and locating information from website. Regarding creation of blogs (32.8) or websites (33.3), use of computer programming language (33.5) and installation of an operating system (39.5), the respondents claimed to have least expertise. The competency was found to be limited in the use of GPS to navigate and also for connecting a new device and installing its drivers in a computer. A moderate level of digital competency can be observed in most of the other skills.

A similar study was carried out by Judi et al. (2011) and analysed the Malaysian secondary school students' ICT competencies. They found that ICT skills of participants were lying in moderate and weak level. The students exhibited a medium level competency in information searching, using Microsoft Word, Power Point, Bluetooth, interactive social website and chat applications. However, they were weak to use Microsoft Excel, e-mail application, authoring software, multimedia applications and anti-virus software. These findings suggested that there is some differences in students' digital skills and these are not randomly distributed. So these variations are consistent with the idea that even among a highly wired group of students, the use of ICT does not necessarily end in meaningful applications as identified by Santos, Azevedo and Pedro (2013).

After making basic analysis using the percentage method, the researcher wished to calculate the percentage score for each dimension of digital competency. Percentage score for each dimension was worked out by adding the scores of all the statements related to each dimension. For this, each statement was scored as 0 (not at all), 1 (not good), 2 (average), 3 (good) and 4 (excellent), depending on the responses of the students in the Likert Scale. Then the total score for each dimension was divided by the maximum expected score (number of statements x 4) and multiplied by 100 to get the percentage score for each dimension. These percentage scores were divided into three equal classes. Low level of digital competency was associated with scores less than 33.3, average level for scores between 33.3 and 66.7 and high level of digital competency for scores greater than 66.7. Assessment of digital competency is given in table 43.

Table 43

Level of Digital Competency

Dimensions	**Percentage score**	**Level**
Defining information needs	77.53	High
Access to information	67.47	High
Technological self reliance	58.87	Average
Information management	67.74	High
Information assessment	55.18	Average
Integration of information	67.39	High
Communication and information sharing	70.94	High
Creating information	38.44	Average
Problem solving capacity	43.43	Average
Overall digital competency	**62.84**	**Average**

As evident from the table, the overall digital competency of the students (62.84) appeared to be at an average level. Students scored highest for identifying and defining information needs (77.53) followed by communication and information sharing (70.94). In the areas of access to information, information management and integration of information, the participants possessed a similar percentage score and expressed a high level of digital competency. The competence seems to be somewhat lower with regard to technological self reliance (58.87) and information assessment (55.18), and the students acquired an average level of digital competency in these areas. The outcome of the analysis also specified that the respondents have least expertise in the areas of problem solving (43.43) and in creating new information using ICT tools (38.44). In the cases of defining information needs and creating information, a corresponding result has been put forward by Kjølseth (2008) while measuring the digital competency of Norwegian population. The Norwegian population experienced highest level of digital competency in defining information needs and lowest level in creating information. Thus the researcher summarised that variations can be seen in the level of expertise among students in all the nine ICT areas. As the overall digital competency of the students appeared to be average level, the researcher commented that lack of digital competency also contributes to the digital divide among the students to some extent.

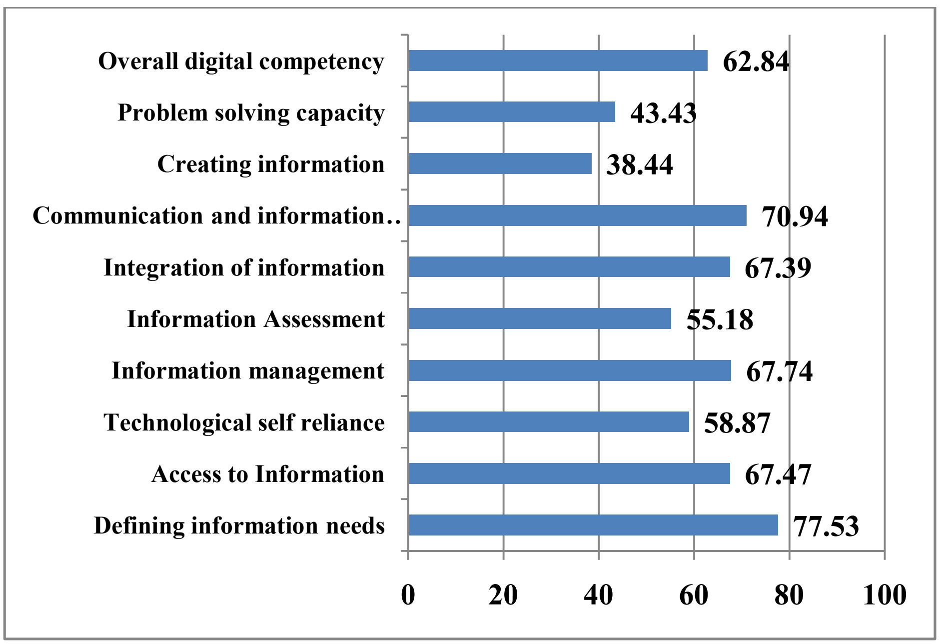

Figure 4. Students' Digital Competency in Different Dimensions of ICT

Figure 4 gives an overview of the students' percentage score for each dimension of digital competency. The figure shows that the students possessed minimum score in creating information, while maximum was scored in defining information needs.

A combined percentage score for all 37 items in ICT areas were calculated as in the case of each dimension of digital competency (table 43) and grouped as high, medium and low classes. The level of digital expertise acquired by the students for all digital competency measures is shown in table 44.

Table 44

Classification of Level of Digital Competency

Level of Competency	Frequency (%)
Low	40 (6.7)
Medium	290 (48.8)
High	264 (44.4)
Total	594 (100)

It can be seen that a large number of the students (48.8%) lies in the medium competency level. It is surprising that a good number of the students (44.4%) come under high competency class and only a limited number of the students fell in the low competency level.

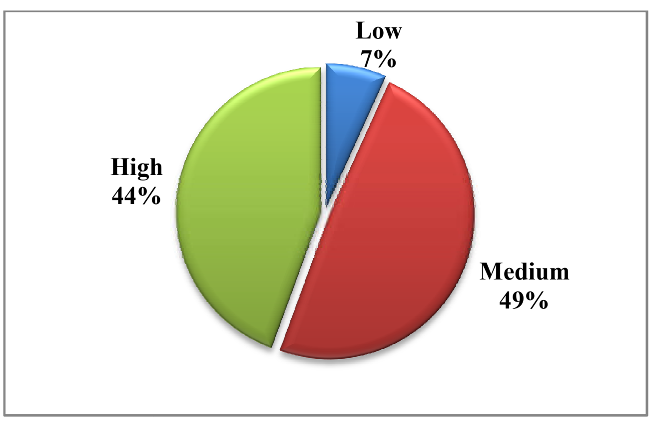

Figure 5. Digital Competency Divide

In Figure 5, the graphical representation of the digital competency divide exhibited by the students is shown. Likewise, variations in digital competency among ninth-grade Norwegian students in lower secondary schools were reported by Hatlevik, Guðmundsdóttir and Loi (2015). They realized that the students' conditions at home (e.g. cultural factors) and academic achievements appear to predict the respondents' digital competency. In addition to these factors, this study suggested that students' attitude (liking and interest) towards technology and teachers support also causes variations in level of digital competency among the students.

4.3.5.10 Gender Differences in Digital Competency

The issues of gender differences in terms of ICT competency have been extensively studied by many researchers. The society possesses a prejudiced view that girls have a lower self-efficacy compared to boys, especially in more complicated technology oriented tasks. In addition, studies have proved that girls are less confident than boys in their ICT skills, and boys scored better than girls in computer related knowledge and skills (Danner & Pessu, 2013).

Table 45

Gender Differences in Digital Competency

Gender	N	Mean	Std. Deviation	Z-value	p-value
Male	232	77.27	12.56	20.482**	< 0.001
Female	362	53.59	15.44		

*** Significant at 0.01 level*

In this study the researcher also investigated whether any gender differences exist among the students in their digital competency. For the purpose, Kolmogorov Smirnov test was done for testing the normality of the variable (digital competency). The p-value was found to be greater than 0.05 which indicates that the variable is following normal distribution; hence parametric test was done for gender-wise comparison.

Independent Z-test was carried out for making a comparison between the digital competency of male and female respondents (table 45). Z-value was found to be significant at 0.01 level. This reveals that there is a significant difference in the level of competency between male and female respondents for doing various ICT related activities/processes. The mean score was higher in the case of male students, which shows that they have significantly higher level of digital competency when compared to that of female students. Thus the gender difference is established by the researcher in digital competency also. A notable gender gap in the ability to use ICT applications was communicated by Saha and Zaman (2017). They found that girls were less efficient in various ICT applications like downloading and installing software from Internet and solving virus related problems. They were also less competent in MS-Word, Excel and presentation software. They also noticed that the main reasons for this gender divide in competency were mental dependency and lesser learning curiosity of the female students in the ICT sector. A comparable statement was made by Hargittai and Shafer (2006). They commended that women's low level self assessed web skill may affect significantly the extent of their online behaviour. These may be the reasons for gender differences in digital competency among the students in this investigation also.

4.3.5.11 Discipline-wise Comparison of Digital Competency

According to Tien and Fu (2008), the disciplinary training and norms are varying among Humanities and Social Science disciplines from Natural Science and Engineering. Hence this study also analysed whether any significant differences can be observed in the level of digital competency of the students from different disciplines. Table 46 depicts the comparison of digital competency of the students from different disciplines. One way ANOVA was done for comparing the digital competency of the respondents from different disciplines.

Table 46

Discipline-wise Differences in Digital Competency

Gender	N	Mean	Std. Deviation	F-value	p-value
Science	194	63.75	17.59	1.129^{ns}	0.324
Humanities	193	61.21	18.69		
Social Science	207	63.51	19.00		

ns - non-significant at 0.05 level

The result shows that p-value was found to be greater than 0.05; hence the F-value is non-significant at 0.05 level. This indicates that there is no significant difference among the respondents from Science, Humanities as well as Social Science with regard to their digital competency level in doing various ICT applications. So there is no significant variations can be noted in ICT skills among the students from different disciplines. Even though there is no significant discipline-wise differences in digital competency, the mean value (61.21) for students from Humanities was found to be low as compared to other two disciplines (63.75 for Science and 63.51 for Social Science students). This finding differs from that of McNaught et al. (2009). They disclosed that the students from various disciplines in Chinese University of Hong Kong varied in their confidence to use computers and had statistically significant differences in their perceived skilfulness to use online tools.

4.3.6 Expertise in Digital Devices *versus* Dimensions of Digital Competency

Further, the researcher attempted to find out whether any relationship exists between the expertise in digital devices and the different dimensions of digital competency among the students. Correlation analysis was selected in order to examine this relation. Karl Pearson's correlation was found out and is displayed in table 47. Positive correlations can be observed between proficiency in digital devices and each of the nine dimensions of digital competency as all the correlation coefficients are found to be positive and significant at one per cent level.

Table 47

Correlation of Expertise in Digital Devices with Dimensions of Digital Competency

Dimensions	Correlation with level of expertise
Defining information needs	0.521**
Access to Information	0.620**
Technological self reliance	0.760**
Information management	0.691**
Information assessment	0.633**
Integration of information	0.570**
Communication and information sharing	0.711**
Creating information	0.636**
Problem solving capacity	0.690**
Overall digital competency	**0.809****

*** significant at 0.01 level*

It can be concluded that as the level of digital competency in ICT applications increases, the level of expertise to use digital devices seems to be better. Ziefle and Schaar (2010) mentioned that users with a high level of technical expertise exhibited considerably good performance when using technical devices. For some ICT devices (PC, mobile phone, and digital camera), they found significant correlations between expertise and ease of use ratings as well as frequency of usage.

4.3.7 ICT Related Training and Digital Competency

Lack of adequate ICT training might be one of the reasons that lead the students to acquire a low level of expertise in ICT competency. ICT related courses offer the training to handle various ICT applications easily for the students. Danner and Pessu (2013) pointed out that lack of training in ICT makes a negative attitude towards ICT which in turn reduces confidence to use the same. This study also tried to compare the digital competency of the students who have attended the ICT related courses with those who have not. The output is demonstrated in table 48.

Table 48

ICT Training and Digital Competency

Course Attended	N	Mean	Std. Deviation	Z-value	p-value
Yes	385	65.97	17.77	5.755**	< 0.001
No	209	57.08	18.33		

*** Significant at 0.01 level*

The Z test was done for making this comparison. Z-value was found to be significant at 0.01 level. This implies that there is significant variation in the digital competency of the students between those who have participated in ICT related courses and those who haven't. Mean score was higher for those who have attended the courses, which can be interpreted as the students who attended the courses have significantly higher level digital competency than those who didn't. This finding is broadly in agreement with the report of Danner and Pessu (2013) who noticed a significant difference in the ICT competencies between the students who had and had not taken computer related courses before.

4.3.8 Access to ICT and Digital Competency

Access to technology (digital devices and Internet connection) is an integral part for developing the digital competency. It is necessary for handling the various ICT applications in the digital world. Thus lack of access to technology may impact on the level of digital competency of the students. Here correlation analysis is used to determine if there were any relationships between access to ICT by the participants and their level of digital competency. Spearman's rank correlation coefficient was worked out for analysing the relationship. The result is given in table 49.

Table 49

Correlation of Access to ICT with Digital Competency

Variables	Digital Competency
Access to digital device	0.510**
Access to the Internet	0.494**
Access to ICT	0.544**

** Significant at 0.01 level

It is clear from the table that, there exists a positive relationship between access to ICT and digital competency of the students as correlation coefficients are found to be positive and significant at

0.01 level in all the three cases (access to digital devices, the Internet and overall ICT). The result indicates that when access to technology increases at the personal level, an increase in digital competency can also occur. Guðmundsdóttir (2010) reported supporting findings and noticed a higher level of ICT competency among the seventh-grade learners, who had computer and Internet access at home compared to those who hadn't. Thus autonomy of access to digital technology improves the digital competency of students which in turn reduces the digital divide. The analysis related to personal level access to ICT confirmed that digital inequalities exist among the respondents in terms of access. So these inequalities may be one of the reasons that can result in differences in the digital competency of the students.

4.4 Use of the Internet

In earlier studies on digital divide, the scholars mainly focussed on the gap in technical access. Accordingly, they identified the digital divide as the result of differences in accessing technologies among people. Thereafter, researchers emphasised that it 'denotes not only the differences in access, but also the inequalities among the Internet users in the extent to which they are capable of receiving benefits from their use of technology (Li & Ranieri, 2013). Thus digital divide is more than the inequalities between those who have access to and those who do not have access to the Internet and other digital technologies. The Internet has appeared as the most distinguishable component of the dynamic development of ICTs. The rate of take up of the Internet exceeds that of all technologies before it. Hence many researchers addressed the digital divide in terms of differences in Internet access and usage intensities. Their research on digital inequality reflects on the quality and quantity of Internet usage. Thus the second level digital divide represents the disparities in Internet use. Although the university provided Internet access, the intensity and purpose of use of the Internet by the students may vary. In other words, access to the Internet does not ensure the equal use of it. Therefore, the current study also sought differences in the time, frequency and various purposes of Internet use among the students, which also can drive the second level of digital divide.

4.4.1 Experience in the Use of the Internet

Students who spend more time online will likely to possess more knowledge about the web and thus will have better online skills. Moreover, those who had been Internet users for a long period of time are supposed to be better in accessing information online as they have more experiences to draw on. Furthermore, early adopters tend to be more advanced, with a greater desire to explore a new medium and to become more aware about it (Howard, Rainie & Jones, 2001; Hargittai, 2002). The researchers commented that prior experience with the Internet affects students' online activities. So a question was included in the questionnaire to realize the respondents' experience in the use of Internet (table 50). The table also incorporates gender differences in their experiences in Internet use. The data suggest that majority of the students (38%) come under the group with 4-6 years experience in the use of the Internet succeeded by 1-3 years experience with 180 responses (i.e. 30.3%). Approximately one quarter of the participants (24.1%) have good experience (more than 7 years) in the use of Internet.

Table 50

Experience in Use of the Internet

Experience	Frequency (%)		
	Male	Female	Total
Less than one year	7 (3)	38 (10.5)	45 (7.6)
1-3 years	54 (23.3)	126 (34.8)	180 (30.3)
4-6 years	98 (42.2)	128 (35.4)	226 (38)
7-9 years	38 (16.4)	42 (11.6)	80 (13.5)
More than 9 years	35 (15.1)	28 (7.7)	63 (10.6)
Total	232 (100)	362 (100)	594 (100)
Chi-square = 28.006**; p-value < 0.001			

***Significant at 0.01 level*

Considering the gender-wise analysis, the fraction of the male students outpaces the female students in three categories (4-6, 7-9 and more than 9 years) of experience. Consequently the percentage of the female students is higher in both group; 1-3 years and less than one year experience in Internet use as compared to the male participants. The investigator expounded the result as male participants got more experience in the use of the Internet than their female counterparts. The data were subjected to Chi-square test to know the association of gender in the experience to use the Internet, which indicates a significant association at one per cent level since the p-value is less than 0.001. The result makes it clear that male and female students differ significantly regarding their Internet experience. This finding has an important implication while considering the report of Cotten and Jelenewicz (2006) in their observation of digital inequalities existing among college freshman in USA. They revealed that prior Internet experience and gender affected particular types of Internet usage and demonstrated that the digital divide is indeed multilayered.

4.4.2 Frequency of Use of the Internet

Over the last few years the penetration of the Internet has increased exponentially. However, studies reflected that many people remained reluctant to use the Internet regularly. A differential usage pattern with regard to the frequency of Internet use was also noted along gender line in certain studies. The progress in the society has changed the way people engage themselves with the Internet. With these transitions, women participation in the Internet has also become more visible. Some researchers opined that although most of the Internet users are men, the gender divide among users has reduced (Thanuskodi, 2013). The investigator wished to scrutinize the differential usage pattern of the Internet by male and female students in terms of frequency (periodicity and duration) of use. Frequency is measured by taking both the periodicity and duration of Internet use and it is represented in tables 51 and 52.

Table 51

Frequency of the Internet Use

Periodicity	Frequency (%)		
	Male	**Female**	**Total**
Rarely	8 (3.4)	56 (15.5)	64 (10.8)
Monthly	12 (5.2)	50 (13.8)	62 (10.4)
A few days a week	87 (37.5)	156 (43.1)	243 (40.9)
Daily	88 (37.9)	66 (18.2)	154 (25.9)
Stay connected most of the time	37 (15.9)	34 (9.4)	71 (12)
Total	232 (100)	362 (100)	594 (100)
Chi-square = 56.403**; p-value < 0.001			

***Significant at 0.01 level*

In table 51, it is clearly seen that a considerable proportion of the students (40.9%) connected to the Internet a few days in a week and just over one fourth of them (25.9%) visited the Internet on a daily basis. The number of students who remained connected most of the time on the Internet was found to be very low. Similarly, the fraction of the students who used the Internet monthly as well as rarely also seemed to be very small. These differences may be due to the students' attitude towards Internet and the level of Internet self-efficacy as analysed by Zeng (2011).

