Digital Divide in Rural Tertiary Education

Jesus M. Meneses III, Rowena P. Capada

Abstract: Recent studies show that Digital Divide continue to exist persistently despite efforts in a global scale to address the same through diffusion of Information Communication Technology (ICT). Inequality of access to technology as the main driving force behind these efforts, suffered deficiencies to fully capture the entire picture of the gap. The focus now is on the ability to use the technology among those who have access to it where skill and education plays a pivotal role. This is supported by findings of certain studies where digital skill particularly strategic and operational skill dictates a new frontier for bridging the gap especially in rural areas of developing countries where it is prevalent. To investigate whether there exists a digital divide among students enrolled with computer related programs in Eastern Samar State University Borongan City, Eastern Samar Philippines, the researchers conducted a survey using a questionnaire employed by Krause (2014) primarily based on LoTi H.E.A.T. Digital Age Survey developed by Dr. Chris Moersch of the LoTi Institute Carlsbad, California with modification. Data regarding gadgets and access to internet were solicited from the respondents including their perception about their related skills and later analyze and described using descriptive statistics. Results revealed that there exists a digital divide among the four groups of students (BSIT, BSCS, BSCpE, ACT) in terms of availability/access to internet and related technologies including a substantial deficiency in skill/knowledge to use the same.

Index Terms: digital divide, rural tertiary education, digital skills, digital literacy

I. INTRODUCTION

Despite significant progress in worldwide use of internet and related technologies, persistent inequalities continue to exist in terms of who has access to it and those who don't (Cruz-Jesus, F., Vicente, M. R., Bacao, F., & Oliveira, T. ,2016). Henry (2019), Livingstone & Helper (2007) call this inequity as "Digital Divide" which is defined as divisions *"within and across societies according to those that have access to digital technologies (including the internet) and those that do not."*. However, Gorski (2005) reconceptualization concentrate more on the meaningful use of ICT rather than physical access alone. This has been identified as a potential contributor to the widening income gap both within and among countries for about 20 years now (Henry, 2019). Earlier studies show that most of disproportionate users are common in developed countries. In 2001, United States users alone constituted 29 percent of the world's internet population (Chen & Wellman, 2004).

In the 2018 report of the International Telecommunication Union (ITU), more than half of the world (3.9 billion) is now online but the rest of the half are still offline situated mostly in rural areas of developing countries. Wong, Fung, Law, Lam, & Lee, (2009) argued, that while it is important to improve accessibility and knowledge of ICT, the promotion of community-based ICT user networks for certain disadvantaged groups is essential to augment their participation in the information society. Studies suggest that socioeconomic status is more closely associated with the informational use of the Internet than with access to the Internet (Wei & Hindman, 2011). That being said, the challenge now lies on narrowing the technological gap in said areas where persistent poverty resides despite the existence of "Urban Bias" which is considered one of the culprits in the uneven development between rural and urban communities (Henry, 2019).

Although the concept of digital divide is widely appreciated and recognized by most academicians, politicians and policy makers, existing empirical works are mostly in the macro perspective where impact of country wealth measured in GDP plays heavy influences in the diffusion of ICT. GDP alone however is not the sole determinant of digital divide between countries (White, Gunasekaran, Shea, & Ariguzo, 2011). In fact, such concept fails to capture the full picture of the inequity that Gorski (2005) end up redefining it shifting the "access" paradigm towards one not based on equality of physical access alone, but on equity of access. Equity of access means that digital divide can be better appreciated as inequalities in the meaningful use of information and communication technologies (Wei & Hindman, 2011) and the idea that digital divide can be best rectified by increasing and improving the physical access to computers or internet alone is simplistic and shallow (Gorski, 2005).

In the context of teaching and learning process, Information Communication Technology (ICT) proved to be a significant domain and has become an object of interest to improve the effectiveness of education (Abidin & Jafre, 2015). Van Deursen, Helsper, & Eynon, (2014) utilized digital skills in measuring digital divide and find education to be the most important correlating factor wherein highly educated people perform better than the other.

In light of the above, the researchers deemed it of utmost interest to conduct a survey whether or not there exist digital divide based not only on the access to ICT but on the meaningful use of information and communication technologies of students in higher education institutions situated in rural areas in the Philippines particularly in Eastern Samar State University.

