Network Infrastructure for a Ubiquitous Computing Learning Environment of Cebu Technological University-Argao Campus

Eingilbert C. Benolirao
Cebu Technological University-Argao Campus

ABSTRACT

A campus network infrastructure is a collection of interconnected Local Area Network (LAN) which includes Wireless LAN (WLAN). Hence, this study was aimed to assess the network infrastructure and the ubiquitous computing activities of the faculty and students. The qualitative and quantitative methods were used and analysed using descriptive statistics. It came up with the findings that the campus network infrastructure has internet connection with twelve Wi-Fi Access Points where computers in laboratories and offices were connected. Most of the respondents have owned their mobile computing devices and have used the internet. The faculty members have accessed the internet in the offices and considered themselves as advanced users. However, the students have accessed the internet in the classrooms and computer laboratories and considered themselves as intermediate users. The most persistent problems encountered by the users in the use of the internet were the slow internet speed and the long period of time to view/download pages as well their difficulty in finding relevant information, including the overload of information on the internet and the privacy problem. The respondents' internet use variable is related to their internet skills. Upgrading the ISP internet bandwidth, a BYOD Program and training sessions were recommended.

Keywords: Campus Network Infrastructure, Local Area Network, Ubiquitous Computing, qualitative and quantitative methods, Argao, Cebu

INTRODUCTION

In a typical university campus computer network, a number of components, such as mainframe computers, computer workstations, PC's, user terminals, printers, etc. are connected together. Various devices such as network switches, routers, hubs, etc., are used to interconnect and network these computers and peripherals. In terms of user needs in the network, a network is a communication system which allows application programs on different hosts or PCs to work together (Panko, 2009). Geographical constraints dictate the division of such internetworks into smaller parts or groups of nodes, where each group makes up what is called a LAN or a Local Area Network. Thus, we can define a campus network as a collection of interconnected LANs which also includes the Wireless Local Area Network (WLAN) for wireless network services. In 1990s, there is a popular saying: Network is PC. Now, it seems it is not exaggerating to say: Mobile Phone is PC. Many people directly use phone to access Internet (Luvi and Zheng, 2005). A network isn't defined by its media, rather a network is defined by the services

and access resources it provides its users (Price, 2007).

Many of today's classroom experiences can be replicated using a network that supports sending video segments to any location one way, including today's Internet. Although the Internet will become the most cost-effective way to deliver this type of content for learning, the real power of the new technology lies well beyond mimicking television (Barone and Luker, 1999).

Ubiquitous computing is found to have three principle dimensions: technology – the sophistication of the technology and infrastructure deployed; policy-the degree of deployment across the university; and pedagogy-the influence and impact on teaching methods (Professor Ted Smith, 2003).

Because of the fourfold functions of the University, which are instruction, research, extension and production, it is the University's aim to further improve and intensify its functions through the establishment and effective use of an improved Computer Local Area Network (LAN) Infrastructure to effectively carry-out its mandate and to meet the current demands of a fast-developing society. Computers on the Campus are brimming over with gigabytes of data, millions of images, music of every genre, streaming videos, online blogs and forum, social networking sites, communications and chats, papers, theses, spreadsheets, great novels and, of course, mountains of e-mail messages. As more CTU - Argao educators, students and researchers tap into the campus wired and wireless computer network for their work, the strain on existing resources begins to affect everyone who uses the network. Networks connect people, and they provide the mechanism for archiving and sharing an ever-increasing amount of data, information and knowledge. There is a need to add more capacity to reliable networks to keep ahead of demand. The MIS – ICT Department at CTU - Argao Campus began designing a new network infrastructure to overhaul the existing 10-year-old system and install a more adaptable solution to support research, teaching, learning and administration with free-flowing data and limited bottlenecks.

Computer and Information Technology use appears to have a general salutary influence on the overall learning environment (Kuh and Hu, 2001). In order to support mobile computing research, including the access to online technology which is the internet, a wireless local area network infrastructure is being built at Cebu Technological University – Argao Campus including its Oslob Extension Campus. This infrastructure can allow researchers and other members of the campus community to use mobile computers like laptops and other mobile gadgets to gain access to data and online networks using the different access points or hot spots designed for free internet access while they are in the campus. For many students, wireless technology has become part of their lives. They depend on it for entertainment, social interaction (social networking), information and for a myriad of purposes.

In the context of Cebu Technological University – Argao Campus, the MIS – ICT Department of the campus managed a network infrastructure that provides network services for those connected to the Campus' wired and wireless network. The computers in all offices of the campus are all connected to the network with internet connection and for the wireless network it provides wireless services (i.e. Hotspots and Wi-Fi Access Points). The CTU – Argao Campus

faculty and staff as well as the students can use these services to access the Internet for free when they are within the vicinity of the designated access points inside the campus and this makes it possible for them to use a variety of online technological tools when they are in the campus. Studies have shown that the usage of wireless technology can provide new learning opportunities to the learners by increasing their interest in education, providing opportunity for independent learning and allowing learners to overcome physical barriers such as distance from the source of information with ease through the use of online libraries and other online sources.