Responses on the frequency of the Internet use generated a precise difference between male and female participants. The use of the Internet by the female students were less frequent, as more female students come under the categories 'a few days a week' (43.1%), 'monthly' (13.8%) as well as in 'rarely' (15.5%), when compared to male students. This in fact, conflicts with the high responses got from the male students' Internet use on 'daily basis' and also in 'stay connected most of the time'. In addition, Chi-square test was conducted to examine whether the proportion of male and female students varied significantly in the frequency of the Internet use and revealed that there is a significant difference between the proportion of male and female students since the p-value is less than 0.001. In other words, the gender differences in the frequency of the Internet use are statistically significant at one per cent level. A similar trend has been reported by Anunobi and Mbagwu (2009) as they found that the frequency of the Internet use produced a sharp difference between men and women in Nigeria.

Another important variable related to the Internet use is the typical duration spent by the students when they connect to the Internet. The investigator tried to find the duration spent on the Internet by the students. Table 52 presents the result. It can be seen that above half of the students (57.3%) spent the time on the Internet either '30-60 minutes' or '1-2 hours' on an average whenever they connect to the Internet. The percentages of the students who used the Internet 'more than three hours' (15.3%) and '2-3 hours' (12.1%) were seemed to be very low. Likewise a small fraction of the students used the Internet 'less than half an hour' in a day.

Table 52

Time Spent in a Day to Access the Internet

Periodicity	Frequency (%)		
	Male	Female	Total
Less than 30 minutes	16 (6.9)	75 (20.7)	91 (15.3)
30-60 minutes	66 (28.4)	105 (29)	171 (28.8)
1-2 hrs	66 (28.4)	103 (28.5)	169 (28.5)
2-3 hrs	27 (11.6)	45 (12.4)	72 (12.1)
More than 3hrs	57 (24.6)	34 (9.4)	91 (15.3)
Total	232 (100)	362 (100)	594 (100)
Chi-square = 38.977**; p-value < 0.001			

***Significant at 0.01 level*

The table also describes the gender-wise difference in the duration of the Internet use in a day. It can be noted from the table that the duration of use of the Internet by male students was higher in the case of 'more than three hours', as compared to that of the female students. In other three cases ('2-3 hours', '1-2 hours' and '30-60 minutes'); the duration of the Internet use was found to be similar to both male and female students.

However, the proportion of female students exceeded that of male students in the duration of below half an hour. Thus, the results indicated that there were differences between male and female respondents on the duration of the Internet usage. The result of Chi-square test also revealed that the differences in the duration of the Internet use among male and female students are statistically significant at one percent level as the p-value is less than 0.001. Hence the duration of the Internet use differs between male and female students and male students reported a higher duration in the Internet use than female students. The result is supported by the statement of Winker (2005) who opined that along with other factors, time is an important one in the use of the Internet and men used the Internet more frequently, that too for long hours than women.

4.4.3 Relationship between Internet Use and Digital Competency

The relationship of technical skills and the Internet use among young adults was looked at by Hargittai and Hinnant (2008). They reported that online abilities would likely influence how people use the medium and higher skills were associated with more capital-enhancing online activities. Here the investigator checked whether any relationship existed between the Internet use and digital competency of the students. Correlations with different dimensions used to evaluate the digital competency of the students and their Internet usage pattern are shown in table 53. Spearman's correlation coefficient was calculated to find out these relations.

Table 53

Relationship between Intensity of Use of the Internet and Digital Competency

Dimensions	Experience in the use of the Internet	Frequency of use of the Internet	Time spent in a day to access Internet
Defining information needs	0.285**	0.356**	0.311**
Access to information	0.321**	0.391**	0.338**
Technological self reliance	0.384**	0.441**	0.376**
Information management	0.368**	0.433**	0.420**
Information assessment	0.325**	0.400**	0.332**
Integration of information	0.332**	0.325**	0.307**
Communication and information sharing	0.344**	0.471**	0.439**
Creating information	0.249**	0.319**	0.258**
Problem solving capacity	0.354**	0.384**	0.356**
Overall digital competency	0.406**	0.488**	0.438**

*** Significant at 0.01 level*

The correlations of nine ICT areas in digital competency with years of experience in the use of the Internet were found to be positive and significant at 0.01 level. In other words, as the experience in the use of the Internet increases, the digital competency of the students also improves. Similarly, positive correlations were found in the cases of each nine digital competency dimensions and periodicity in connecting to the Internet, that also significant at one per cent level. The result established that as the intensity of use of the Internet increases, digital competency tends to be better. Likewise, the relationships between the nine areas of digital competency and the time spent on the Internet in a day also showed positive correlations, significant at one per cent level. This result also confirmed that as the duration of the use of the Internet increases, the level of digital competency also improves. Thus the overall analysis concluded that there exists a significant positive relationship between the students' digital skills and Internet use. Eastin and LaRose (2000) gave a supporting report that, with more online experiences, the people could attain a level of the Internet self-efficacy, or trust in their ability to accomplish certain digital tasks online.

4.4.4 Location of the Internet Access

Location of the Internet use implied from where the students access the Internet. Hargittai (2010) suggested that number of the Internet access locations were positively related to online skills. So another aspect covered by the researcher was to understand the location from where the students access and use the Internet. Multiple options were permitted for every answer.

As per the details of the table 54, around two third of the respondents (67.7%) used the Internet from their home, as vast majority of the students have mobile phone with Internet connection.

Department was the second place, where nearly three fifth of the students (59.3%) access the Internet. Almost same proportion of the students (21%) used the Internet from library as well as Internet cafe and one quarter of them also used the Internet from their hostels. For 'others' category, some students answered that they have accessed the Internet from houses of their friends and relatives, while some others used it during travelling.

Table 54

Location of Access to the Internet

Locations	Frequency (%)
Home	402 (67.7)
Department	352 (59.3)
Library	129 (21.7)
Internet cafe	127 (21.4)
Hostel	148 (24.9)
Others	14 (2.6)

Lei and Zhou (2012) claimed that the access and use of the Internet from homes promote the self efficacy of the students to use technology and make their attitude towards ICT positive. It also assists the students in their learning outcomes. In the study, the researcher reminded that home Internet access furnishes the autonomy of the Internet use among students. However, imbalances could be noticed among the students in the location of access to the Internet as one third of the students didn't access the Internet from their home which is an indication of digital divide.

4.4.5 Monthly Expenditure for the Internet Access

Even though universities provided free Internet access to the students, the researcher noticed that there were problems associated with network coverage and adequate infrastructure to access the Internet. As previously stated, lack of enough money forms a prominent barrier in the use of the Internet among the students at personal level. Therefore, the investigator has a curiosity to know the students' monthly expenditure for Internet access, which is represented in table 55.

Table 55

Monthly Costs for the Internet Access

Cost	Frequency (%)
Nil	103 (17.3)
0-50	74 (12.5)
51-100	154 (25.9)
101-200	116 (19.5)
Above 200	147 (24.7)
Total	594 (100)

As seen from the table, around one quarter of the students spent Rs. 51-100 for their Internet access. Almost same percentage of the students spent relatively a bigger amount of rupees above 200 for their Internet access. The most important result is that 103, out of 594 students didn't spend any money for their Internet access. This output is an indication of digital divide among the students. If the participants spend adequate money for their Internet access, it will provide a great autonomy in their Internet use. However, the researcher noted that some students didn't enjoy the personal level Internet access. They can access the Internet mainly from their university.

4.4.6 Frequency of Use of Internet Related Services/Activities

As the Internet has become progressively widespread in the world, most researchers agreed that the digital divide should include more dimensions than the simple measure of physical access to ICT. So the range or the breadth of Internet use could be a better indicator of the digital inequalities. Scholarly literature on Internet use suggested that even when people overcome the initial connectivity divide, there exist large differences among them in how they embrace the Internet into their daily lives (e.g., Van Dijk, 2005; Barzilai-Nahon, 2006). As a result, it is important to investigate the differential Internet use by those who go online. In this study, the investigator identified the differentiated uses of the Internet over the last twelve months among the students by examining the variations in the frequency of the Internet use for different activities/services, searching e-resources and also for various other purposes, which are detailed in following tables.

In order to augment the interpretation, the researcher regrouped 'always' and 'often' classes together into high level of the Internet use. In the same manner, 'rarely' and 'never' were grouped into low level of use. The frequency class 'sometimes' is interpreted as a medium level use of the Internet. The variations in the frequency of use of the Internet for wide varieties of activities among the students over the previous year were examined by the researcher and are portrayed in table 56. Activities related to WWW, social networking and WhatsApp enjoyed a high level of use among the students with over 60 per cent participation. These followed immediately by downloading files (59.1%), e-mail (58.1%), use of chatting applications (57.4%) and sharing course material (53.7%). The fractions of the respondents in the low level Internet use for WhatsApp, sharing course material, social networking, chat, downloading files, e-mail and WWW were 26.2, 23.3, 22.5, 21.0, 17.0, 15.5, and 10.1 per cent, respectively. The Internet services that majority of the participants used seldom include RSS (87.5%), bookmarking (77.8%), blog (68.3%), tagging (58.3%) and Internet call (52.8%). Further, these services were used heavily only by a small fraction of the students. In other words RSS had only 4.9 per cent heavy users followed by bookmarking (12.4), blog (15.4) and tagging (21.1). However, Internet calling was used at a high level by over a quarter of the students (25.1%).

Table 56

Frequency of Use of the Internet Related Services/Activities

Service/ Activities/ Tools	Frequency (%)				
	Always	**Often**	**Sometimes**	**Rarely**	**Never**
WWW	223 (37.5)	162 (27.3)	149 (25.1)	60 (10.1)	0 (0)
E-mail (Web mail)	174 (29.3)	171 (28.8)	157 (26.4)	77 (13)	15 (2.5)
Chat	212 (35.7)	129 (21.7)	128 (21.5)	66 (11.1)	59 (9.9)
Internet call	57 (9.6)	92 (15.5)	131 (22.1)	125 (21)	189 (31.8)
WhatsApp/Hike	267 (44.9)	98(16.5)	73 (12.3)	40(6.7)	116 (19.5)
Social Networking Sites (Eg., Facebook)	236 (39.7)	135 (22.7)	89 (15)	49 (8.2)	85 (14.3)
Blogs	27 (4.5)	65 (10.9)	96(16.2)	132(22.2)	274 (46.1)
Wikis	82 (13.8)	125 (21)	122 (20.5)	86 (14.5)	179 (30.1)
RSS (Really Simple Syndicate)	4 (0.7)	25(4.2)	47(7.9)	82 (15.8)	426 (71.7)
Book Marks (Eg., MyBookmark.com)	25 (4.2)	49 (8.2)	58 (9.8)	114 (19.2)	348 (58.6)
Tagging	55 (9.3)	70 (11.8)	123 (20.7)	112 (18.9)	234 (39.4)
Video sharing (Eg. YouTube)	82 (13.8)	94 (15.8)	137 (231)	98 (16.5)	183 (30.8)
Photo sharing (Eg. Picaso)	98 (16.5)	96 (16.2)	139 (23.4)	86 (14.5)	175 (29.5)
Downloading Files (Eg. Audio, Video)	183 (30.8)	168 (28.3)	142 (23.9)	65(10.9)	36 (6.1)
Sharing course materials/ Lecture notes	137 (23.1)	182 (30.6)	137 (23.1)	71 (12)	67 (11.3)

In applications like wiki, photo sharing and video sharing a reasonable percentage of the students (34.8, 32.7 and 29.6%, respectively) put themselves in the high level usage. At the same time 44 per cent of the respondents reported low level use of the Internet for using wikis and also for photo sharing. Other Internet related services/activities by the students were related to movie database, online courses, online shopping, etc.

The findings show that everybody used WWW, though with varying frequencies. Relatively a high level usage of social networking sites and WhatsApp application can be seen among the students. The most unused service was RSS as over 70 per cent of the students never used it. Similar trends were revealed by the students in the cases of bookmarking and blog. The gradations in the use of the Internet for wide variety of activities were explained by the researcher. A related study was done by Livingstone and Helsper (2007), in which they evaluated the nature and quantity of the Internet use among a national sample of 9 to 19 year-olds from UK. They portrayed the digital divide by giving the multimodality of the Internet use and informed that going online is a progression in differences between those who engage in more and those who engage less in Internet activities. Here also, the researcher explored the differences in frequency of the Internet use and substantiate the usage divide in Internet related applications.

Percentage score for each Internet activity/service was worked out by adding the scores of all the fifteen items. The response was scored 0, 1, 2, 3 and 4 for never, rarely, sometimes, often and always, respectively. Then the total score for all the items was divided by the maximum expected score (number of items x 4) and multiplied by 100 to get the percentage score for Internet activity/service. These percentage scores are classified into three equal classes. Low level use with scores less than 33.3, average level in between 33.3 and 66.7 and high level with score greater than 66.7. The distribution of the respondents along different levels (low, medium and high) is given in table 57.

Table 57

Level of Frequency of the Internet Use

Level of Use	Frequency (%)
Low	149 (25.1)
Medium	323 (54.4)
High	122 (20.5)
Total	594 (100)

As table 57 depicts, more than half of the students (54.4%) reported medium level frequency in the use of overall Internet related activities. Only one fifth of the students fell under high frequency of use and one fourth of them appeared in the low level of use. Thus the researcher highlighted the inequalities in the frequency of the Internet related activities and the associated digital divide. These findings are confirmation of the existence of the gap in terms of the Internet use reported by Van Dijk (2012). The researcher opined that some segments of the population will more frequently use the Internet for serious applications with the highest benefits on capital and resources (e.g. work, study, etc.), while others use the various applications with no, or very little, advantageous effects on capital and resources. In such a way, some students highly engaged in various complicated applications to use the Internet, while some others remained far away from it. This is an indication of digital divide.

4.4.7 Frequency of Use of E-Resources

There was a need to assess the frequency of use of e-resources by the respondents in order to gauge their imbalances to use it. It is seen in table 58. As mentioned above in the case of Internet related activities and services, the researcher followed the same categorisation for the Likert scale. The frequencies 'always' and 'often' were grouped together to form high intensity of use, whereas 'rarely' and 'never' were classified into low intensity of use. The category 'sometimes' was considered as an average level of use.

In the cases of e-books and e-journals, around 30 per cent of the participants have high level frequency of use; while just above 40 per cent of them have low frequency of use. When compared with other resources, a considerable percentage of the students (43.3%) have high level frequency of use of online reference sources, as most of them marked their responses in 'always' as well as 'often' categories. At the same time, a reasonable number of the students (33.9%) fell into the low level use of online reference sources. The frequency of use of Electronic Thesis and Dissertations (ETDs), institutional repositories and library consortia were found to be minimum as roughly three fourth of the students reported a low level usage. On the other hand, approximately 10 per cent of the participants had a high frequency of use of ETDs, institutional repositories, as well as library consortia. There was also a low frequency of use of e-zines can be seen as over 60 per cent of the participants come under the categories 'rarely' as well as 'never' and only a small proportion of them (17.5%) had high level frequency of use. A similar patterning was found in the frequencies of use of web portals and digital libraries. Comparable fractions of the students (about 35%) reported in both high level and low level frequency in the use of e-newspapers.

Table 58

Frequency of Use of E-resources

E-resources	Frequency (%)				
	Always	Often	Sometimes	Rarely	Never
E-journals	52 (8.8)	123(20.7)	163 (27.4)	123 (20.7)	133 (22.4)
E-books	54 (9.1)	121 (20.4)	175 (29.5)	124(20.9)	120 (20.2)
E-newspapers/ e-news sites	84 (14.1)	122 (20.5)	163 (27.4)	112 (18.9)	113 (19)
E-zines (Electronic Magazines)	27 (4.5)	77 (13)	116 (19.5)	150 (25.3)	224 (37.7)
ETD (Electronic Thesis and Dissertations)	10 (1.7)	57 (9.6)	76 (12.8)	145 (24.4)	306(51.5)
Online Reference Sources (Eg. Dictionaries)	98 (16.5)	159 (26.8)	136 (22.9)	121 (20.4)	80 (13.5)
Institutional Repositories	21 (3.5)	31 (5.2)	89 (15)	152 (25.6)	301 (50.7)
Web Portals	55 (9.3)	73 (12.3)	141 (23.7)	163 (27.4)	162 (27.3)
Digital Libraries	32 (5.4)	74 (12.5)	118 (19.9)	160 (26.9)	210 (35.4)
Library Consortia	17 (2.9)	47 (7.9)	97 (16.3)	163 (27.4)	270 (45.5)

From the responses, it is clear that the overall use of e-resources appeared to be limited. The frequency of use was higher in the case of online reference sources among the students. Very low level usage intensity can be noticed in the cases of library consortia, institutional repositories and ETDs. This result implied that the students make use of e-resources to some extend in their academic work. The findings stand opposed to the result of Akpojotor (2016) who found a great extend of use of e-resources by postgraduate students of Library and Information Science in Southern Nigeria.

The percentage score for e-resources was calculated in the same manner as in the case of the Internet related activities and classified the overall usage frequencies of e-resources in to high, medium and low usage. The classification is indicated in table 59.

Table 59

Level of Frequency of Use of E-resources

Level of Use	Frequency (%)
Low	300 (50.5)
Medium	235 (39.6)
High	59 (9.9)
Total	594 (100)

Data in the table illustrated that greater part of the participants (50.5%) come under low frequency of use of e-resources and nearly 40 per cent of them grouped under medium frequency of usage. A very minor part of the sample classified in the highest frequency of use of e-resources. Again, the inequalities of Internet use in terms of e-resources were proved by the researcher. Gakibayo, Ikoja-Odongo, and Okello-Obura (2013) revealed that the utilization of e-resources was affected by the students' lack of computer skill as well as information literacy skills. Inadequate ICT infrastructure also affects the use of e-resources.

4.4.8 Purpose of Use of the Internet

Internet use is confined mostly to educational, general or recreational purposes among students. Differences in the use of the Internet for various purposes were identified by many scholars in their research. The aspects of digital divide in terms Internet use by college freshman for specific purpose was identified by Cotten and

Jelenewicz (2006). Therefore, one important area to be analysed is the differences in utilization of the Internet for varieties of purposes. An attempt was made to estimate the students' frequency of use of the Internet for different purposes and it is unveiled in table 60.

Regrouping of classes in the Likert scale were done similar to the cases of the Internet related activities and e-resources. The findings conveyed that a vast majority of the respondents (above three fourth) were reported to have high frequency of the Internet use for educational and academic purposes, whereas only a negligible number of the students fell under the low frequency group. Regarding communicational and recreational purposes, around 65 per cent of the students have high frequency of use of the Internet, while a very small fraction of them appeared in the low level usage. Furthermore, about half of the participants expressed high level frequency of the Internet use for seeking information related to job opportunities and getting news online. Around 20 per cent of them have reported to be in low frequency of use for the same. A low frequency of the Internet use could be observed in the mobile recharging, Internet banking, travelling purpose, online shopping and government interaction, as above half of the students responded either 'Rarely' or 'Never' categories. On the other hand, a relatively small percentage of the students appeared in the high frequency of the Internet use for mobile recharging, government interactions and Internet banking. However, the students showed a little bit higher frequency of the Internet use in online shopping and travelling purposes when compared to mobile recharging, government interactions and Internet banking. The percentages of the students fell in high (36.3%) and low classes (35.9%) for seeking health related information were almost similar. In the case of seeking political information, around 40 per cent of the students came under low frequency of the Internet use whereas around 34 per cent fell under the high frequency class.