Computing facilities in Eastern Samar State University has increase over time based on its Supply Inventory records. From 50 units of PC-XT machines acquired in mid 90s, the University now has more than a hundred tripling the number of computers. Some of these computers are used for administrative functions to cater to different service functions and the remaining eighty percent of the

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computer units are used for instruction. Inequities may exist and these inequities have far-reaching consequences when it comes to education since inadequate access to technology can hinder students from learning technology skills that are crucial to their success (Soltan, 2016). The researchers believe that to have a glimpse of the unique reality of digital divide of herein locale, it may provide an equally unique perspective of the issue vital to the wider view of the world so that a more sustainable solution thereof maybe afforded.

II. OBJECTIVES OF THE STUDY

This paper sought to answer the following questions:

1. What are the gadgets the students own and use to access the internet or perform computing tasks;
2. What computing facilities are available for students use in the colleges for the following computer related academic programs?
   - 2.1 Associate in Computer Science
   - 2.2 Computer Science
   - 2.3 Information Technology
   - 2.4 Computer Engineering
3. What is the perception of the students on the development of their computing skills on the various courses offered in their college?

III. METHODOLOGY

A. Research Design

The study employed the descriptive and evaluative research design. The paper described and evaluated the technology gap of the students enrolled in the four computer related programs of the University in terms of accessibility and utilization of computer and internet technology as perceived by the identified BSCpE, CS, IT and ACT students.

B. Instrument and Data Gathering Procedure

The focus of this study was to describe and evaluate the computing facilities available and not available for the students of the four computer related programs offered by the University. This also looked into the use and access to computer and internet technology as perceived by students. To collect the participants perception questionnaire employed by Krause (2014) primarily based on LoTi H.E.A.T. Digital Age Survey developed by Dr. Chris Moersch of the LoTi Institute Carlsbad, California was used. Some items were modified and added to suit the need of the study.

IV. RESULTS

Respondents of the study included the students of the different computer related programs offered in the University. Respondents, as shown in table 1, are distributed as follows: Computer Engineering (50), Computer Science (50), Information Technology (100), Associate in Computer Technology (50).

Table 1. Distribution of Respondents

COURSE	f
BSCpE	50
CS	50
IT	100
ACT	50
TOTAL	**250**

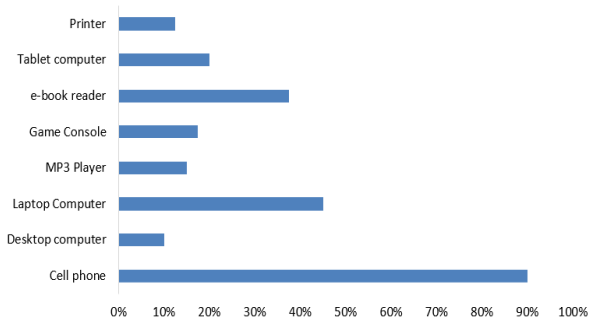

Figure 1. Gadgets Owned by Students

As shown in Figure 1, the most common gadget owned by students is cell phone, followed by laptop computers and e-book readers. The least popular gadget is desktop computer indicating that the students now preferred to use laptop over desktop computers.

Table 2. Cellphone Ownership by Program

COURSE	YES	NO
BSCpE	100%	-
BSCS	90%	10%
BSIT	90%	10%
ACT	100%	-

Table 3. Type of Cellphone Used

COURSE	BASIC CELLPHONE	iPhone	ANDROID
BSCpE	20%	-	80%
BSCS	-	10%	80%
BSIT	40%	10%	40%
ACT	10%	20%	70%

Moreover, students were specifically asked if they personally own a cellphone unit. Table 2 presents the students responses per program. As shown, there is a high percentage of ownership and that most of them are using android phones (See Table 3). According to Soltan (2016), smart phones have helped bridge digital divide, as they provide internet access to populations who are at a digital disadvantage.As expected, the use of cell phone in performing computing tasks is very prevalent among students. As can be gleaned from Table 4, almost all computing tasks identified in the study which include, sending and receiving mail, internet access, entertainment, social media and location tagging are done using cell phone except for online banking. These findings explain the high ownership of cell phone among students and that they are already using android phones or cell phones with available facilities for these tasks. It should be noted that these tasks require internet connection. According to the students, internet connection is not basically available at their homes (See Table 5). They access and use internet services mostly by using their cell phones.