Table 60

Frequency of the Internet Use for Different Purposes

Purposes	Frequency (%)				
	Always	Often	Sometimes	Rarely	Never
Educational (Eg., Admissions, checking of examination results, etc.)	291 (49)	161 (27.1)	124 (20.9)	18 (3.0)	0.00
Academic (Exam, assignments, projects, etc.)	294 (49.5)	165 (27.8)	113 (19)	20 (3.4)	2 (0.3)
Employment/job opportunity/ career	162 (27.3)	135 (22.7)	181 (30.5)	84 (14.1)	32 (5.4)
Government interaction	42 (7.1)	53 (8.9)	163 (27.4)	170 (28.6)	166 (27.9)
News	150 (25.3)	144 (24.2)	160 (26.9)	97 (16.3)	43 (7.2)
Health information	75 (12.6)	141 (23.7)	165 (27.8)	133 (22.4)	80 (13.5)
Political information	84 (14.1)	117 (19.7)	153 (25.8)	126 (21.2)	114 (19.2)
Communication	247 (41.6)	143 (24.1)	119 (20)	68 (11.4)	17 (2.9)
Recreation/Entertainment (music, games, etc.)	211 (35.5)	189 (31.8)	134 (22.6)	45 (7.6)	15 (2.5)
Shopping	46 (7.7)	105 (17.7)	130 (21.9)	118 (19.9)	195 (32.8)
Travelling (Online ticket reservation)	49 (8.2)	70 (11.8)	128 (21.5)	130 (21.9)	217 (36.5)
Internet banking	44 (7.4)	62 (10.4)	114 (19.2)	122 (20.5)	252 (42.4)
Mobile recharging	54 (9.1)	39 (6.6)	87 (14.6)	137 (23.1)	277 (46.6)

The frequency of Internet use became good level for the purpose of education, recreation and communication; whereas it was very limited for government interactions, mobile recharging, travelling, Internet banking, and online shopping. The utilization of the Internet for academic purpose was high among the students. It is an indication of reducing the second level digital divide among the students. Comparatively an average frequency of the Internet use was exhibited by the students for searching news and job opportunities online. Results suggest the existence of a second level digital divide as variations existed in the frequency of the Internet use to attain different objectives. It also shows the differences in the advantages they take from the use of the Internet.

To find out the overall variations in the frequency of the Internet use for different purposes, the researcher adopted the same method to calculate percentage score as in the case of the Internet related activities (table 58). The result is presented in table 61.

Table 61

Level of the Internet Use for Different Purposes

Level of Use	Frequency (%)
Low	119 (20)
Medium	318 (53.5)
High	157 (26.4)
Total	594 (100)

As evidenced from the table, more than half of the participants (53.5%) exhibited a medium level frequency in the Internet use for different purposes. A substantial proportion of the students (26.4%) found to be high intensity in Internet usage, whereas relatively a small fraction of them (20%) fell under low usage of the Internet for variety of purposes. Variations in intensity of the Internet use for different purposes are illustrated here. Like in the case of variations in frequency of use of the Internet related activities, students reported almost similar differences in the frequency of the Internet use for different purposes. The result established the second level digital divide as stated by Youssef and Ragni (2008) in terms of differences in purpose of the Internet use. They put forward that the second level digital divide exists among the students in terms of differences in the time devoted to the Internet use and in their purpose of the Internet use.

The percentage score for each item in frequency of use of Internet related activities, use of e-resources and use of the Internet for different purposes were measured to know the overall frequency of the Internet use and made a similar classification as mentioned earlier. It is given in table 62.

Table 62

Level of Frequency in the Internet Use

Level of Use	Frequency (%)
Low	156 (26.3)
Medium	343 (57.7)
High	95 (16)
Total	594 (100)

The analysis showed that the fraction of the students who had medium level frequency of the Internet use was found to be more than half (57.7%). A very few of the participants (16%) have higher frequency of the Internet use and about quarter of them (26.3%) have low level frequency of the Internet use. The pie chart showing the divide in the Internet use exhibited by the students is also given in Figure 6.

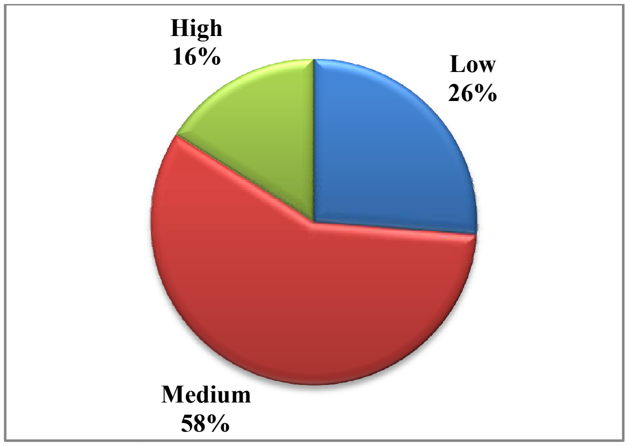

Figure 6. Divide in Internet Use

The findings obtained from the analysis reflected the inequalities exist in the Internet use and also the second level digital divide. In summary, differences in the frequency of the Internet use for various activities/services, e-resources and purposes suggested that even though students have basic Internet access; there are many other factors that influence their use of the Internet. Hargittai (2010) explained that socioeconomic status, autonomy of Internet use, experience with medium and Internet skills were important predictors of how people were incorporating the web into their everyday lives. Along the same line, the researcher also feels that parental education and income, students' Internet experiences, autonomy of Internet use, Internet skills and attitude are the main factors that affect the level of the Internet usage.

4.4.9 Gender Difference in the Internet Use

There are lots of discussions on the association between gender and Internet use. Many scholars proved the existence of gender inequality in the Internet usage. Some researchers mentioned that once the female students got online access, they remained less frequent and less intense users of the Internet compared to men (Ono & Zavodny, 2003; Hilbert, 2011). This indicates that even though the students have Internet access, there may be variations in the frequency of the Internet use between male and female students. Hence this study also attempted to check whether any significant gender difference existed in the frequency of Internet use and the result is shown in table 63.

Comparisons of frequency of the Internet use among male and female students were done by Z-test. It was done in the cases of use of the Internet services/activities/tools, use of e-resources, Internet use for different purposes and overall uses separately. In all these cases, Z-values were found to be significant at 0.01 level, as the corresponding p values were less than 0.001. This shows that there exist significant gender differences in the frequency of the Internet use in all these aspects. In all cases, male students have higher mean scores compared to female students which suggested that male respondents use the Internet more frequently than female respondents. The data analysis displayed a clear picture of differential Internet use along gender lines. It is also consistent with the findings available in scholarly literature. The results corroborate the statement of Van Dijk (2012), who mentioned that in all nations, men and women still retain different preferences for certain Internet applications and a gender usage gap existed in terms of Internet related applications.

Table 63

Gender-wise Comparison of Frequency of the Internet Use

Frequency of Internet use	Group	N	Mean	Std. Deviation	Z-value	p-value
Internet Related Activities/Services	Male	232	62.43	17.93	15.35**	< 0.001
	Female	362	39.00	18.29		
Use of E-resources	Male	232	47.32	22.16	11.04**	< 0.001
	Female	362	27.78	19.18		
Purpose of Internet Use	Male	232	65.92	16.41	14.72**	< 0.001
	Female	362	44.76	18.13		
Overall Use	Male	232	59.65	16.02	15.67**	< 0.001
	Female	362	38.01	16.66		

** Significant at 0.01 level

An interesting disparity can also be noted in the use of e-resources in the study. The result concurs with the report by Manda and Mukangara (2007). They revealed that male students used e-resources more frequently than female students. Jones et al. (2009) suggested that boys were usually found to use the Internet more for different purposes compared to girls, which also supported the findings of the present study. The low frequency of the Internet use by the female students may be attributed to their social status, time they spent on Internet, and exposure in using different ICT resources.

4.4.10 Discipline-wise Comparison of the Internet Use

There is a possibility of differences in the prevalence of the Internet use among students from different academic disciplines. Discipline related differences in the frequency of the Internet use have been investigated very little. It was pointed out that noticeable communication traditions of various disciplines have great impact on students' use of the Internet (Matzat, 2009). In the present study also, the researcher analysed whether any significant differences existed among the students from different disciplines in the frequency of the Internet use for different services, for the use of e-resources and also for various purposes. Comparison of frequency of the Internet use among the students from different disciplines is displayed in table 64.

Table 64

Discipline-wise Comparison of Frequency of the Internet Use

Discipline	N	Services /Activity /Tools		E-resources		Purposes		Overall	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Science	194	49.67	21.02	36.38	22.52	54.78	20.00	47.92	19.12
Humanities	193	47.44	20.47	34.69	22.50	51.91	19.99	45.62	19.17
Social Science	207	47.38	22.71	35.17	22.56	52.42	20.84	45.89	20.19
F-value		0.729^{ns}		0.290^{ns}		1.107^{ns}		0.813^{ns}	
p-value		0.483		0.748		0.331		0.444	

^{ns} non significant at 0.05 level

Comparison of frequency of the Internet use among the participants from different disciplines was done by one way ANOVA. It was done in the cases of use of the Internet services/activities/tools, use of e-resources, Internet use for different purposes and their overall Internet use. F-values shown in table 64 are found to be non significant in all cases as the corresponding p-values are greater than 0.05. Hence it can be concluded that there is no significant discipline-wise variations existing in the frequency of the Internet use.

The result is opposed to the report of Mahmood (2009), who disclosed significant differences in the use of the Internet and e-mail services based on students' academic disciplines. The researcher found that students from Arts and Humanities were lesser users of both technologies than their counterparts from Social Sciences as well as Science and Technology. In this study, the analysis disclosed that even though there were no significant differences in the frequency of the Internet use among the students from three academic disciplines, the mean values are slightly higher for the students from Science subjects when compared to the other two disciplines. So it can be interpreted that the Science students' frequency of the Internet use is slightly higher than those from other disciplines. Lazinger, Bar-llan and Peritz (1997) reported that the intensity of the Internet use was higher even among faculty members from Science discipline than those from Social Science and Humanities in the Hebrew University of Jerusalem.

4.4.11 University-wise Comparison of the Internet Use

The student community is embracing new technologies in various ways. These variations make the utilization of resources from Internet in different ways, thus making digital gaps within university population. So a university-wise analysis was also conducted in the case of frequency of Internet use. The researcher analysed whether any significant differences existed in the frequency of the Internet use among the students from different universities. The result is unveiled in table 65. ANOVA was carried out for comparing the use of the Internet among the students from different universities. The p-value was found to be less than 0.001; hence the F-value is significant at 0.01 level. The result indicates that there exist significant variations in the frequency of the Internet use among the students from four universities. So pair wise comparison was done using Duncan's Multiple Range Test (DMRT).

Table 65

University-wise Comparison of the Internet Use

University	N	Mean	Std. Deviation	F-value	p-value
University of Kerala	176	46.15^{b}	21.43	8.646**	<0.001
University of Calicut	145	47.75^{b}	16.60		
Mahatma Gandhi University	111	52.99^{a}	18.98		
Kannur University	162	41.18^{c}	18.73		

*** Significant at 0.01 level*

Means having same letter as superscript are homogeneous

Results revealed that there exist no significant differences in the use of the Internet among the students from University of Calicut and University of Kerala. It can be inferred as almost the same level of Internet use can be seen among the respondents from University of Calicut and University of Kerala. However, the students from Mahatma Gandhi University were found significantly different from those from other three universities. Mean score obtained for the Internet use is higher for the respondents from Mahatma Gandhi University, hence they had significantly higher level of the Internet use as compared to the students from other universities. It is also clear that the students from Kannur University showed significant differences in the Internet use when compared to those from other universities. But they exhibited significantly low level of the Internet use when compared to those from other universities as the corresponding mean value became lower. In the level of barriers in accessing and use of ICT (table 26), it is apparent that the students from Kannur University experienced higher level of barriers. These high level barriers are expected to restrict students from Kannur University in their Internet use. The results justified the comments of Torres-Diaz and Duart (2015) that digital disparities can be seen in universities, even though access to ICT is provided. The students use these technologies in different ways and accordingly the benefits they reap also vary significantly.

4.4.12 Relation between Frequency of the Internet Use and Digital Competency

The relation between experience in the use of the Internet and digital competency has already proven in this study. It is also essential to understand whether any relationship existed between frequency of the Internet use and digital competency of the students. Correlations between different Internet usage levels and overall digital competency of the students were worked out separately by Karl Pearson Coefficient and the result is given in table 66.

Table 66

Relation between Frequency of the Internet Use and Digital Competency

Level of Use	Correlation	P-value
Frequency of use of Internet related activities	0.726**	< 0.001
Frequency of use of e-resources	0.618**	< 0.001
Frequency of use of Internet for different purposes	0.703**	< 0.001
Overall frequency of use of Internet	0.752**	< 0.001

*** Significant at 0.01 level*

The table shows that the correlations of digital competency with frequency of the Internet use for various online-activities, for using e-resources and also for different purposes, are seemed to be positive and significant at 0.01 level. It implies that as the frequency of the Internet use increases, corresponding increase in the digital competency also results. The overall analysis again concluded that there exists a positive relationship between digital skills and the frequency of the Internet use among the students. The result is contradictory to the report of Li and Ranieri (2010) where they noticed that frequency of the Internet use did not have any significant impact on the ninth grade students' digital competence in China.

4.5 Attitude towards ICT

Psychological factors may act as a barrier to prevent students from integrating ICT into their lives. The importance of positive attitude towards use of new technologies is widely acknowledged. There may be other internal forces, making the students less motivated to use ICT. These internal forces within an individual will have significant influence on their decision to participate actively in a digital world. Hence favourable internal factors are necessary for adopting the technological advancement thereby alleviating the digital divide. These internal forces include comfort (perceived ease of use)/anxiety, liking and perceived usefulness. Loyd and Gressard (1984) made a psychological construct to evaluate attitude towards computer which include computer liking, computer anxiety, computer confidence, and perceived usefulness of the computer. Based on these four constructs, the researcher attempted to find out the attitude of the participants towards the use of ICT. The study seeks the students' level of attitude towards ICT so that the investigator can recognize whether attitude does matter in establishing or alleviating the digital divide. For the purpose, the researcher tried to measure the attitude with 38 statements, distributed among the four constructs, using five point Likert scale. The following sections describe the students' attitude towards ICT.

4.5.1 Perception of Comfort/Anxiety towards ICT

Decreasing anxiety and increasing positive feelings towards technology can offer a comfortable environment to use ICT. Being comfortable with new technologies may influence the students' intensity in ICT usage. Less comfort and more anxiety towards digital technologies will make students hesitant to use it and less enjoyable, which may lead to a negative attitude towards ICT. So there is a need to assess the participants' comfort/anxiety towards technologies. Here the researcher measured the comfort/anxiety using nine statements, out of which five statements are negative statements (Sl. No. 2, 5, 7, 8 and 9). Table 67 highlights the students' comfort/anxiety towards ICT.

It is apparent from the table that vast majority of the respondents (around 76%) favourable with the statements 1 and 3 as they felt very comfortable to use computer and the use of computer was clear and understandable for them. Almost similar percentages (18.2 and 19.4) of the respondents felt neutral to these statements. A few of them responded unfavourably with these statements. In response to the statement 'Internet is difficult to use', three-quarters of the participants (75.6%) showed disagreement. This implied that most of the students believe that the Internet is easy to use. However, 18 per cent of them neither agreed nor disagreed with this statement.

Table 67

Perception of Comfort/Anxiety towards ICT

Sl. No.	Statements	Frequency (%)				
		Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	I am very comfortable to use computer	226 (38)	239 (40.2)	108 (18.2)	18 (3)	3 (0.5)
2	Internet is difficult to use	9 (1.5)	29 (4.9)	107 (18)	255 (42.9)	194 (32.7)
3	Using the computer is clear and understandable	172 (29)	280 (47.1)	115 (19.4)	22 (3.7)	5 (0.8)
4	I am not bothered about security issues related to the Internet	47 (7.9)	96 (16.2)	170 (28.6)	184 (31)	97 (16.3)
5	I am anxious that my personal information available on the Internet may be misused	89 (15)	196 (33)	162 (27.3)	116 (19.5)	31 (5.2)
6	The information available on the Internet is trustworthy	47 (7.9)	134 (22.6)	305 (51.3)	94 (15.8)	14 (2.4)
7	Use of computer and other digital devices result in people becoming isolated	40 (6.7)	153 (25.8)	254 (42.8)	111(18.7)	36 (6.1)
8	Internet destroys human creativity	35 (5.9)	109 (18.4)	214 (36)	169 (28.5)	67 (11.3)
9	Use of computer and other digital devices can cause health problems	73 (12.3)	256 (43.1)	197 (33.2)	51 (8.6)	17 (2.9)

The degree of agreement regarding the statements 'I am not bothered about security issues related to the Internet', data depict that nearly half of the students (47.3%) replied negatively while nearly a quarter of them (24.1%) replied positively. The result can be interpreted as a large number of the participants bothered about security issues related to the Internet which may affect their Internet usage. With respect to the statements 5 and 7, about one fourth of the students expressed disagreement. However, around half of the students (48%) have anxiety about the possibility of their personal information available on the Internet being misused and about 33 per cent believed that use of computer and other digital devices result in people becoming isolated.

When asked whether 'the information available on the Internet is trustworthy', above half of the respondents (51.3%) have no opinion as they opted for being neutral. Considerable number of them (30.5%) have favoured with that statement, whereas a few of them (18.2%) have unfavoured. Close to forty per cent of the students didn't subscribe to the idea that 'Internet destroys human creativity' while only one fourth felt otherwise. In the last statement regarding the feeling that 'use of computer and other digital devices can cause health problems', more than half of the respondents (55.4%) considered it true, whereas only about 10 per cent stood against it.

In short, the findings can be concluded as, out of the four positive statements (1, 3, 4, and 6) most of the students expressed positive attitude towards two statements (1 and 3). It can also be concluded that out of the five negative statements (2, 5 7, 8, and 9), a vast majority of the participants showed disagreement only with the statement 'Internet is difficult to use'. For the last statement (9), above half of them expressed agreement. Most of the students opted 'neutral' for the statement number 6. Hence, a fully positive attitude could not be identified by the researcher for the construct comfort/anxiety.

To get an idea about the level of students' attitude in the construct comfort/anxiety towards ICT, the researcher calculated the percentage score as follows. First, a weight of 4, 3, 2, 1 and 0 was given to each positive statement, if the response was 'strongly agree', 'agree', 'neutral', 'disagree' and 'strongly disagree', respectively. For negative statements, the scoring was reversed, with the strongly disagree response being given the weight of 4 while the strongly agree response got 0 weight. Then the total score for the construct was obtained by adding the scores for all statements. This total score was divided by the maximum possible score (number of statements x 4) and multiplied by 100 to get the percentage score. The percentage score is classified into three equal classes. Low level with scores less than 33.3, average level in between 33.3 and 66.7 and high level with score greater than 66.7. The distribution of the respondents along low, medium and high level attitude is given in table 68. Here, high and low levels are interpreted as positive and negative attitude, respectively, while a medium level is considered as the students having an average level attitude.

Table 68

Level of Perception in the Construct Comfort/Anxiety

Level of Perception	Frequency (%)
Low	9 (1.5)
Medium	502 (84.5)
High	83 (14)
Total	594 (100)

As the table depicts, a large majority of the students (84.5%) possessed medium level attitude in the case of comfort/anxiety towards ICT. Only eighty three students fell in the group of fully positive attitude and just nine people categorised under the low level attitude. The analysis showed that most of the respondents have a moderate level perception regarding the construct 'comfort' which implied that a few students felt anxiety to some extent in the use of digital technologies. A similar result was also observed among academicians from Nigerian University who possessed a medium level of computer anxiousness when using technology (Oye et al., 2012). They concluded that computer anxiety was related to fear of ICT.

4.5.2 Perception of Liking towards ICT

Next, the researcher analysed the liking/enjoyment of the students in the use of technologies and it is demonstrated in table 69. The enjoyment that they get from the use of technology makes them a favourable attitude toward ICT. Computer liking is referred to as the internal feeling of enjoyment and stimulation, or the wish to know about and think about it (Loyd, Loyd & Gressard, 1987). Likewise, liking towards ICT is also referred to as the students' interest to use the digital devices, software and the Internet for different purposes. The liking of ICT also promotes the use of modern technologies. In the study, nine statements were used to evaluate the liking of ICT by the students, out of which four statements (5, 7, 8 and 9) were negative.

Table 69

Perception of Liking towards ICT

Sl. No.	Statements	Frequency (%)				
		Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	I think using the Internet is enjoyable	115 (19.4)	303 (51)	158 (26.6)	14 (2.4)	4 (0.7)
2	I like to work with computer and mobile phone	137 (23.1)	271 (45.6)	138 (23.2)	47 (7.9)	1 (0.2)
3	Using the Internet makes learning fun	91 (15.3)	248 (41.8)	193 (32.5)	55 (9.3)	7 (1.2)
4	Once I start working with the Internet, I find it hard to stop	68 (11.4)	145 (24.4)	189 (31.8)	158 (26.6)	34 (5.7)
5	I am not interested in developing my skills and knowledge to use computer and the Internet.	20 (3.4)	83 (14)	123 (20.7)	260 (43.8)	108 (18.2)
6	I enjoy to use computer and other digital devices than being with my friends/relatives	51 (8.6)	163 (27.4)	135 (22.7)	169 (28.5)	76 (12.8)
7	I do not enjoy talking with others about computer and the Internet applications	31 (5.2)	69 (11.6)	193 (32.5)	223 (37.5)	78 (13.1)
8	I like to avoid reading books on Information Technology	37 (6.2)	99 (16.7)	175 (29.5)	214 (36)	69 (11.6)
9	I am not interested in a career that involves the extensive use of Information Technology	50 (8.4)	112 (18.9)	193 (32.5)	174 (29.3)	65 (10.9)

With respect to the statements 'I think using the Internet is enjoyable' and 'I like to work with computer and mobile phone', majority of the students (around 70 per cent) gave a favourable opinion. So it can be interpreted as majority of the students enjoyed Internet very much and also like to work with digital devices. A negligible per cent of the participants reported that they were not enjoying the Internet and a very few of them didn't like to work with computer and the Internet. At the same time, a considerable number of the students held a neutral opinion to these statements.

Regarding the statement 'using the Internet makes learning fun' (item 3), the table reveals that more than half of the respondents (57.1%) had a positive feeling towards it. But about one third of them neither agree nor disagree with it. In other words, some students have no opinion about the use of the Internet to make learning fun. For the statement 'once I start working with the Internet, I find it hard to stop', over thirty per cent of the respondents (32.3%) replied negatively and an almost similar per cent remained neutral. The table 69 shows that the fraction of students who has favoured this statement is 35.8 per cent. It is also apparent that more than 60 per cent of the participants were interested to develop their skills and knowledge in the use of computer and the Internet, and only 17 per cent of them opined negatively in their interest to promote skill and knowledge in the use of computer and the Internet (item 5).

The table also shows that a reasonable fraction of the students (41.3%) did not favour the statement 'I enjoy to use computer and other digital devices than being with my friends/relatives', meanwhile about one third of them (36%) favoured it. The result indicated that a good number of the students preferred the company of their friends/relatives than using digital technologies. In response to the statements (item 7 and item 8) associated with the enjoyment they get while talking about computer and Internet applications to others and regarding the avoidance of reading books related to IT, around half of the students showed disagreement. At the same time around 20 per cent respondents supported both the statements.

Considering the last statement (statement 9), close to thirty per cent of the participants (27.3%) reported that they did not wish to get a job involving extensive use of IT. So they expressed a negative attitude towards it. However, forty per cent of the students favoured to get a job that involves extensive use of ICT, while nearly one third of them had a neutral attitude towards it. In summary, three of five positive statements (1, 2, and 3) got a favourable reply from a great majority of the students. Their positive attitude for the construct liking were further supported by a low percentage (below 25%) of the responses in the two most positive descriptors (strongly agree and agree), for three negatively stated items (5, 7 and 8). However, a reasonable number of the respondents exhibited negative attitude towards the statements 4, 6, and 9. This result reflects that even though most of the students have positive attitude towards ICT in the case of liking, a considerable number of the students also stood against it.

The investigator calculated the percentage score for the construct liking towards ICT as in the case of the construct comfort/anxiety towards ICT and classified it into three classes. Table 70 discloses the result. As per the analysis, one fourth of the participants exhibited a fully positive attitude (high level) in terms of their liking of ICT. Over 70 per cent of the students were found to be in the medium level attitude and only a limited number of them came under negative attitude (low level liking).

Table 70

Level of Perception in the Construct Liking

Level of Perception	Frequency (%)
Low	13 (2.2)
Medium	429 (72.2)
High	152 (25.6)
Total	594 (100)

Shih (2004) opined that attitude decides the reaction of someone's like or dislike towards something. Here the researcher comments that liking towards ICT makes a student more active in the digital world. The result reflected that most of the students have only a medium level liking towards ICT. Hence it can be concluded that in the construct liking, the students have to acquire a fully positive approach.

4.5.3 Perception of Confidence in ICT

Self-confidence denotes the belief of an individual in doing certain task. Confidence towards ICT refers to the favourable beliefs to use technology and in doing communication related activities. It is a strong predictor in the use of technologies. Lack of knowledge or experience in the use of ICT also creates lack of confidence among individuals to use it (Demirdag, 2016). The researcher evaluated the students' perception regarding confidence in ICT use through their responses for a set of nine statements, out of which the last four were negative (table 71). Both for the first two statements, 'I can use the Internet effectively and efficiently' and 'I am sure I can do works using computer', a majority of the students (close to 70 per cent) responded positively.

Table 71

Perception of Confidence in ICT

Sl. No.	Statements	Frequency (%)				
		Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	I can use the Internet effectively and efficiently	135 (22.7)	276 (46.5)	144 (24.2)	32 (5.4)	7 (1.2)
2	I am sure I can do works using computer	155 (26.1)	256 (43.1)	133 (22.4)	41 (6.9)	9 (1.5)
3	I can get high marks for Information Technology related courses	79 (13.3)	194 (32.7)	241 (40.6)	69 (11.6)	11 (1.9)
4	I can learn new software easily	70 (11.8)	169 (28.5)	226 (38)	105 (17.7)	24 (4)
5	I can select appropriate Internet based e-resources for learning	75 (12.6)	238 (40.1)	190 (32)	77 (13)	14 (2.4)
6	I am not competent enough to follow advancements in the digital world	48 (8.1)	101 (17)	242 (40.7)	165 (27.8)	38 (6.4)
7	It is not easy to become skilful at using computers	29 (4.9)	109(18.4)	175 (29.5)	215(36.2)	66 (11.1)
8	My skills and knowledge in computer and other digital devices are not adequate	39 (6.6)	152 (25.6)	215 (36.2)	154 (25.9)	34 (5.7)
9	I cannot do advanced Information Technology related work	21 (3.5)	102 (17.2)	211 (35.5)	191 (32.2)	69 (11.6)

The fraction of pupils who agreed to the fifth statement related to the selection of appropriate Internet based e-resources for learning, was 52.7 per cent, while for the statement related to learning new software (item 4), the response was about 40 per cent. With respect to the statement 'I can get high marks for IT related courses' 46 per cent pupils replied positively. Among the negative statements, it was for the statement 'It is not easy to become skilful at using computers' (item 7), that the maximum number of students (47.3%) disagreed. Around 30 per cent of the students neither agree nor disagree with it. On the other hand, one fourth of the participants believed that they were not competent enough to follow the advancement in digital world (item 6). Similarly, one fifth of the respondents felt that they were not competent enough to do advanced work related to IT (item 9). For the 8th statement, regarding the adequacy of skills and knowledge in computer and other digital devices, the responses were divided roughly equally among the positive and negative classes. A considerable number of the students (36.2%) came under the neutral class.

The overall responses reflected that the students' indeed felt confident in undergoing activities related to the Internet and computers. Around 70 per cent of the students felt very confident in the effective use of the Internet and computers (items 1 and 2) and above forty per cent (43.8%) considered themselves comfortable in doing advanced ICT related tasks (item 9). Further, more than half of the participants conveyed positively for all positive statements, except for the statement about learning new software (item 4). For statements 3 and 6, the fraction of neutral responses was 40 per cent. The negative statements reflected that some of the participants hold lack of confidence in the use of ICT as above one fifth of them agreed with the items.

Here also the researcher calculated percentage score for the construct confidence in ICT use. From table 72, it can be observed that close to thirty per cent of the students came under the high level of confidence. Two-thirds of the pupils lie in medium level confidence and only about 4 per cent were categorised under low level confidence.

Table 72

Level of Perception in the Construct Confidence

Level of Perception	Frequency (%)
Low	23 (3.9)
Medium	394 (66.3)
High	177 (29.8)
Total	594 (100)

As mentioned earlier, confidence in the use technology is essential for making a positive attitude towards it. Demirdag (2016) noticed that the self confidence in the use of ICT by substitute teachers from Turkey showed positive and significant association with their computer and Internet attitudes. The self confidence is a major factor that promotes the use of ICT and the persons with high level of self confidence have more inclination towards technologies than those who have low level (Sam, Othman & Nordin, 2005). However, a fully confident level in the use of ICT among the students cannot be seen from the result of this study.

4.5.4 Perceived Usefulness of ICT

Perceived usefulness of ICT was another dimension covered for evaluating the attitude towards technology. It is the extent to which an individual believes that using a system will improve their performance. Perceived usefulness of technology has an important impact on a person's attitude toward the use of ICT (Davis, 1989; Abedalaziz, Jamaluddin, & Chin, 2013). Here it is referred to as the extent of help the students feel from the quality of services provided by digital devices and Internet in their daily life. The researcher set up eleven questions for this purpose and the data regarding the perceived usefulness of ICT are displayed in table 73. The first eight statements are positive.

For almost all positive statements, the fraction of participants responded positively was quite high. The statements like knowledge of computer will widen job opportunities (item 2), Internet knowledge is essential for succeeding in education (item 5) and the Internet promotes getting latest knowledge than other resources (item 8), got around 80 per cent positive feedback, while for the statements related to the use of the Internet enables to accomplish tasks more quickly and to improve academic performance (statements 4 and 6), about 75 per cent of the students replied positively. For the first statement 'the Internet makes life easier', 64.3 per cent agreed and nearly one fourth of the students (23.7%) had no opinion. In order to find information, more than half of the respondents (57.8%) considered using the Internet easier than using library (item 7), whereas 15 per cent stood against it. For the statement 'I feel left behind if I do not use Information Technology' (item 3), the fraction of pupils responded positively was 39.8 per cent.

Table 73

Perception Regarding the Perceived Usefulness of ICT

Sl. No.	Statements	Frequency (%)				
		Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	The Internet makes life easier	124 (20.9)	258 (43.4)	141 (23.7)	64 (10.8)	7 (1.2)
2	Knowledge of computer will widen job opportunities	192 (32.3)	285 (48)	108 (18.2)	7 (1.2)	2 (0.3)
3	I feel left behind if I do not use Information Technology.	90 (15.2)	146 (24.6)	218 (36.7)	116 (19.5)	24 (4)
4	Using the Internet enables me to accomplish tasks more quickly	150 (25.3)	304 (51.2)	125 (21)	14 (2.4)	1 (0.2)
5	Knowledge of the Internet is essential for succeeding in education	172 (29)	313 (52.7)	103 (17.3)	6 (1.0)	0 (0)
6	Using the Internet improves my academic performance	162 (27.3)	282 (47.5)	121 (20.4)	26 (4.4)	3 (0.5)
7	I find using the Internet to be easier than using library to find information	124 (20.9)	219 (36.9)	161 (27.1)	83 (14)	7 (1.2)
8	The Internet helps me better to get the latest knowledge than other resources	196 (33)	278 (46.8)	90 (15.2)	28 (4.7)	2 (0.3)
9	I can learn effectively without using the Internet.	35 (5.9)	116 (19.5)	279 (47)	132 (22.2)	32 (5.4)
10	Using the Internet wastes my time	25 (4.2)	73 (12.3)	191 (32.2)	233 (39.2)	72 (12.1)
11	Using the Internet is not important in my university life	18 (3)	39 (6.6)	115 (19.4)	240 (40.4)	182 (30.6)

For the first negative statement 'I can learn effectively without using the Internet' (item 9), nearly half of the students (47%) remained neutral. The positive outlook of the participants towards ICT was also evident from their response to the statement 'using the Internet wastes my time', as over fifty per cent of them (51.3%) disagreed to it. Their response for the last statement 'using the Internet is not important in my university life' also got a much stronger disagreement, as over 70 per cent of the students did not favour it.

It was clear from the analysis that vast majority of the participants have a positive outlook regarding the perceived usefulness of ICT. Only very small per cent of the respondents (16.5%) expressed that the Internet waste their time. Some of them also neglected the academic use of the Internet. In general, the participants exhibited a strong belief that learning and applying ICT are highly useful in their education, career and also for their overall uplift in life. The results supported the findings of Ariffin, (2005), who noted that students had a positive attitude regarding the perceived usefulness of computer.

Again, the percentage score for the statements related to the perceived usefulness of ICT was worked out and grouped into three classes (high, low and medium) for understanding the overall level of perceived usefulness. Table 74 outlines the result. It is very interesting to note that only one student lie in the negative attitude category and more than half of the participants have a highly positive attitude towards perceived usefulness of ICT. The proportion of students fell under the medium level perception regarding the perceived usefulness became nearly half.

Table 74

Level of Perceived Usefulness of ICT

Level of Perception	Frequency (%)
Low	1 (0.2)
Medium	274 (46.1)
High	319 (53.7)
Total	594 (100)

The analysis reflected that most of the students experienced a strong perceived usefulness of ICT. The same result was also obtained in the study conducted by Hassan et al. (2011) among the rural community leaders in Peninsular Malaysia. They claimed that the respondents had a high level of perceived usefulness towards ICT usage. Doh and Stough (2010) stated that people with a more positive ICT perception may attempt to learn to use ICT; consequently, their ICT usage ability may be higher than those with a lesser positive ICT perception. In other words, those who perceived the usefulness of technologies and feel confident in using it become more positive in their attitude towards ICT. The perceived usefulness of ICT is essential in the demolition of digital divide. The result of this study indicated a positive approach to this construct.

Finally, the investigator wishes to explore the overall level of attitude towards ICT among the students. For achieving this, the percentage score for all the constructs comfort/anxiety, liking, confidence and perceived usefulness was estimated and made a categorization in to three equal classes (high, medium and low). A glimpse on table 75 reveals that about one third of the respondents showed a high level attitude towards ICT, while above two thirds of them have a medium level attitude.

Table 75

Level of Attitude towards ICT

Level of Perception	Frequency (%)
Low	2 (0.3)
Medium	415 (69.9)
High	177 (29.8)
Total	594 (100)

The Figure 7 shows the pie chart representation of the classification of students into the different levels of their attitude towards ICT.

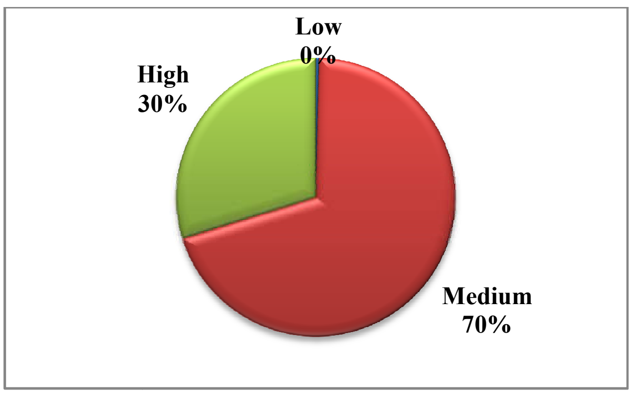

Figure 7. Level of Attitude towards ICT

The result shows that most of the students have moderately positive attitude towards ICT. A matching result was reported by Ariffin (2005) based on survey among secondary school students in rural areas where the students exhibited a positive attitude towards ICT. They showed a moderate level of confidence and attitude towards ICT. Thus the positive attitude towards ICT promotes its use and reduces the digital divide.

4.5.5 Gender-wise Comparison of Attitude towards ICT

Many researchers opined that girls tend to like and use ICT less than boys. They also mentioned that girls felt less comfortable with the use of technologies and were less favoured to enjoy the benefits of ICT than their male counterparts. Women appeared less involved with computers and the Internet than men (Cooper, 2006; Saha, & Zaman, 2017). Cooper and Weaver (2003) explored that young women were not confident to use the computers when compared to young men. Thus studies showed that attitudinal differences towards ICT use existed along gender line.

In this study also, the researcher attempted to find out whether any attitudinal differences towards ICT can be observed among male and female respondents. Table 76 highlights the result. Kolmogorov Smirnov test was done for testing the normality of the variable attitude towards ICT. The p-value was found to be greater than 0.05 which indicates that the variable is following normal distribution. Hence parametric tests were done for comparing gender-wise and discipline-wise attitudinal differences towards ICT use among the students.