Table 4. Gadgets Used by Students to Perform Computing Tasks.

TASKS	Cell Phone	Computer	Laptop	Tablet	Others
Send or receive email	X				
Play music	X				
Download an application	X				
Record a video	X				

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Access the internet	X				
Watch a video	X				
Send a photo of video to someone	X				
Post a photo or video online	X				
Access a social networking site	X				
Check your bank account or do online banking	-				
Participate in video chat or call	X				
Get directions, recommendations or other information based on your present location	X				

Table 5. Type of Internet Access at home

Course	None	Dial-Up	Hi-Speed Access
BSCpE	90%	-	10%
BSCS	90%	-	10%
BSIT	100%	-	-
ACS	100%	-	-

But despite of their ownership of the gadget, there are still some students in all the four programs which do not have experience in doing some of the computing tasks identified (See Table 6). Though, only a small percentage of them, this finding cannot be ignored considering that they are pursuing a degree in computer related area. What is notable is that all the 4 groups of students are in common with they have never performed, and they are performing daily, which are online banking and playing music or video respectively. BSCS however, are into downloading application more.

For BSCpE students, there are still 8 out of the 10 tasks which they have not yet experienced doing, these include sending and receiving emails, downloading application, recording, watching and sending video, sending and posting pictures, using social media, online banking and getting directions. For BSCS students, 7 out of 10 computing tasks, this includes sending and receiving emails, downloading application, recording, sending video, accessing the internet, sending and posting pictures, using social media, online banking and getting directions. BSIT students still have to perform 5 out of the 10 computing tasks like sending and receiving mails, sending a photo or video, online e banking, video call, and getting directions. Likewise, ACS students still have to experience 8 out of the 10 tasks, these include sending and receiving emails, downloading application, recording, watching and sending video, sending and posting pictures, using social media, online banking, getting directions and internet access. Table 7 summarizes the status of students' use of computers in terms of performing selected computing tasks.

Table 6. Extent of Use of Computers in Performing some Computing Tasks

STUDENTS	TASKS	Never	Once a Year	Once a Month	Once a Week	Daily
BS CpE	Send or receive email	20%		30%	30%	
	Play music		30%		30%	40%
	Download an application	10%		40%	30%	20%
	Record a video	20%			80%	
	Access the internet for academic purposes			10%	50%	40%
	Watch a video	20%		10%		**70 %**
	Send a photo of video to someone	10%	20%		50%	20%
	Post a photo or video online	20%	10%	10%	40%	20%
	Access a social networking site	30%		60%		10%
	Check your bank account or do online banking	**80%**		20%		
	Participate in video chat or call	30%		30%	30%	10%
	Get directions, recommendations or other information based on your present location	50%	10%	30%	10%	
BSCS	Send or receive email	10%	10%	10%	30%	40%
	Play music	10%	10%			**80 %**
	Download an application				30%	70%
	Record a video	20%		10%	50%	20%
	Access the internet for academic purposes	20%			60%	20%
	Watch a video	10%			70%	20%
	Send a photo of video to someone			30%	50%	20%
	Post a photo or video online	10%	10%		40%	40%
	Access a social networking site	10%			90%	
	Check your bank account or do online banking	**60%**	20%		20%	
	Participate in video chat or call	10%	10%	10%	70%	
	Get directions, recommendations or other information based on your present location	20%		70%	10%	
BSIT	Send or receive email	30%		10%		60%
	Play music				20%	**80 %**
	Download an application			30%	50%	20%
	Record a video			10%	30%	60%
	Access the internet for academic purposes		20%	30%	50%	
	Watch a video			10%	50%	60%
	Send a photo of video to someone	30%	10%		60%	
	Post a photo or video online				40%	60%
	Access a social networking site			10%	20%	70%
	Check your bank account or do online banking	**90%**	10%			
	Participate in video chat or call	30%	30%	20%	10%	10%
	Get directions, recommendations or other information based on your present location	30%	10%	30%	30%	
ACT	Send or receive email	10%	20%	10%	50%	10%
	Play music				20%	**80 %**
	Download an application	10%		10%	50%	30%
	Record a video	30%		30%	20%	20%
	Access the internet for academic purposes				60%	40%
	Watch a video			10%	20%	70%
	Send a photo of video to someone	20%			60%	20%
	Post a photo or video online	20%		50%	30%	20%
	Access a social networking site	10%		30%	30%	30%
	Check your bank account or do online banking	**70%**		20%	10%	
	Participate in video chat or call	20%		20%	20%	20%
	Get directions, recommendations or other information based on your present location	30%		30%	10%	30%