Independent Z-test was done for making the comparison of attitude towards ICT among male and female respondents. The Z-value was found to be significant at 0.01 level, as the p-value was less than 0.001. The result discloses that there is a significant gender difference in the attitude towards ICT among the respondents. Mean score was higher in the case of male students, showing that they have significantly higher level of positive attitude towards ICT when compared to that of female students. Thus gender difference existed in the case of attitude towards ICT.

Table 76

Gender-wise Comparison of Attitude towards ICT

Gender	N	Mean	Std. Deviation	Z-value	p-value
Male	232	67.93	9.08	13.916**	< 0.001
Female	362	57.67	8.56		

*** Significant at 0.01 level*

The gender difference in attitude towards technologies has been proved by many researchers. Slate, Manuel and Brinson Jr. (2002*)* gave a comparable report through their survey of Hispanic Freshmen at a South-western U. S. University. They realized that men had more favourable attitude towards the Internet when compared to women and they also exhibited more comfort and less confusion in the Internet use (Jones et al., 2009). The result of this study also confirmed the statement of Cooper (2006), who stated that there existed stereotypes, suggesting girls to be less proficient in the use of technology and have a negative attitude towards computer use. They are also more likely to be anxious in the use of technology.

4.5.6 Discipline-wise Comparison of Attitude towards ICT

Sometimes the students from different disciplines may have different levels of motivation and attitude towards ICT. Hence the study also analysed whether any attitudinal differences towards ICT can be observed among the students from different disciplines and it is presented in table 77. One-way ANOVA was carried out for comparing the attitude of the students from different disciplines. The p-value for the comparison was 0.025 which is less than 0.05. Hence the F-value was found to be significant at 0.05 level. The result revealed that there existed significant difference in the attitude of the students at least between one pair of discipline groups. As there existed significant difference between the groups, pair-wise comparison was done with the DMRT test and the result is also given in table 77.

Table 77

Discipline-wise Comparison of Attitude towards ICT

Discipline	N	Mean	Std. Deviation	F-value	p-value
Science	194	60.34^{b}	9.58	3.696*	0.025
Humanities	193	61.54^{ab}	10.10		
Social Science	207	63.06^{a}	10.41		

** Significant at 0.05 level*

The result shows that there existed significant difference in the attitude of the students belonging to Science and Social Science disciplines towards ICT. However, the attitude of the students from Humanities discipline shows no significant difference with those from both Science and Social Science disciplines. The mean value obtained for the students from Social Sciences is also higher when compared to those from other two disciplines. Hence the students from Social Science have significantly higher level attitude towards ICT than the students from other two disciplines.

The result is surprising in the sense that Science students may have more application level ICT use as compared to other disciplines. So there is a possibility of more favourable attitude expressed by these students compared to the students from the other two disciplines. However, the findings indicated that the students from Social Science showed more favourable attitude towards ICT. A study conducted by Mahmood (2009) among the students from University of Punjab also revealed that the Social Science students showed more favourable attitude towards ICT when compared to those from Science and Technology as well as Arts and Humanities.

4.5.7 Attitude towards ICT and Digital Divide

From the reviews related to psychological aspects, the researcher concluded that attitude towards technology plays a significant role in the access and use of ICT. Hence an analysis was executed to know whether attitude plays any significant role in contributing to the digital divide among students. Spearman's rank correlation was used for finding the relationship between attitude towards ICT with different variables like the ICT access, digital competency and the frequency of the Internet use. The output is shown in table 78.

In all the cases correlations were found to be positive and significant at 0.01 level. This implies that as the attitude towards ICT increases, an increase in access to ICT, digital competency and frequency of the Internet use can also occur among the students. The relation can be seen in all the four constructs of attitude. However, high correlation was found in the case of digital competency, which shows that better attitude significantly more influences digital competency of the students. Among the different constructs of attitude, confidence and comfort showed high correlations with the digital competency when compared to liking and perceived usefulness. However, a high level correlation can be noticed between perceived usefulness of ICT and frequency of use of the Internet among the students.

Table 78

Correlations of Attitude towards ICT with ICT Access, Digital Competency and Frequency of the Internet Use

Dimensions of Attitude	Access to ICT	Digital competency	Frequency of Internet Use
Comfort	0.276**	0.531**	0.338**
Liking	0.182**	0.414**	0.456**
Confidence	0.385**	0.665**	0.472**
Perceived Usefulness	0.268**	0.403**	0.745**
Overall Attitude	0.365**	0.654**	0.358**

*** Significant at 0.01 level*

The findings here favour the explanation of Porter and Donthu (2006), which were derived from the extended version of Technology Acceptance Model (TAM) to find out the role of attitude to predict the Internet use. They suggested that perceived usefulness and ease of technology use significantly influence the use of ICT. The basic assumption of the model was that adoption and use of ICT were related to a positive attitude towards technology which in turn was related to a greater probability of ICT access. This study also revealed that the overall attitude of the students towards ICT significantly correlated with their access to ICT, digital competency and the frequency of the Internet use.

4.6 Education Level of Parents and Digital Divide

The background of students including their home environment may also play an important role in their access to ICT at personal level. DeBell and Chapman (2006) highlighted that the students living with educated parents were found to be more familiar with technologies than those with less educated parents. So there may be a possibility of higher access to technologies among the students with highly educated parents compared to those who have less educated parents. As a result, it may also affect the digital competency of students. The educational background of parents considerably influences the students' use of the Internet (Daramola, 2015). Further, a favourable approach of parents to use the ICT makes the students possess positive attitude towards technology. Thus the parents' educational qualifications may also affect the students' attitude towards technology. So an analysis was carried out to know whether parents' educational qualifications have any significant impact on the students' ICT access, digital competency, Internet use and attitude towards ICT. Spearman's rank correlation was done for finding the relationship between the variables. The outcome of the analysis is explicated in table 79.

Table 79

Association of Education of Parents with Access to ICT, Digital Competency, Frequency of Internet Use and Attitude towards ICT

Variable	Education of Father	Education of Mother
Access to digital device	0.357**	0.349**
Access to the Internet	0.344**	0.304**
Access to ICT	0.378**	0.359**
Expertise to use digital devices	0.165**	0.184**
Digital competency	0.198**	0.221**
Frequency of Internet use	0.177**	0.197**
Overall ICT attitude	0.116**	0.161**

*** Significant at 0.01 level*

In all cases correlations were seemed to be positive and significant at 0.01 level. This shows that as the educational qualifications of parents become higher, students' access to technology (access to digital devices and Internet), digital competency (expertise in handling various devices and in using various ICT applications) and the frequency of the Internet use also increase. In addition, higher parental education also favours a positive attitude among their wards towards the use of ICT. The result indicated that educational level of parents significantly influences the students' ICT access, digital competency, Internet use and attitude towards technology. Yuen and Park (2012) corroborated these suspicions and highlighted the effect of parents' educational qualifications in their wards' ICT use. They opined that home environment, particularly parental support, influences the students' attitude towards and attainment from ICT use. The family culture also affects the use of ICT by the students. Aesaert and Van Braak (2015) found that educational level of mothers was positively related to their children's ICT competency in a study involving 378 sixth grade students of primary schools in Flanders. In the earlier results (tables 8, 14 and 19) the researcher established that students' access to ICT depends upon their family income. Therefore, the investigator favours the notion of Heinz (2016), to conclude that socio-economic background of the students has a significant influence on their usage of ICT and digital competencies.

4.7 Role of Income in Digital Divide

From the result, it is seen that individual and household Internet connections remain a challenge for some students. Hargittai (2010) described that the students from higher socio-economic background tend to use the Internet more frequently and possess more online experience and knowledge in the use of technology. The study also found that students reported a high level engagement in different types of computer and Internet applications than their less privileged counterparts. Family income acts as a primary factor that leads the inequalities in Internet access, which in turns, may affect the intensity of Internet use. Hence the study also sought whether family income has any impact on students' use of the Internet, digital competency and attitude towards ICT. Spearman's rank correlation coefficient was worked out for analysing the relationship. Table 80 reveals the result. The analysis shows that parental income positively correlated with the students' digital competency, frequency of the Internet use as well as attitude towards ICT. In all the cases correlations were significant at 0.01 level. The result revealed that, as the level of family income increases, students' digital competency, frequency of the Internet use and attitude towards ICT also improve. In other words, family income significantly influences the students' digital competency, Internet use and attitude towards ICT.

Table 80

Relation of Income with Digital Competency, Frequency of the Internet Use and Attitude towards ICT

Variable	**Correlation**	**p-value**
Digital competency	0.396**	< 0.001
Overall frequency of use of Internet	0.403**	< 0.001
Overall attitude	0.269**	< 0.001

*** Significant at 0.01 level*

The result is consistent with the report of Goldfarb and Prince (2008), who explained that the pattern of Internet adoption and usage indeed differ by demography by surveying 18439 Americans. They proved that income was one of the factors that affect the Internet adoption and usage among them. Likewise, Torres-Diaz and Duart (2015) reported that family income has a great influence on the level of technology know-how. Lebens, Graff and Mayer (2009) noticed a similar result when observing the impact of children's socio-economic factors on their attitudes towards computers by conducting a survey among general secondary school students in Germany. They explored that children from low SES households had negative attitude when they think about using technology.

4.8 Conclusion

Equitable access to digital technologies is a preliminary requisite, but not fully sufficient in itself to confirm the benefits of using these technologies. However, the result confirmed that ICT access is still a major issue among the students. University-wise differences can also be seen among the student in the case of access to digital devices and the Internet. The participants also exhibited differences in the level of digital competency and the frequency of the Internet use. In the case of attitude towards ICT, majority of the students showed a favourable attitude. However, the overall analysis showed that attitude plays a significant role in contributing to the digital divide. Regarding the subject-wise analysis, no significant difference can be found in the students' access to ICT and frequency of Internet use. But in the cases of competency in handling various digital devices and attitude towards digital technologies, the Social Science students comparatively lead the students from Science and Humanities discipline. It is clear that the gender divide has remained among the students as significant differences existed in the access to ICT, digital competency, Internet use and attitude towards ICT. In short, the overall result established the presence of digital divide among the students from universities in Kerala.

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Chapter 5

FINDINGS, SUGGESSIONS AND CONCLUSIONS

5.1 Introduction

The study was carried out to know the digital divide among the students of universities in Kerala. A number of valuable findings were identified about the digital inequalities based on the analysis of data, which are original in nature. These findings help develop an insight towards framing proper suggestions and recommendations for alleviating the digital divide among the students. In this unit, the researcher discusses the major findings of the study and derives conclusions obtained through analysis of the data. The researcher also gives recommendations and suggestions for possible future research on digital inequality issues. Five research questions were propounded in order to direct this study. The answer to these questions and verifiability of the hypotheses are also presented in this unit.

5.2 Major Findings

Based on the analysis and interpretations of data, it is intended to give a consolidated picture of findings by taking into account of the objectives of the study. The major research findings are listed in the following sub sections.

5.2.1 ICT Access

1. A high proportion of the students (69.2%) have unrestricted access to mobile phone with Internet connection in comparison with land line connection.

2. A considerable number of the students have unrestricted access to laptop (40.9%) and desktop (35.9%) computers. At the same time, a reasonable fraction of the participants lacked laptop and desktop computers. So lack of access to desktop computers and laptop at personal level is still a major problem among the students.

3. The personal level access to digital devices like Netbook computer, tablet, printer, scanner and MP3 player were only at a minimum level among the students.

4. Majority of the students (64.3%) have a low level of access to the overall digital devices. Meanwhile, only a small number of the students (4.9%) seemed to be well versed with all the technological devices.

5. Male students were better positioned towards access to digital devices than female students.

6. A statistically significant difference existed between male and female students in the level of access to digital devices.

7. Personal level access to digital devices was not significantly different between the students who came from rural and urban areas. Even though the result is statistically non-significant, the mean value obtained for the access to digital devices for urban students (8.05) is higher than that for their rural counterparts (6.92). So the students from urban areas possessed more digital devices than those from rural areas.

8. There was a significant difference in the access to digital devices among the students as their parental income changes. The correlation coefficient of income with access to digital devices was found to be positive and significant at one per cent

level, which confirmed the fact that as the parental income increases the level of access to digital devices among the students also improves.

9. University of Calicut, Mahatma Gandhi University and University of Kerala had both Wi-Fi and Ethernet connections in the campus. In Kannur University, only one campus (Palayad) had Wi-Fi Internet connection. In other campuses, there was not even Ethernet connection available to the students. Even though Wi-Fi connections were available in all universities, there were regions or departments where Wi-Fi signals were weak or absent.

10. A large number of the students (81.6%) had access to the Internet at personal level, whereas nearly one fifth of them lacked the same.

11. Lack of access to the Internet among female respondents was higher when compared to their male counterparts. Also the variations in Internet access between male and female respondents were statistically significant.

12. Regarding the modes of Internet connection, majority of the students have access to mobile Internet at personal level, but a comparatively low level of access to USB and broadband connections could be seen from the result.

13. Above half of the students (61.1%) have low level access to the Internet, with all the possible modes of connections while a very few of them (4.9) enjoyed a high level Internet access.

14. The fraction of male students exceeds that of female students in their access to various modes of Internet connections. There existed a statistically significant gender difference in the level of Internet access.

15. The students living in urban areas are significantly more likely to have Internet access when compared to those living in rural areas.

16. There were significant differences in the level of access to the Internet as the gross parental income changes. Correlation of income with access to the Internet was found to be positive and significant at 0.01 level, which indicates that as the parental income level increases, the students' access to Internet connections also improves.

17. In the case of overall access to ICT, majority of the students (62.1%) fell under the low level access and about one third of them (33.8%) came under the medium level access. A small number of the students (4.2%) were found within the class of high access to technologies.

18. It appears that the male respondents take a lead position in the overall access to ICT than their female counterparts. There existed significant differences in the level of access to ICT between male and female students and the male students have significantly higher level of access to ICT than female students.

19. There is no statistically significant variation noted among the students from the three disciplines in the level of their overall access to ICT.

20. The respondents from rural area have significantly lower level of access to ICT as compared to those from urban area.

21. The differences in access to ICT among the students from rural and urban areas, suggested a statistically significant association.

22. A significant association was found in the overall level of access to technologies among the students with their family income level.

23. The correlation of income with overall access to ICT was positive and significant at 0.01 level. The result implied that the students' access to ICT becomes high as the parental income increases.

24. The ownership of smart phone with Internet connection was high among the students (72.4%).

25. A relatively low per cent of the students (about 30%) have computer ownership (both desktop and laptop computer).

26. Below half of the students (46.6%) enjoyed a collective ownership of computers in their family.

27. The ownership of digital devices like tablet, e-book reader, printer and scanner was very low among the students.

28. In the case of university level access to digital devices, most of the respondents (91.1%) confirmed the availability of desktop computers in their departments, while only one fourth of them had access to laptops. Above half of the students (52.4%) had access to LCD projector from their departments.

29. Access to printers and scanners were limited to the students from their respective universities.

30. Students from Kannur University had the lowest level of access to desktop computer when compared to those from the other three universities. Meanwhile, the students from University of Calicut and Kannur University had limited access to printer and LCD projector as compared to those from other universities.

31. In the use of different software, Internet explorer got the first position, as almost the entire (98.1%) students used it. The other software commonly used by the students was Text Processor (77.1%) followed by presentation software (73.2%). The use of software like programming language, and statistical packages were very low among the students.

32. Statistically significant gender differences can be seen among the students in the use of different software. The male students reported a higher level of computer software use than the female students.

33. A reasonable number of the students reported that insufficient number of computers with Internet connection in their departments, lack of enough money, poor or no Internet connection at home and poor network coverage in the university campus posed as extreme barriers in acquiring and using ICT.

34. Lack of support from teachers, restrictions to use the Internet, lack of proficiency in English language and lack of parental support appeared to be the least affecting factors towards the use of ICT among the students.

35. Around half of the students (51%) experienced a low level barrier in the access and use of ICT. At the same time, a good number of the students (45.5%) faced a medium level barrier and only a few of them faced a high level barrier in the access and use of technologies.

36. Majority of the respondents (60.8%) from Science discipline and above half of the students (53.6%) from Social Science discipline felt a low level barrier in accessing and using ICT. At

the same time, nearly 40 per cent of the pupils from Humanities reported a low level of barrier for the same. Above half of the students (54.4%) from Humanities reported a medium level barrier in the use of technology. There exist statistically significant differences in the level of barriers faced by the students from the three disciplines for acquiring and using ICT.

37. The mean value obtained for the level of barriers experienced by the students in their access and use of ICT was the highest for those from Humanities (12.38) followed by Social Science (10.64) and Science (9.52) disciplines. Hence, the respondents from Humanities faced significantly high level barriers in accessing and using ICT when compared to those from the other two disciplines.

38. Lack of support from teachers was not a barrier for the students from all the universities to use ICT. However, the barriers like restrictions in the use of the Internet, lack of personnel to maintain equipment in the department, insufficient number of computers with Internet connection in the department and slow speed of Internet connections in the campus, were significantly dominant among the students from Kannur University when compared to those from the other three universities.

39. Considering the ICT barrier created by poor network coverage in campus, mean score for the barrier was significantly higher in Kannur University as compared to the other three universities. Hence the students from Kannur University faced a high level barrier in this case. No significant difference in the barrier of poor network coverage was found between University

of Calicut and Mahatma Gandhi University and also between University of Kerala and Mahatma Gandhi University. However, the pupils from University of Kerala were having significantly less barrier in the case of poor network coverage in the campus when compared to those from University of Calicut.

5.2.2 Digital Competency

40. Above half of the students (50.7%) had more than nine years' experience in the use of computer while a very few of them had less than three years experience in the same.

41. Male students possessed more experience to use computer than their female counterparts.

42. Chi-square test revealed that the gender-wise difference in the students' experience in the use of computer was statistically significant.

43. Majority of the students (64.8%) had attended ICT related courses, whereas just over one third of the respondents (35.2%) claimed that they had never attended any ICT related courses previously.

44. No significant difference was established between male and female students regarding their participation in ICT related courses.

45. Majority of the students (about 70%) depended upon their friends or teachers to acquire the digital skill, followed by attending courses related to ICT (51%).

46. Majority of the students had a high level of expertise in the use of mobile phones with Internet access.

47. A good number of the students reported a high level of expertise in the use of computers and laptops. However, nearly half (around 47%) of the students exhibited a low level expertise to use Netbook computer.

48. In the case of expertise to use devices like printer, scanner and multimedia projector, most of the students fell under the categories of average and below average in their expertise level.

49. The expertises in the use of different digital tools were varying among the students. More than half of the participants (57.6%) came under the medium level expertise category in the use of different digital devices. At the same time around a quarter of the students (26.9%) represented in the high level expertise class.

50. Z-test shows that there existed a significant gender difference in the level of expertise in handling various digital devices. Male students have significantly higher level expertise in the use of digital devices when compared to female ones.

51. There existed no significant difference among the students from Science and Humanities in their expertise to use digital devices. But, the students from Social Science discipline were found to be significantly different from those from the other two disciplines in the level of expertise in handling digital devices.

52. The students from Social Science discipline have significantly higher level expertise in the use of digital devices as compared to those from the other disciplines.

53. In the dimension of defining information need, around one fourth of the students replied an average as well as below

average skill level in determining their information need, whereas a large majority of the students (85%) marked high proficiency in the use of search engine.

54. Seventy per cent of the pupils marked high proficiency in locating websites that contain information they required, meanwhile around 55 per cent of the students reported high expertise in navigating through different websites. Hence a considerable number of the students do not have sufficient navigation skills.

55. In the case of technological self reliance, great majority of the respondents have good competency in creating accounts in e-mail (84%) and social networks (77.6%). At the same time, considerable number of the students reported a weak expertise level in the use of computer programming language and GPS. Over one third of the students (around 35%) were weak in installing software (E.g., MS Office) in a computer while more than half of the students (58.1%) reported high proficiency in printing files and nearly half of them (48.6) reported high expertise in the use of security software.

56. In the dimension of information management, a high fraction of the students (more than 70%) have good competency in activities like creating a folder, saving a file, and in the use of storage devices. Relatively a good number of the students (more than 60%) also exhibited high expertise in arranging information into lists or tables and in the exchange of photos and videos between camera and computer. But over one third of the pupils (36.4%) reported difficulty in taking backup of a computer.

57. In assessing the quality of information and configuring the security settings of the Internet, a large number of the students considered that they were not highly proficient.

58. Considering the dimension of information integration, a high proportion of the respondents (above 70%) were experts in text processing like editing, spell checking and inserting images or symbols, whereas nearly 70 per cent were weak in the use of spreadsheet applications. Around one fifth of the students reported low expertise in including an animation inside a presentation document.

59. A large majority of the students have good expertise in connecting to the Internet with mobile phone (79.8%), in sending and receiving e-mail (82%) and also in the use of Bluetooth (85.7%). The output of the analysis also showed that a high proportion of the students (71.5%) appeared in high proficient classes when considering their participation in social networks. A simple majority of the students (58.4%) also felt highly proficient in uploading audio and video contents to the Internet. However, MMS did not get that much popularity among the participants as only around 60 per cent appeared in the high proficiency classes. Around 36 per cent of the students reported that they were weak in booking tickets online.

60. A higher fraction of the students (around 62%) expressed that they possessed a low proficiency in creating a website and blog. Above one third of them (36.2%) had low expertise in avoiding copyright violation in digital environment. So the students reported a low expertise in the area of creating information.

61. Above half of the students (53%) experienced a low expertise in installing an operating system and about 45 per cent of the pupils expressed a low level of competency in connecting a new device to a system and installing it.

62. Among all the areas of ICT applications, most of the participants scored high in using Bluetooth (84), followed by sending and receiving e-mail (81.5). A higher level of competency (about the score 81) can be noted in the cases of creating an e-mail account, using search engine and also in connecting to the Internet using mobile phones.

63. The students exhibited a relatively good level of competency in information search and to use Microsoft Word, Power Point, interactive social networks as well as chat applications.

64. Most of the respondents possessed the least expertise in creating blogs and websites, in the use of computer programming language and also for installing an operating system.

65. The students scored the highest in the use of digital tool for identifying and defining information needs (77.53) followed by communication and information sharing (70.94). In the areas of access to information (67.47), Information management (67.74) and integration of information (67.39), the participants possessed similar percentage scores and expressed a high level of digital competency.

66. The students acquired an average level of digital competency in the areas like technological self reliance and information assessment.

67. The respondents reflected very low levels of expertise in the areas of problem solving and in creating new information using ICT tools, when compared to other digital competency dimensions.

68. The overall digital competency of the students appeared to be in an average level (62.84).

69. Nearly half of the pupils (48.8%) lie in the medium digital competency level and around 45 per cent of the students came under high digital competency level.

70. There is a significant difference in the level of digital competency between male and female respondents in doing various ICT related activities/processes.

71. The mean score obtained for digital competency for the male students was higher than the female students, which shows that the former have significantly higher level of digital competency than the latter.

72. There is no significant difference among the respondents from Science, Humanities as well as Social Science disciplines with regard to their digital competency level in doing various ICT applications. Hence no significant variations can be noted in the ICT skills among the students from different disciplines.

73. Positive correlations can be observed between proficiency in digital devices and each of the nine dimensions of digital competency, as all the correlation coefficients were found to be positive and significant at one per cent level.

74. There was a significant variation in the level of digital competency of the students between those who have participated in ICT related courses and those who haven't, as the Z value was found to be significant at 0.01 level.

75. The mean score was higher for those students who have attended ICT related courses, which indicates that the students who attended the courses have higher level of digital competency than those who didn't attend such courses.

76. There existed a positive relationship between ICT access and digital competency of the students as the correlation coefficients were found to be positive and significant at 0.01 level.

5.2.3 Internet Use

77. Above one third of the students (38%) came under the group with 4-6 years' experience in the use of Internet and around 30 per cent of them fell under 1-3 years' experience. Approximately one quarter of the participants have good experience with more than 7 years, in the use of Internet.

78. Considering the gender-wise analysis, the fraction of male respondents outpaced their female counterparts in the three high duration categories (experience of 4-6, 7-9 and more than 9 years) in Internet use. Chi-square test revealed that male and female students differ significantly in their Internet experience.

79. A considerable proportion of the students (40.9%) connected to the Internet only a few days in a week and just over one fourth of them connected to the Internet on a daily basis. The number of students (12%) who stayed connected to Internet most of the time was found to be very low.

80. The use of Internet by the female participants was less frequent as more female students came under the less frequent categories ('a few days in a week', 'monthly' and 'rarely') when

compared to the male students. On the other hand, the male students dominated in the more frequent categories of Internet use ('daily basis' and also in 'stay connected most of the time').

81. Chi-square test revealed that there was a significant variation existing between male and female respondents in the periodicity of their Internet use.

82. In a typical connection to the Internet, above half of the students (57.3%) stayed connected to either '30-60 minutes' or '1-2 hours'. The percentage of the students who used the Internet 'more than three hours' and '2-3 hours' was seemed to be very low.

83. The duration of Internet use by the male students was higher in the case of 'more than three hours', as compared to the female students. In the other three cases ('2-3 hours, '1-2 hours' and '30-60 minutes'), the duration of Internet use was almost the same fraction, among male and female students. However, the percentage of the female students exceeded that of male students in the duration of 'below half an hour'.

84. The differences in the duration of Internet use between the male and the female students were statistically significant and the male students reported a higher frequency of Internet use than the female students.

85. The correlations of the nine ICT areas in the digital competency with the years of experience in Internet use by the students were seemed to be positive and significant at 0.01 level.

86. Positive correlations were also found between each of the nine areas of digital competency of the students and their periodicity in connecting to the Internet. All these correlations were significant at one per cent level.

87. The relationship between the nine areas of digital competency and the time spent on Internet in a day by the students also showed positive correlations, all significant at one per cent level.

88. A large fraction of the respondents (67.7%) used the Internet from their home. Department was the second place, where nearly sixty per cent of the students accessed the Internet. Comparatively small fractions of the students (around 21%) used the Internet from library as well as Internet cafe.

89. Around one quarter of the students spent Rs. 51-100 as well as above Rs. 200 for their Internet access. About 17 per cent of the participants didn't spend any money for their Internet access.

90. WWW, social networking, and WhatsApp activities enjoyed a high level of use with over 60 per cent participation, which were followed immediately by downloading files (59.1%), e-mail (58.1%), use of chatting applications (57.4%) and sharing course material (53.7%).

91. The Internet services that were seldom used by majority of the participants include RSS (87.5%), bookmarking (77.8%), blog (68.3%), tagging (58.3%) and Internet call (52.8%).

92. In the applications like wiki, photo sharing and video sharing, comparatively a reasonable percentage of the students (34.8, 32.7 and 29.6%, respectively) put themselves in the high level frequency of use.

93. In percentage score analysis, more than half of the students (54.4%) constituted in the medium level frequency in the use of overall Internet related activities. Only one fifth of the students fell under high frequency of use and one fourth of them appeared in low frequency of use.

94. In the use of e-books and e-journals, around 30 per cent of the participants have high level frequency of Internet use; while just above 40 per cent of them have low frequency of use.

95. A reasonable fraction of the students (43.3%) had high frequency of use of online reference sources. However, the frequency of use of ETD, institutional repositories and library consortia were found to be minimum as roughly three fourth of the students reported a low level frequency in usage. On the other hand, approximately, 10 per cent of the participants had a high frequency in the use of ETD, institutional repositories, as well as the library consortia.

96. A majority of the students reported a low frequency in the use of e-zines, web portals and digital libraries. Comparable fractions of the students (about 35%) reported high level as well as low level frequency in the use of e-newspapers.

97. In the percentage score analysis of overall frequency in the use of e-resources, half of the participants (50.5%) came under the low frequency level and nearly 40 per cent of them grouped under the medium frequency level. Only a very minor part of the sample was classified into the highest frequency level in the use of e-resources.

98. A large majority of the respondents (above three fourth) reported a high frequency of Internet use for educational and academic purposes. Similarly, for communicational and recreational purposes, a good majority of the students (around 65%) reported high frequency of the Internet use.

99. About half of the participants expressed a high level frequency of Internet use in seeking the information related to job opportunities as well as getting the news online.

100. A low frequency of Internet use could be observed in mobile recharging, in Internet banking, for travelling purpose, for online shopping and also for government interaction, as above half of the students responded either in the 'rarely' or 'never' categories. However, the students showed a little bit higher frequency of Internet use for online shopping and travelling purposes when compared to mobile recharging, government interactions and Internet banking.

101. The frequency of Internet use was also found to be limited among majority of the students for the purposes like getting political and health related information.

102. In the percentage score analysis, more than half of the participants (53.5%) exhibited a medium level frequency in Internet use for different purposes. A substantial proportion of the students (26.4%) was categorized under the high frequency level in Internet use whereas a relatively small fraction of them fell under the low level usage of Internet for varieties of purposes.

103. In the overall analysis of frequency of Internet use, more than half of the students (57.7%) came under the medium level frequency in Internet use. A very few of the participants (16%) fell under high level frequency in Internet use and a quarter of them (26.3%) was categorized under the low level frequency.

104. There existed a significant gender difference in the frequency of Internet use for different activities/services as the Z-value was found to be significant at 0.01 level.

105. A significant gender difference was found among the students in the frequency of use of e-resources as the Z-value was found to be significant at 0.01 level.

106. A statistically significant gender difference can be found among the respondents in the frequency of Internet use for different purposes as the Z-value was found to be significant at 0.01 level.

107. The male students had higher mean scores compared to the female respondents in all the three aspects of frequency of the Internet use (Internet related activities, use of e-resources and the use of the Internet for different purposes) which specifies that male respondents' frequency of Internet use was significantly higher than the female students.

108. One way ANOVA test revealed that there were no significant discipline-wise variations existing among the students in the frequency of Internet use for different services, for the use of e-resources and also for various other purposes.

109. ANOVA test results showed that there existed significant variation in the frequency of Internet use among the students from four universities as the p-value was found to be less than 0.001 and the F-value was significant at 0.01 level.

110. DMRT test revealed that there existed no significant difference in the frequency of Internet use among the students from University of Calicut and University of Kerala.

111. The students from Mahatma Gandhi University were found to be significantly different in the frequency of Internet use when compared to the students from the other three universities and the mean score obtained in Internet use was the highest for the respondents from the university. Hence they have significantly higher level of Internet use as compared to the students from other universities.

112. The students from Kannur University were also showing significant difference in the Internet use when compared to those from other universities. But they exhibited significantly low level use of Internet when compared to the students from other universities.

113. The correlation between frequency of Internet use for various online-activities and the digital competency of students was seemed to be positive and significant at 0.01 level.

114. The digital competency of the students showed significant positive correlations separately with the frequency of use of various e-resources and the frequency of Internet use for various purposes.

5.2.4 Attitude towards ICT

115. Majority of the respondents (around 76%) favoured the statements that they felt very comfortable in the use of computer and the use of computer was clear and understandable for them.

116. In response to the statement 'Internet is difficult to use', three-quarters of the participants (75.6%) showed disagreement with it. However, 18 per cent of them neither agree nor disagree with the statement.

117. Data analysis on the degree of agreement regarding the statement 'I am not bothered about security issues related to the Internet', showed that nearly half of the students (47.3%) replied negatively with it while around a quarter of them (24.1%) replied positively.

118. Around half of the students (48%) had anxiety about the possibility of their personal information available on the

Internet being misused and about 33 per cent believed that use of computer and other digital devices result in people becoming isolated. Only one fourth of the students (around 25%) expressed disagreement with both these statements.

119. Above half of the respondents (51.3%) had no opinion about the authenticity of information available in the Internet. Close to 40 per cent of the students didn't subscribe to the idea that 'Internet destroys human creativity' while only one fourth of them favoured it.

120. More than half of the respondents (55.4%) showed their agreement with the statement that 'use of computer and other digital devices can cause health problems', whereas only about 10 per cent stood against it.

121. Most of the respondents (84.5%) have a moderate level of perception regarding the construct 'comfort' towards ICT in the attitude scale.

122. A high fraction of the students (around 70%) gave a favourable opinion for the statements 'I think using the Internet is enjoyable' and 'I like to work with computer and mobile phone'. More than half of the respondents (57.1%) had a positive feeling towards the statement 'using the Internet makes learning fun', while around one third of them had neutral opinion.

123. Over 30 per cent of the respondents (32.3%) replied negatively for the statement 'once I start working with the Internet, I find it hard to stop', and almost similar per cent of the students had neutral opinion about it. More than sixty per cent of the participants were interested to develop their skills and

knowledge in the use of computer and the Internet. A small fraction of the students (17%) opined negatively in their interest to promote skills and knowledge in the use of computer and Internet.

124. A reasonable fraction of the students (41.3%) did not favour the statement 'I enjoy to use computer and other digital devices than being with my friends/relatives' while above one third of them (36%) favoured it.

125. Around half of the students showed disagreement to the statement associated with their interest in talking about computer and Internet applications to others. A similar fraction of the students disagreed to the statement regarding the avoidance of reading books related to IT also. At the same time, around 20 per cent of the students supported both the statements.

126. Nearly thirty per cent of the participants reported that they did not wish to get a job involving extensive use of IT. However, 40 per cent of them favoured the statement.

127. A large majority of the students (72.2%) fell under medium level attitude towards the construct 'liking' in the ICT attitude scale.

128. A high majority of the students (nearly 70%) responded positively for the statements related to their confidence in effective and efficient use of computer and Internet.

129. More than half of the respondents (52.7%) have confidence in the selection of appropriate Internet based e-resources for learning; while about 40 per cent of them have confidence in learning new software. About half of the students (47.3%)

showed disagreement to the statement that 'it is not easy to become skilful at using computer'.

130. One fourth of the participants believed that they were not competent enough to follow the advancement in digital world. Similarly, one fifth of the respondents felt that they were not competent enough to do advanced works related to IT.

131. About one third of the students favoured the statement that their skills and knowledge in computer and other digital devices were not adequate. At the same time, about 40 per cent of the students had no opinion in scoring high marks for Information Technology related courses.

132. Two thirds of the pupils (66.3%) lie in the medium level of confidence towards ICT use and the fraction of students who came under the highly confident group was close to 30 per cent.

133. A great majority of the students (around 80%) reported a positive feedback for the statements like knowledge of computer will widen the job opportunities, Internet knowledge is essential for succeeding in education and the Internet promotes to get the latest knowledge than other resources.

134. Majority of the students (around 75%) also favoured that the use of the Internet enables them to accomplish tasks more quickly and to improve their academic performance. Nearly one fourth of the students have no opinion about the statement 'the Internet makes life easier' and about 65 per cent of them agreed with it.

135. More than half of the respondents (57.8%) favoured that using the Internet is easier than using library to find information.

The fraction of pupils responded positively was nearly 40 per cent for the statement 'I feel left behind if I do not use Information Technology'.

136. Nearly half of the students remained neutral about the statement that they can learn effectively without using the Internet. A high proportion of the students (over 70%) showed disagreement with the statement 'using the Internet is not important in my university life'. Similarly, over fifty per cent of the respondents (51.3%) disagreed that the use of Internet wastes their time and about one third of them neither agree nor disagree with the statement.

137. Above half of the students (53.7%) possessed a highly positive attitude towards perceived usefulness of ICT. The proportion of students fell under the medium level perception regarding the perceived usefulness was nearly half (46.1%).

138. When analysing the overall attitude towards ICT, above two thirds of the participants (69.9%) had a medium level attitude towards ICT whereas around 30 per cent of the respondents (29.8%) showed a high level positive attitude.

139. There was a significant gender difference in the attitude towards ICT among the respondents as the Z-value was found to be significant at 0.01 level.

140. The mean score obtained for ICT attitude for the male students was higher than that for the female students which shows that male students have significantly higher level of attitude towards ICT when compared to that of female students.

141. There existed a significant difference in the level of attitude towards ICT among the students from different discipline groups as the p-value for the comparison was 0.025 which is less than 0.05. Hence the F-value was found to be significant at 0.05 level.

142. DMRT test revealed that there exists a significant difference in the level of attitude towards ICT between the students from Science and Social Science disciplines. However, the attitude towards ICT among the students from Humanities discipline showed no significant difference when compared to those from both the Science and Social Science disciplines.

143. Positive correlations were found between the access to ICT and each of the four dimensions of attitude (comfort, liking, confidence and perceived usefulness). All these correlations were significant at 0.01 level.

144. The correlations between the digital competency of the students and each of the four dimensions of attitude towards ICT were also found to be positive and significant at 0.01 level. A high correlation was found between the ICT attitude and the digital competency of the students which shows that better ICT attitude significantly more influences their digital competency. Among the different constructs of ICT attitude, 'confidence' and 'comfort' showed high correlations with digital competency when compared to 'liking' and 'perceived usefulness'.

145. Positive correlations were found between the frequency of the Internet use and each of the four dimensions of ICT attitude. A high level correlation can be identified between perceived usefulness of ICT and the frequency of Internet use among the students.

146. Overall attitude of the students towards ICT significantly correlated separately with access to ICT, digital competency and the frequency of Internet use.

5.2.5 Family Income and Educational Level of Parents

147. There existed a significant and positive correlation between family income and the digital competency of the students.

148. Parental income was also significantly correlated with the students' frequency of Internet use as well as their attitude towards ICT.

149. Significant positive correlations can be found between the educational level of parents and their wards' access to ICT.

150. The educational level of parents was also significantly and positively correlated with the students' expertise in the use of digital devices and skills to use various ICT applications.

151. The students' frequency of Internet use and attitude towards ICT were also significantly and positively correlated with the educational level of their parents.

5.3 Tenability of Hypotheses

Once the data obtained are analysed, the researcher is ready to test the hypotheses formulated in the beginning of the research. There are ten hypotheses put forward in this study. Here the researcher addresses the tenability of each of these hypotheses.

Hypothesis-1

The first hypothesis states that the place of residence of the students significantly affects their access to ICT.