Moreover, the table identified the computing tasks that still has to be explored by the students. Generally, these tasks are internet services applications which means that there are still some students who are not familiar with the use of internet. OF all these tasks, online banking is the least task performed by the students. Computing tasks were group ranked so as to indicate which task requires the instructional supplement for the University. The ranking are as follows: (1) sending or receiving emails, online banking, participate in video chat or call and getting directions; (2) recording a video; sending a photo or video; posting photo or video; and using social networking site; (3) playing music; downloading application; and watching a video. (4) Accessing the internet.

Computing tasks identified evaluated the condition of our computer students in their pursuit to become a computing professional. Results revealed that there is a gap on access to digital resources. Among the four group of students, the BSIT has a better access to computers and internet, followed by BSCS, BSCpE and finally the ACT students. These results will help academic administrators deliver appropriate course content particularly on basic computing fundamentals. Activities should strengthen the development of the knowledge and skills on these areas appropriate to computing students. As Morris (2011) provided bridging digital divide requires giving students the same learning opportunities as their peers.

Table 7. Summary of Computing Tasks where some students have not yet performed.

TASKS	STUDENTS				GROUPRANK
	CpE	CS	IT	ACT	
Send or receive email	X	X	X	X	1
Play music		X		X	3
Download an application	X			X	3
Record a video	X	X		X	2
Access the internet		X			4
Watch a video	X	X			3
Send a photo of video to someone	X		X	X	2
Post a photo or video online	X	X		X	2
Access a social networking site	X	X		X	2
Check your bank account or do online banking	X	X	X	X	1
Participate in video chat or call	X	X	X	X	1
Get directions, recommendations or other information based on your present location	X	X	X	X	1

Access and use of technology if not available at home is supposedly provided at school. Table 8 presents the available resources in their respective colleges as perceived by the student respondents. Responses on telephone were not included since at present this service is no available for the whole university. Computer laboratory is available in all colleges, with desktop computers. Laptop computers are not available for other computers.Computing software are tools to run the hardware, as reported all platforms run on windows environment. CS and IT students also reported that non-windows operating system are also installed in the computers of their college. Application software are also available, except for desktop publishing which CpE and ACS students claimed that they do not have the software installed in their computers. Only the CpE students reported that they are using application software on networking, this claim is attributed to the nature of their program focus.

Table 8. IT Resources available for use by student in their College as Reported by Student-Respondents

COURSE	STUDENTS			
	BSCpE	BSCS	BSIT	ACS
Desktop computer	Yes	Yes	Yes	Yes
Computer laboratory	Yes	Yes	Yes	Yes
Networked laboratory facility	Yes	Yes	Yes	No
Laptop Computer	No	No	No	No
Internet connection	No	Yes	Yes	No
Printer	No	Yes	Yes	No
Computer Software				
Operating System				
• Windows	Yes	Yes	Yes	Yes
• Non-windows	No	Yes	Yes	No
Application Software				
• Office	Yes	Yes	Yes	Yes
• Programming Tools	Yes	Yes	Yes	Yes
• Desktop Publishing	No	Yes	Yes	No
• Networking Application	Yes	No	No	-

Tables 9 and 10 describe students' experience on the use of computers in their academic activities both for computer and non-computer courses respectively.

Table 9. Extent of use of computers and internet on computer courses.