According to the findings 20 and 21, the students from rural areas have significantly low level of access to ICT as compared to those from urban areas. Further, Chi-square test suggests a statistically significant association between the place of residence of the students and their personal level access to ICT. These results are highlighted in table 18.

On the basis of the above mentioned findings, the first hypothesis is accepted.

Hypothesis-2

The second hypothesis states that there is no significant university-wise difference in the level of barriers experienced by the students to access and use ICT.

According to the finding 9, University of Calicut, Mahatma Gandhi University and University of Kerala had both Wi-Fi and Ethernet connections in the campus. In Kannur University, only the Palayad campus had Wi-Fi Internet connection. However, the other campuses were not even connected by the Ethernet. Similarly, the finding 30 mentioned that the students from Kannur University had the lowest level of access to desktop computer when compared to those from the other three universities. Meanwhile, the students from University of Calicut and Kannur University had limited access to printer and LCD projector in their departments as compared to those from the other universities. The percentage analysis showed in table 21 supports this finding. The results obtained through Kruskal Wallis ANOVA coupled with Mann-Whitney U test reveal that there existed significant variations in the level of barriers faced by the students in the access and use of ICT from their respective universities. The barriers in the access and use of ICT were significantly dominant among the students from Kannur University when compared to those from other universities. This is illustrated in the findings 38 and 39 as well as in table 26.

As per the findings given above, the second hypothesis is rejected. It is concluded that there exists significant university-wise difference in the level of barriers experienced by the students to access and use of ICT.

Hypothesis-3

The third hypothesis states that there exists a significant relationship between the digital competency of the students and their access to ICT.

The finding 76 clearly shows that the digital competency of the students is directly related to their access to ICT as the correlation coefficients are found to be positive and significant at 0.01 level. The result was deducted from correlation analysis and the corresponding data are shown in table 49.

As per the finding mentioned above, the hypothesis is accepted.

Hypothesis-4

The fourth hypothesis states that there is no significant difference in the frequency of Internet use among the students of different universities.

The ANOVA test exposes the significant variations existing in the frequency of Internet use among the students from the four universities, as the p-value is found to be less than 0.001; hence, the F-value is significant at 0.01 level. However, the analysis with DMRT reveals no significant difference in the frequency of Internet use between the students from University of Calicut and University of Kerala. It is also identified that the students from Mahatma Gandhi

University have significantly higher level frequency in the use of Internet as compared to those from other universities. On the other hand, the students from Kannur University exhibited significantly low level frequency in the Internet use. These are evidenced from the findings 109, 110, 111 and 112 as well as table 65.

As per the findings discussed above, this hypothesis is rejected. It is concluded that there is significant difference in the frequency of use of the Internet among the students of different universities.

Hypothesis-5

The fifth hypothesis states that there exists a significant relationship between the digital competency of the students and their frequency of use of the Internet.

Each of the nine ICT areas in the digital competency of the students is found to be significantly and positively correlated separately with the years' of experience in the use of the Internet, frequency in connecting to the Internet and the time spent in a day to access the Internet. This result is given in table 53 and also in the findings 85, 86 and 87. Moreover, the digital competency of the students is significantly and positively correlated with the frequency of Internet use for various online activities, for the use of e-resources and also for different other purposes. The findings 113 and 114 support the result. All the corresponding correlation coefficients are found to be significant at 0.01 level and are given in table 66.

Based on the above findings, the fifth hypothesis is substantiated.

Hypothesis-6

The sixth research hypothesis states that there exist significant gender differences in ICT access, digital competency, frequency of the Internet use and attitude towards ICT among the students.

The Chi-square analysis of the data reveals that gender plays a significant role in the students' access to ICT. The findings 5 and 6 supported that the male students have significantly better access to digital devices than their female counterparts. Similarly, the finding 11 shows that lack of access to the Internet among the female students was significantly higher when compared to their male counterparts. The fraction of male students exceeds that of female students in the access to various modes of Internet connections. This statistically significant gender bias is stated in finding 14. Further the finding 18 shows that the male students significantly dominate in the overall access to ICT over the female students. All these results are evident from the tables 6, 9, 12, and 16.

The finding 50 shows that the male students have significantly higher level expertise in the use of digital devices when compared to the female students. Table 32 highlights this result. Similarly, there is a significant difference in the level of digital competency between male and female students in doing various ICT related activities/processes and the male students have significantly higher level of digital competency than the female students. This is validated through the findings 70 and 71 as well as table 45. These results are based on the Z-test.

The findings 78, 80, 81, 83 and 84, derived from the Chi-square analysis illustrate that the male and female students differ significantly in their previous Internet experience, in the periodicity of Internet use and in their duration of Internet use, with male students dominating in all the three cases. The results of Chi-square analysis are shown in tables 50, 51, and 52.

The finding 104 confirms the gender difference in the frequency of Internet use for different activities/services. A significant difference is also found between the male and female students in their frequency of use of e-resources, and is given as finding 105. The finding 106 shows a statistically significant gender difference in the frequency of Internet use for different purposes. The male students' frequency of Internet use was significantly higher than the female students in all the three cases and is stated in finding 107. The gender-wise comparison was done by the Z-test and the results are given in table 63.

The result of the Z-test illustrated in table 76 shows that there exists a significant gender difference in the attitude towards ICT among the students, as the Z-value is found to be significant at 0.01 level. The male students have significantly higher level attitude towards ICT than the female students. The findings 139 and 140 also indicate the disparity in attitude.

Hence based on the above mentioned findings, the sixth hypothesis is substantiated.

Hypothesis-7

The seventh hypothesis states that there exists significant difference in the ICT access among the students of different disciplines.

In table 17, the Chi-square test revealed that there is no significant difference in ICT access among the students of different disciplines. Finding 19 confirms the result.

Hence based on the finding mentioned above, the seventh hypothesis is rejected.

Hypothesis-8

The eighth hypothesis states that there is no significant difference in the attitude towards ICT among the students of different disciplines.

The finding 141 clearly identifies a significant discipline-wise difference in the level of attitude towards ICT among the students. Results of the ANOVA test given in table 77 show that the p-value obtained for the comparison is 0.025. As the p-value is less than 0.05, the F-value is found to be significant at 0.05 level. Further, finding 142 reveals there exists a significant difference in the level of attitude towards ICT between the students from Science and Social Science disciplines. However, it is evident from table 77 that the attitude towards ICT among the students from Humanities discipline showed no significant difference when compared to those from both the Science and Social Science disciplines.

Hence considering the findings mentioned above, the eighth hypothesis is rejected. It is concluded that there is significant difference in the attitude towards ICT among the students of different disciplines.

Hypothesis-9

The ninth hypothesis states that attitude of the students towards ICT significantly influences the digital divide among them.

All the four dimensions of attitude towards ICT, viz; comfort, liking, confidence and perceived usefulness, showed significant and positive correlations with the students' access to ICT. In addition, as showed in table 78, the four dimensions exhibited positive and significant correlations with the students' digital competency and frequency of the Internet use. Further, all these correlation coefficients were found to be significant at 0.01 level. The result coupled with findings 143, 144, 145 and 146, makes it vivid that the ICT attitude plays a significant role in influencing the digital divide among the students.

Following the results, the ninth research hypothesis is accepted.

Hypothesis-10

The tenth hypothesis states that the socio-economic status of the students significantly influences their access to ICT, digital competency, Internet use and attitude towards ICT.

As per findings 8, 16, 22 and 23, obtained from Kruskal Wallis ANOVA followed by Mann-Whitney U test and correlation analysis, there is a significant difference among the students in their level of access to digital devices, Internet and overall ICT access, as the parental income changes. These findings also confirm that as the income increases, the level of access to ICT improves among the students. The result is supported by tables 8, 14, and 19. Simple correlation analysis indicates that family income significantly influences the students' digital competency, frequency of Internet use and their attitude towards ICT. The findings 147 and 148 (table 80) reflect the results. Further, the educational level of parents is also significantly and positively correlated with students' access to ICT, digital competency, frequency of Internet use and their attitude towards technology which is illustrated by findings 149, 150 and 151. The table 79 also supports this result.

Considering the facts detailed above, the last hypothesis is accepted.

5.4 Suggestions of the Study

Digital divide has been identified as a social problem to be solved. Effective mechanisms have to be taken to address the multi-dimensional issues related to the digital divide. Solutions to bridge the digital divide among students are based not only on providing them access to ICT devices for connecting to the Internet, but also on giving them personal guidance at an administrative level. As ICT has become a tool for social change and improvement, aggressive steps should be put in place to address the digital inequality. National and local governments, public and private industries, international bodies, and citizens will need to come together to plan, design and implement effective remedies to solve the digital divide.

The researcher showed that socio-economic status of parents forms a pivotal factor in contributing digital divide among the students. Parental support is essential in getting access to and use of digital technologies. It is desired that enough efforts are undertaken to improve the awareness among parents about the importance of the use of ICT in education so that they become more likely to spend money towards ICT tools and devices like computers and mobile phones. Government can impart guidance on ICT adaptation to parents so that their wards are encouraged at home in using ICT constructively.

Several public policy initiatives, including subsidised Internet access to houses, are to be designed to help bridge the digital divide. An appropriate price differentiation strategy for mobile computing devices can also help minimize the digital gap. To achieve a wider range of adoption of mobile Internet, mobile network operators will have to make mobile Internet more affordable and try to penetrate more into digitally disadvantaged people. As the research results reveal that income levels form significant predictors of ICT adoption of digital devices and Internet, a reduction in the cost of mobile Internet will definitely encourage more students to use it. ICT ministry should come forward with subsidies for the poor to access and use technologies. It may be more cost efficient to set up or empower public libraries to become knowledge centres with ICT infrastructure, so that economically disadvantaged people can utilise it.

In this ICT era, educators have recommended for the integration of ICT across curriculum. The teachers can give ICT integrated assignments/ projects to students in order to motivate them to start using ICT for their learning and communication purposes. The integration of ICT here denotes learning with computer and Internet rather than learning about computer and Internet.

For professional development of teachers, they have to possess skills and competency to use and integrate ICT into their teaching practice. To promote awareness and use of ICT in education among teachers, educational authorities can arrange seminars, conferences, and workshops. Library professionals can introduce e-resources to teachers so that they become more competent to retrieve the required information and inspire the students to use it effectively.

Teachers can integrate technology in order to improve their effectiveness and need to be in the front for promoting digital inclusion in education. Technical assistance to teachers and their professional developments facilitate effective integration of technology into curriculum. This relieves the level of stress among teachers while moving towards ICT self-efficacy.

ICT awareness programmes must be started at an early stage, most notably for the students who come from uneducated families. It's necessary to take steps to improve the digital literacy of the students. Digital literacy and computer skills are now an important requirement for all students to bridge the digital divide. Educational authorities can organise awareness and training programmes for effective ICT use. Students must be made aware of the many ICT tools available, so that they can effectively use ICT in their education and build confidence to use it in their career too. Further, a positive attitude can be promoted by introducing training programmes related to the constructive role of Internet in education.

For reducing the digital divide in universities, in fact, attempts should begin from school level itself. Decision makers on educational policies need to act quickly. It will be beneficial to setup a network of inter-connected schools for sharing resources and to impart training programmes to teachers (of schools). Students should have a clear and valid motivation to use the Internet, not simply because they feel obliged to do so. It is also essential that schools intensify classroom ICT infrastructural facilities as well as teacher practices of ICT in learning, so that the disparities in access and usage of ICT are reduced among the students. In short, the introduction of IT, particularly computer and the Internet in the earlier stages of childhood helps minimize the digital divide among students.

An active participation from the government seems to be the need of the hour in order to decrease gradually the digital divide and diminish it finally. The research reveals that insufficient number of computers with Internet connection acts as a major barrier to use ICT among the students. Poor network coverage in the campus also hindered the smooth use of ICT. Hence governments and university authorities have to play a leading role in reforming and improving the ICT infrastructure available to students. Governments have to take efforts to improve the quality of digital equipments coupled with easy access to fast Internet connection in educational institutions. Adequate provision of ICT infrastructure in institutions will motivate both teachers and learners to use it in the teaching and learning processes. If universities attain the adequate access to technology, authorities must evaluate not only the equipment availability among students but also their skills in these technologies. Government can enact a state level information literacy policy to ensure that information reaches all sections of society.

In this digital era, libraries need to be transformed to knowledge hubs, where the users can get required information fast from reliable sources. Library professionals can take a very constructive role in updating academic community on the available digital resources in the university libraries. Further, they can take part in activities to spread information literacy among the users of library, so that the ICT usage divide can be minimised. Hence efforts are needed to increase ICT infrastructure facilities in university libraries and to impart training to librarians in order to equip them to be the torch bearers of changing technology.

5.5 Recommendations for Further Research

This study adds to the data available pertaining to the digital divide among students. However, there are still areas that need to be explored. Investigators interested in this topic could use this study to conduct similar explorations.

Reviews reveal that age is an important determinant factor that contributes to the digital divide. Hence future research needs to focus on large cross section of Internet users and nonusers by employing more diversified samples including adult and aged population.

An evaluative study can be conducted to know the extent of various ICT initiatives succeeded in bridging the digital divide among students.

Further studies can also concentrate on practices and policies that facilitate parents to provide appropriate learning environment by using ICT at home for their children.

It may be interesting to conduct a study on the digital divide, by directly measuring digital competency of the participants in terms of their actual use and management of ICT applications, rather than taking their perceptions on the same. Thus, further studies can embrace and explore the wider scope of digital spectrum by developing and applying similar measurements of digital divide.

As the mobile phone penetration has reached almost all sections of the society, further research can emphasise on the role of mobile phone in bridging the digital divide.

Additional research could be conducted to examine the connectivity level of the Internet available to students in their homes and educational institutions. In addition to this, it is important to observe the roles of ICT infrastructural characteristics offered by educational institutions and modern practices employed by teachers in reducing the digital disparity among students.

Researchers can also try to compare the government and private school systems in Kerala to determine the nature and extent of digital divide. This could be very important research for a school board or other school officials looking to create change. These data would be important as it can help implement positive changes to ensure that computer access and the digital divide become less of an issue for the society at large.

Further research could also contribute to understand the importance of teachers' support and training towards minimising the digital divide as they influence meaningful integration of ICT.

A study can also be conducted to know the digital divide among students and teachers in higher educational institutions.

5.6 Conclusions

Access to technology forms a fundamental element necessary for incorporating technology into a society. The study identified that the personal level access to ICT is still a major problem among the students. The first-level digital divide is referred to as the differences in the physical access to technology experienced by the students both within their homes and universities. The overall results confirmed the existence of inequalities among the students in their access to technologies. A reasonable number of the students experienced lack of access to desktop or laptop computer at personal level and it is still a major issue among them. Very limited number of the students was seemed to be well versed with all the technological devices. Findings also disclose that a low rate of ownership to digital devices can be seen among the students except in the case of smart phones. Regarding the Internet access at personal level, some of the students kept away from enjoying it. Even though, majority of the students have access to the Internet at personal level, a few of them enjoyed a high level Internet access whereas majority of them experienced a low level access. Subject-wise analysis reveals that there is no significant difference in the access to ICT among the students from Science, Humanities and Social Science.

Financially disadvantaged students have the provision of access to computer and the Internet from their universities. Even though universities provide computers with Internet connection and Wi-Fi facilities in the campuses, it is not adequate for the students to meet their requirements. It can be substantiated by observing the university level barriers faced by the students to access and use of ICT. Major issue for the students to access and use ICT was insufficient number of computers with Internet connection in their departments. In the case of overall level of barriers, respondents from Humanities faced higher level barriers to access and use ICT when compared with those from the other two disciplines. Barriers like lack of personnel to maintain equipment in the department, insufficient number of computers with Internet connection in departments and slow speed of Internet connection in campus were higher in Kannur University when compared to other universities. Male students had a higher level of computer software use than female students. In addition, inequalities in access to ICT among the students can also be observed along gender-line and geographic areas. In short, overall analysis in access to ICT concludes that equitable access is essential, but not sufficient for the students to ensure comparable benefits from using technologies. Moreover, access to ICT infrastructure is the foundation toward having better digital skills and Internet use among the students. So lack of enough access to ICT accelerates the extent of digital divide among the students. First level digital divide still persists among the students even though university provided free Internet access.

The students have to be digitally competent in order achieve the efficient utilization of digital resources. The study measured digital competency of the students in the use of various digital devices and also in doing various ICT applications. In the case of expertise in digital devices, majority of the students exhibited above average level of competency in the use of mobile phones, desktop computers and laptops. On the whole, fairly wide differences can be recognized among the students with regard to the type of digital skills in the use of different ICT applications. With respect to the perceived ICT competencies, the analysis of the data explored that majority of the students did not perceive themselves very competent in the use of ICT. An average level of digital competency can be noticed among the students, which means lack of adequate competency in the use of ICT contributes to the digital divide among the students to some extent. A clear idea about the competency level of the students was obtained in all the nine dimensions of digital competency. As a result, the researcher could understand the major areas that led to the digital skill divide among the respondents. In addition, the researcher proved that participation in ICT related courses will improve the digital competency level of students, subsequently narrowing the digital divide. Gender divide in the digital competency was also explored in the result. However, there were no discipline-wise differences in handling various ICT applications among the students.

The findings confirm digital inequalities in terms of the frequency of Internet use. Some respondents reported a higher level frequency in the use of Internet for certain activities and for the use of e-resources. Some of the students also used the Internet highly for different purposes. But some others exhibited a low frequency in the use of Internet for various items. This is a sign of digital divide with regard to the Internet usage. The differences in digital competency and Internet usage highlight the existence of second level digital divide among the students. Although the students have Internet access, (especially from university), there exist differences in the intensity of Internet use. The students also showed differences in their experience and frequency in the use of Internet. These differences can also be seen along the gender line. However, no significant variations in the frequency of Internet use based on their academic disciplines could be identified. University-wise variations in the use of Internet indicate that the ICT infrastructure facilities provided in the campuses are not adequate. Another interesting result is that there existed a significant relationship between frequency of Internet use of the students and their digital competency.

The tendency in favour of or against the use of ICT in daily life strongly depends on the students' attitude towards ICT. There must be a right kind of attitude towards technologies for faster adoption of the same. From the overall analysis, the researcher concluded that a majority of the students had a medium level attitude towards ICT, although a considerable proportion of them exhibited a high level attitude. In general, students showed a positive attitude towards computer and Internet usage. A significant gender difference in attitude towards ICT can also be observed in the result. So the gender divide still persists in the case of attitude towards technology among the students. Regarding the discipline-wise analysis, the students from Social Science exhibited more favourable attitude towards technology compared to those from the other two disciplines. Finally, the researcher concluded that attitude towards ICT plays a significant role in contributing to the digital divide among the students as it showed significant positive relationship with ICT access, digital competency and the frequency of Internet use.