TASKS	WEIGHTED MEAN			
	ACT	CpE	CS	IT
I am required to use digital tools and resources for instructional purposes.	2.0	4.0	4.7	4.4
I am encouraged to use the digital tools and resources in school to increase my own creativity and thinking.	3.0	3.9	5.0	4.6
I have been taught the correct and careful use of digital resources and know the consequences if I don't use them, correctly.	3.3	4.1	4.3	4.6
I use digital tools and resources at school mostly to increase my understanding of a subject or to improve computing skills.	4.0	4.0	4.9	4.6
I am encouraged to use digital tools to access internet and other academic works.	2.7	4.0	5.0	5.0
I am encouraged to use different media and formats to communicate with teachers, parents, and peers.	3.0	3.0	4.7	4.7
OVERALL MEAN	**3.0**	**3.8**	**4.8**	**4.7**

Results revealed that students from ACS are not encouraged to use digital resources on instruction and other academic activities and that use of computers is focused on understanding the subject matter. These results may be attributed to the non-availability of computing facilities for their use in their college. These experiences also manifest among the CpE students, where students indicated that they too are not encouraged to use digital tools to facilitate learning the skills. Again, this may be attributed to the inadequacies of the computing resources for their use. CS and IT students have a higher rating in terms of encouraging if not requiring digital tools to facilitate classroom learning. The findings were echoed for general education courses.

Table 10. Extent of use of computers and internet on General Education Courses.

TASKS	WEIGHTED MEAN			
	ACT	CpE	CS	IT
I am required to use a digital tools and resources for instructional purposes.	2.1	2.1	4.2	4.0
I am encouraged to use the digital tools and resources in school to increase my own creativity and thinking.	2.9	2.2	4.1	4.3
I have been taught the correct and careful use of digital resources and know the consequences if I don't use them, correctly.	2.1	3.1	4.1	4.8

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I use digital tools and resources at school mostly to increase my understanding of a subject or to improve computing skills.	1.7	3.1	4.1	4.8
I am encouraged to use digital tools to access internet and other academic works.	3.0	3.7	4.2	4.8
I am encouraged to use different media and formats to communicate with teachers, parents, and peers.	3.0	3.0	4.1	4.5
OVERALL MEAN	**2.5**	**2.9**	**4.1**	**4.5**

V. CONCLUSIONS

From the results obtained, the following conclusions are forwarded:

1. Generally, all students owned electronic gadgets. Moreover, BSCS students has the highest percentage of ownership of gadgets, followed by BSIT students, then BSCpE and ACT students. The most common gadgets owned by the students are cellphone, laptop computers and ebook readers. The least popular gadget is desktop computer indicating that the students now preferred to use laptop over desktop computers.

   Internet access is common to all student-participants, however (20%) of students have not yet accessed the internet. Internet services is commonly accessed using their cell phones (100%). On Internet connection ownership only 10% of BSCpE and BSCS students claimed that internet is available at home having the rest no internet connection. Likewise, this facility is also not available at school except for BSCS and BSIT students who declared that they can access internet in their college.

   On computer utilization, BSIT students ranked first, with the other group of students followed. Computing tasks identified on computer use and access were group ranked: (1) sending or receiving emails, online banking, participate in video chat or call and getting directions; (2) recording a video; sending a photo or video; posting photo or video; and using social networking site; (3) playing music; downloading application; and watching a video. (4) accessing the internet.

   Results revealed that there is a gap on access to digital resources. Among the four group of students, the BSIT has a better access to computers and internet, followed by BSCS, BSCpE and finally the ACT students.

2. Computer laboratory is available in all colleges, with desktop computers and printers. Laptop computers though are not available. Computing software are tools to run the hardware, as reported all platforms run on windows environment. CS and IT students also reported that non-windows operating system are also installed in the computers of their college. Application softwares are also available, except for desktop publishing which CpE and ACS students claimed that they do not have the software installed in their computers. Only the CpE students reported that they are, this claim is attributed to the nature of their program focus.

RECOMMENDATIONS

The results showed that there is digital divide among group of respondents in terms of computing knowledge, equal access and opportunity to computing resources.

Therefore:

1. Provide supplemental discussion and activities to develop other computing skills of the students, particularly internet technology and the services/application software available. Classroom discussion must be complemented with actual learning experience.
2. The University may consider providing equal access and opportunity to computing resources by establishing laboratory facilities equipped with adequate computers and other digital tools to increase computing knowledge, awareness and skills and further narrowing the gap that exists among students pursuing computer education particularly on basic computing knowledge expected from a student/graduate of computer education program.

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