The study finds that parental income acts as a key determinant factor in affecting the students' technological access. It was shown that as the family income increased, the students' access to technology improved. Similarly the family income significantly influenced the students' digital competency, frequency of the Internet use and their attitude towards ICT. In addition, the result proved that educational level of the parents also acted as a key determinant in the digital divide among the students. From the analysis, it was found that the educational qualification of the parents significantly and positively correlated with the students' access to technology, digital competency and frequency of the Internet use. Further, higher parental education promotes a positive attitude among the students towards ICT. Even though the students are studying at post-graduate level, the research reveals that the socio-economic status of their family crucially influences their access and use of technology.

Appendix 1

University of Calicut
Department of Library and Information Science

Dear Student,

I wish to conduct a study entitled ***Digital Divide among Students of Universities in Kerala***. Digital Divide refers to the inequality in access, distribution and use of Information and Communication Technology between two or more populations. I request you to kindly spare a few minutes to fill up the questionnaire. I assure you that the information provided by you will be kept confidential, and will be used only for the research work. Thanking you in advance for your kind gesture.

Aswathi P.
Research Scholar

A. Background Information (*Please tick (√) your responses in the space provided*).

1. Gender: a) Male ☐ b) Female ☐
2. Name of the University: a) University of Kerala ☐ b) University of Calicut ☐
   c) M.G. University ☐ d) Kannur University ☐
3. Name of the Department:…………………………………………………
4. Home Area: a) Rural ☐ b) Urban ☐
5. Monthly income of your family in Rs. (Please tick)

Below 10000	10001-20000	20001-30000	30001 - 40000	40001 - 50000	50001-60000	Above 60000
☐	☐	☐	☐	☐	☐	☐

6. Education level of your parents (Please tick)

Parents	Below SSLC	SSLC or +2/ Pre-degree	Degree	Post-graduate	Above Post-graduate
Father	☐	☐	☐	☐	☐
Mother	☐	☐	☐	☐	☐

7. How long have you been familiar with the use of computers? (please tick)

Less than one year	1-3 years	4-6 years	7-9 years	More than 9 years
☐	☐	☐	☐	☐

8. Have you attended any computer/Information Technology related courses?
   a) Yes ☐ b) No ☐
9. What is the approximate monthly cost (in Rs) for your Internet access?
   a) Nil ☐ b) 0-50 ☐ c) 51-100 ☐ d) 101-200 ☐ e) Above 200 ☐

B. Access to Information and Communication Technology

10. Please indicate your access to computer and other digital devices at your **personal level** (Please tick)

Sl. No.	Devices	Unrestricted (Free) Access	Restricted (Limited)Access	No Access
1	Computer	☐	☐	☐
2	Laptop Computer	☐	☐	☐
3	Netbook/Notebook Computer	☐	☐	☐
4	Tablet	☐	☐	☐
5	PDA (Personal Digital	☐	☐	☐
6	Land phone	☐	☐	☐
7	Mobile phone (with Internet	☐	☐	☐
8	Digital Camera	☐	☐	☐
9	MP3/MP4 Player/IPOD	☐	☐	☐
10	Printer	☐	☐	☐
11	Scanner	☐	☐	☐
12	E-book reader	☐	☐	☐
13	Others (Please	☐	☐	☐

11. Please indicate the nature of ownership to computer and other digital devices **at your home**?

Sl. No.	Devices	Ownership	
		In Your Family	Your Own
1	Computer (Desktop, Laptop, Netbook, etc.)	☐	☐
2	Smart Phone (Mobile phone with high speed (3G) Internet access)	☐	☐
3	Tablet	☐	☐
4	E-book reader	☐	☐
5	Printer	☐	☐
6	Scanner	☐	☐
7	Others...	☐	☐

12. Which of the following devices can you access from your **university department**?

a)Computer ☐ b) Laptop ☐ c) E-book reader ☐ d) Digital Camera ☐

e) Printer ☐ f) Scanner ☐ g) LCD Projector ☐

13. Do you have Internet access **on a personal level**? a) Yes ☐ b) No ☐

If yes, please indicate the level of your access to the Internet using the following modes of connection.

Sl. No.	Mode of Internet Access	Unrestricted (Free) Access	Restricted (Limited) Access	No access
1	Dial up	☐	☐	☐
2	Broadband (Cable/WiFi)	☐	☐	☐
3	USB-Dongle (E.g. Net setter)	☐	☐	☐
4	Mobile Internet (GPRS, 2G, 3G)	☐	☐	☐
5	I don't know		☐	

14. Please indicate the software you use (Please tick)

Sl. No.	Software	Please Tick	Sl. No.	Software	Please Tick
1	Text Processor (Eg. MS Word, Libre Office)	☐	6	Internet Browser (Eg. Firefox, Chrome, Internet Explorer)	☐
2	Spreadsheet (Eg. MS Excel)	☐	7	Antivirus (Eg. Avira, McAfee)	☐
3	Presentation (Eg. MS PowerPoint)	☐	8	Programming Language (Eg. Python, Java)	☐
4	Movie/Animation (Eg. Adobe Flash)	☐	9	Database (Eg. MS Access)	☐
5	Graphics (Eg. Photoshop)	☐	10	Statistical Packages (Eg. SPSS)	☐
11	Any others (Please specify)	....			

15. Please indicate the level of barriers faced by you in acquiring/using Information and Communication Technology

Sl. No.	Obstacles / Barriers	Extreme	Moderate	Not a Barrier
1	Lack of support from parents	☐	☐	☐
2	Not having an Information Technology background in family	☐	☐	☐
3	Poor or no connection to the Internet at home	☐	☐	☐
4	Restrictions to use the Internet at home	☐	☐	☐
5	Lack of support from teachers	☐	☐	☐
6	Restrictions to use the Internet in university/library	☐	☐	☐
7	Lack of personnel to maintain ICT equipment in the department	☐	☐	☐
8	Insufficient number of computers with Internet connection in the department/library	☐	☐	☐
9	Slow speed of the Internet connection at the department.	☐	☐	☐

Sl. No.	Obstacles / Barriers	Extreme	Moderate	Not a Barrier
10	Poor network coverage in the university campus	☐	☐	☐
11	Complexity of new technologies	☐	☐	☐
12	Lack of training	☐	☐	☐
13	Lack of enough money	☐	☐	☐
14	Lack of competency (Knowledge and Skills)	☐	☐	☐
15	Lack of time	☐	☐	☐
16	Lack of proficiency in English language	☐	☐	☐
17	Lack of need (No need)	☐	☐	☐
18	Others (Please specify)...........................	☐	☐	☐

C. Digital Competency

16. Please indicate your major source(s) for learning digital (Information Technology) skills. (Please tick)

Courses	Friends/ Teachers	Self-Learning (Manuals, Demo package etc.)	Others (Please specify)
☐	☐	☐	☐

17. Please indicate your level of expertise in using computers and other digital devices (Here '**Excellent**' means fully competent, '**Good**' means I am a regular and confident user, '**Average**' means use occasionally but need further training, '**Not good'** means not confident and use rarely, '**Not at all'** means not aware)

Sl. No.	Devices	Level of Expertise				
		Excellent	Good	Average	Not Good	Not at all
1	Computer	☐	☐	☐	☐	☐
2	Laptop Computer	☐	☐	☐	☐	☐
3	Netbook/Note book Computer	☐	☐	☐	☐	☐
4	Tablet	☐	☐	☐	☐	☐
5	Mobile phone (with Internet access)	☐	☐	☐	☐	☐
6	Printer	☐	☐	☐	☐	☐
7	Scanner	☐	☐	☐	☐	☐
8	LCD/ Multimedia Projector	☐	☐	☐	☐	☐

18. Please indicate your level of expertise in the following activities/ processes (Here '**Excellent**' means fully competent, '**Good**' means I am a regular and confident user, '**Average**' means use occasionally but need further training, '**Not good'** means not confident and use rarely, '**Not at all'** means not aware).

Sl. No.	Activities/Processes	Level of Expertise				
		Excellent	Good	Average	Not Good	Not at all
1	Determine what kind of information you need and that can be retrieved from the Internet.	☐	☐	☐	☐	☐
2	Use search engines (Eg., Google) on the Internet	☐	☐	☐	☐	☐
3	Locate websites that contain the information	☐	☐	☐	☐	☐

Sl. No.	Activities/Processes	Level of Expertise				
		Excellent	Good	Average	Not Good	Not at all
	you need					
4	Navigate through different websites	☐	☐	☐	☐	☐
5	Create an e-mail address	☐	☐	☐	☐	☐
6	Create an account in social networks (Eg., Facebook, Twitter)	☐	☐	☐	☐	☐
7	Print a computer document/ file	☐	☐	☐	☐	☐
8	Install a software (Eg., MS Office) in a computer	☐	☐	☐	☐	☐
9	Use a security software or tool (Eg., Antivirus)	☐	☐	☐	☐	☐
10	Use a computer programming language (Eg., Java)	☐	☐	☐	☐	☐
11	Use GPS to navigate	☐	☐	☐	☐	☐
12	Create a folder and save a file downloaded from the Internet in to it	☐	☐	☐	☐	☐
13	Arrange collected information into lists and tables	☐	☐	☐	☐	☐
14	Use of storage devices (i.e., Hard disk, CD/DVD, Pen drive)	☐	☐	☐	☐	☐
15	Transfer photos/video from a digital camera to a computer	☐	☐	☐	☐	☐
16	Take backup of a computer	☐	☐	☐	☐	☐
17	Assess the quality of information that you find on the Internet, for Eg., whether it is old, biased or trustworthy	☐	☐	☐	☐	☐
18	Configure the security settings of the Internet tools/devices/utilities (Web browser, E-mail, Social Networking Sites, etc)	☐	☐	☐	☐	☐
19	Write and edit text in a text processor (Eg. MS Word)	☐	☐	☐	☐	☐
20	Use spell checkers/ dictionaries	☐	☐	☐	☐	☐
21	Insert images/symbols in text documents	☐	☐	☐	☐	☐
22	Include an animation or movie inside a presentation document (Eg., MS PowerPoint)	☐	☐	☐	☐	☐
23	Sort data using spreadsheet	☐	☐	☐	☐	☐
24	Use functions/Formulae inside a spreadsheet	☐	☐	☐	☐	☐
25	Connect to the Internet using mobile phone	☐	☐	☐	☐	☐
26	Send / receive e-mail	☐	☐	☐	☐	☐
27	Send/ receive MMS messages from a mobile phone	☐	☐	☐	☐	☐
28	Send/receive files (Eg. Image, Video) using Bluetooth	☐	☐	☐	☐	☐
29	Upload contents (Eg. Video, Audio) to a website to be shared	☐	☐	☐	☐	☐

Sl. No.	Activities/Processes	Level of Expertise				
		Excellent	Good	Average	Not Good	Not at all
30	Use the Internet to make telephone call (Eg. Skype)	☐	☐	☐	☐	☐
31	Participate in social networks (Eg. Facebook, Twitter)	☐	☐	☐	☐	☐
32	Online booking of tickets (Eg., For travelling or film reservation)	☐	☐	☐	☐	☐
33	Create a website	☐	☐	☐	☐	☐
34	Create a blog	☐	☐	☐	☐	☐
35	Use information from the Internet without violating copyright	☐	☐	☐	☐	☐
36	Connect a new device to a computer and install it (Eg. Printer)	☐	☐	☐	☐	☐
37	Install an operating system (Eg. Windows, Linux)	☐	☐	☐	☐	☐

D. Internet Use

19. How long have you been using the Internet? (Please Tick)

Less than one year	1-3 years	4-6 years	7-9 years	More than 9 years
☐	☐	☐	☐	☐

20. How often did you connect to the Internet during last 12 months? (Please Tick)

Rarely	Monthly	A Few days a week.	Daily	Stay connected most of the time
☐	☐	☐	☐	☐

21. On an average how much time do you spend daily to access the Internet? (Please Tick)

Less than 30 minutes	30-60 minutes	1-2 hrs	2-3hrs	More than 3 hrs
☐	☐	☐	☐	☐

22. Please indicate the location(s) from where you access the Internet. (Please Tick)

Home	Department	Library	Internet Cafe	Hostel	Others (Please specify)
☐	☐	☐	☐	☐	

23. Please mention the frequency of use of the Internet related services/activities over the last 12 months

Sl. No.	Services/ Activities/Tools	Always	Often	Sometimes	Rarely	Never
1	WWW	☐	☐	☐	☐	☐
2	E-mail (Web mail)	☐	☐	☐	☐	☐
3	Chat	☐	☐	☐	☐	☐
4	Internet call	☐	☐	☐	☐	☐
5	WhatsApp/Hike	☐	☐	☐	☐	☐
6	Social Networking Sites (Eg., Facebook)	☐	☐	☐	☐	☐
7	Blogs	☐	☐	☐	☐	☐
8	Wikis	☐	☐	☐	☐	☐
9	RSS(Really Simple Syndicate)	☐	☐	☐	☐	☐
10	Book Marking(Eg., MyBookmark.com)	☐	☐	☐	☐	☐
11	Tagging	☐	☐	☐	☐	☐
12	Video sharing (Eg. YouTube)	☐	☐	☐	☐	☐
13	Photo sharing (Eg. Picaso)	☐	☐	☐	☐	☐
14	Downloading Files (Eg. Audio, Video)	☐	☐	☐	☐	☐
15	Sharing course materials/ Lecture notes	☐	☐	☐	☐	☐
16	Others (Please specify)	☐	☐	☐	☐	☐

24. Please mention the frequency of use of the following e-resources through the Internet.

Sl. No.	E-resources	Always	Often	Sometimes	Rarely	Never
1	E-journals	☐	☐	☐	☐	☐
2	E-books	☐	☐	☐	☐	☐
3	E-newspapers/e-news sites	☐	☐	☐	☐	☐
4	E-zines (Electronic Magazines)	☐	☐	☐	☐	☐
5	ETD (Electronic Thesis and Dissertations)	☐	☐	☐	☐	☐
6	Online Reference Sources (Eg.	☐	☐	☐	☐	☐
7	Institutional Repositories	☐	☐	☐	☐	☐
8	Web Portals	☐	☐	☐	☐	☐
9	Digital Libraries	☐	☐	☐	☐	☐
10	Library Consortia (Eg. Infonet, INDEST)	☐	☐	☐	☐	☐
11	Others (Please specify)	☐	☐	☐	☐	☐

25. How often do you use the Internet for the following purposes?

Sl. No.	Purposes	Always	Often	Sometimes	Rarely	Never
1	Educational (Eg., Admissions, checking of examination results, etc.)	☐	☐	☐	☐	☐
2	Academic (Exam, assignments, projects, etc.)	☐	☐	☐	☐	☐
3	Employment / job opportunity / career	☐	☐	☐	☐	☐
4	Government interaction	☐	☐	☐	☐	☐
5	News	☐	☐	☐	☐	☐
6	Health information	☐	☐	☐	☐	☐
7	Political information	☐	☐	☐	☐	☐
8	Communication	☐	☐	☐	☐	☐
9	Recreation/Entertainment (music, games, etc.)	☐	☐	☐	☐	☐
10	Shopping	☐	☐	☐	☐	☐
11	Travelling (Online ticket reservation)	☐	☐	☐	☐	☐
12	Internet banking	☐	☐	☐	☐	☐
13	Mobile recharging	☐	☐	☐	☐	☐
14	Others (Please specify)..	☐	☐	☐	☐	☐

G. Attitude towards Information and Communication Technology

26. Please indicate the degree of your agreement with the following statements.

Sl. No.	Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	I am very comfortable in using computer.	☐	☐	☐	☐	☐
2	Internet is difficult to use	☐	☐	☐	☐	☐
3	Using the computer is clear and understandable	☐	☐	☐	☐	☐
4	I am not bothered about security issues related to the Internet	☐	☐	☐	☐	☐
5	I am anxious that my personal information available on the Internet may be misused	☐	☐	☐	☐	☐
6	The information available on the Internet is trustworthy	☐	☐	☐	☐	☐
7	Use of computer and other digital devices result in people becoming isolated	☐	☐	☐	☐	☐
8	Internet destroy human creativity	☐	☐	☐	☐	☐
9	Use of computer and other digital devices can cause health problems	☐	☐	☐	☐	☐
10	I think using the Internet is enjoyable	☐	☐	☐	☐	☐

Sl. No.	Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
11	I like to work with computer and mobile phone	☐	☐	☐	☐	☐
12	Using the Internet makes learning fun	☐	☐	☐	☐	☐
13	Once I start working with the Internet, I find it hard to stop	☐	☐	☐	☐	☐
14	I am not interested in developing my skills and knowledge in using computer and the Internet.	☐	☐	☐	☐	☐
15	I enjoy using computer and other digital devices than being with my friends / relatives	☐	☐	☐	☐	☐
16	I do not enjoy talking with others about computer and the Internet applications	☐	☐	☐	☐	☐
17	I like to avoid reading books on Information Technology	☐	☐	☐	☐	☐
18	I am not interested in a career that involves the extensive use of Information Technology	☐	☐	☐	☐	☐
19	I can use the Internet effectively and efficiently	☐	☐	☐	☐	☐
20	I am sure I can do work using computer	☐	☐	☐	☐	☐
21	I can get high marks for Information Technology related courses	☐	☐	☐	☐	☐
22	I can learn new software easily	☐	☐	☐	☐	☐
23	I can select appropriate Internet based e-resources for learning	☐	☐	☐	☐	☐
24	I am not competent enough to follow advancements in the digital world	☐	☐	☐	☐	☐
25	It is not easy to become skilful at using computers	☐	☐	☐	☐	☐
26	My skills and knowledge in computer and other digital devices are not adequate	☐	☐	☐	☐	☐
27	I can't do advanced Information Technology related work	☐	☐	☐	☐	☐
28	The Internet makes life easier	☐	☐	☐	☐	☐
29	Knowledge of computer will widen job opportunities	☐	☐	☐	☐	☐
30	I feel left behind if I do not use Information Technology.	☐	☐	☐	☐	☐
31	Using the Internet enables me to accomplish tasks more quickly	☐	☐	☐	☐	☐
32	Knowledge of the Internet is essential for succeeding in education	☐	☐	☐	☐	☐
33	Using the Internet improves my academic performance	☐	☐	☐	☐	☐

Sl. No.	Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
34	I find using the Internet to be easier than using library	☐	☐	☐	☐	☐
35	The Internet helps me better to get the latest knowledge than other resources	☐	☐	☐	☐	☐
36	I can learn effectively without using the Internet.	☐	☐	☐	☐	☐
37	Using the Internet wastes my time	☐	☐	☐	☐	☐
38	Using the Internet is not important in my university life	☐	☐	☐	☐	☐

27. Please give your valuable suggestions for improving the access and use of Information Technology by the students in universities in Kerala.

    ....

    ....

    ....

Thank You Very Much

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2. Aswathi, P., & Haneefa, K. M. (2013). Bridging the digital divide: E-governance initiatives in India. *Communication & Journalism Research*, *2*(2), 1-10.

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3. Aswathi, P., & Haneefa, K. M. (2019). Digital divide paradox: Role of librarians in bridging the digital divide. In K. M. Haneefa & T. M. Vasudevan (EDs), *Proceedings of the National Conference on Innovations and Transformation in Libraries* (pp. 271-290). Madurai: Jayalakshmi Publications.

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