Theoretical-Conceptual Background

This study is anchored on the form of learning advocated by Mark Weiser in 1990s, the Ubiquitous Computing. Figure 1, shows the theoretical framework of the study. Ubiquitous Computing (Ubicomp) is an interaction paradigm for constructing information technologies embedded throughout our everyday work, home and school environments that are designed to fit into natural practices of humans (Weiser, Mark 1991).
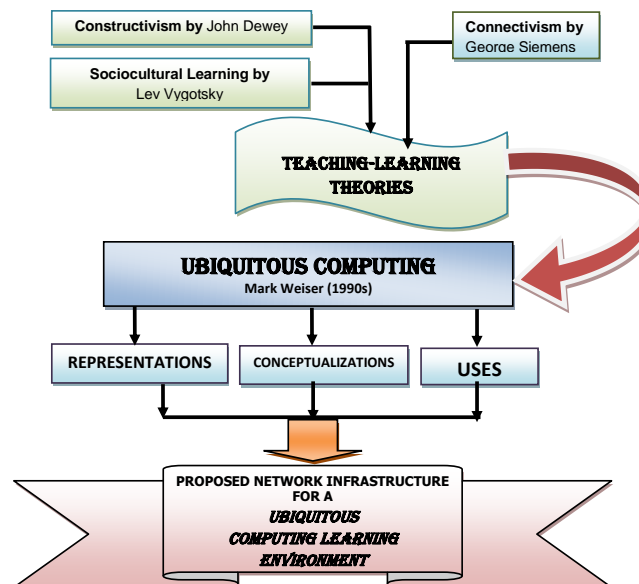

Figure 1. Theoretical-conceptual Framework of the Study

The teaching and learning theories also support the concept of Ubiquitous Computing and it was anchored on the theory of constructivism by John Dewey and Lev Vygotsky's theory of socio cultural learning. John Dewey was a constructivist theorist and Constructivists believe that people actively learn from their environment by reflecting on the experiences around them. Active learning requires the learner to continually assimilate and accommodate new information to construct knowledge. Vygotsky's theory of socio cultural learning highlights the role of social and cultural interactions play in the learning process. It is called a social constructivist theory because in Vygotsky's opinion the learner must be engaged in the learning process. Another theory in which the study on ubiquitous computing is anchored is the theory of connectivism by

George Seimens. According to Seimens, the pipe is more important than the content within the pipe. Our ability to learn what we need for tomorrow is more important than what we know today. When knowledge, however, is needed, but not known, the ability to plug into sources to meet the requirements becomes a vital skill. As knowledge continues to grow and evolve, access to what is needed is more important than what the learner currently possesses. Connectivism provides insight into learning skills and tasks needed for learners to flourish in a digital era (Siemens, 2004).

Ubiquitous computing seems to particularly impact learning processes through its effects in three broad areas: 1.) Ubiquitous computing makes a wide variety of **"representations"** of knowledge available to support learning. 2.) Ubiquitous computing provides unique supports for individuals' internal construction of knowledge, referring to the term **"conceptualizations"**. 3.) Ubiquitous computing changes the nature of social interactions and the shared **"uses"** of knowledge in classrooms, and so affects the social construction of knowledge within them.

Ubiquitous access to digital technologies changes what is pedagogically possible in at least three ways. First, ubiquitous access to the Internet and telecommunications technologies changes classrooms into places with access to abundant resources and rich connections to the world. Internet and broadband communications networks has been identified as one of the technological innovations which have already changed what is pedagogically possible (McClintock, Robbie 1999). Second, ubiquitous access to a variety of digital devices and multimedia tools makes it possible to create, analyze, synthesize and communicate knowledge using a rich variety of media forms. Third, ubiquitous access to digital tools that automate lower level skills allows students to concentrate on higher level thinking, and lessens the skill levels needed to explore a range of complex topics.

Thus, the study was conducted to assess the use of the existing Local Area Network (LAN) Infrastructure as an important technology for the ubiquitous access to internet for a ubiquitous computing learning environment of Cebu Technological University – Argao Campus and its Oslob Extension Campus. The findings served as basis for a Network Infrastructure Development Plan Proposal to improve the University Campus' Computer Network Infrastructure and its services.

MATERIALS AND METHODS

This research used the descriptive survey method in gathering the data. This involved administering the researcher-made survey questionnaires to the respondents, treating the data, analyze it and formulate a development plan proposal to improve the University Campus' Computer Local Area Network (LAN) Infrastructure and its services for a Ubiquitous Computing Learning Environment. The universal sampling procedure was used since the researcher conducted the study in the BSIT major in Computer Technology and BSICT departments of Cebu Technological University – Argao Campus and its Oslob Extension Campus (Figure 2).

Figure 2. Spot Map of Argao, Cebu and Oslob, Cebu

Respondents of this study were the Computer Technology and BSICT students and faculty in the said courses of Cebu Technological University – Argao Campus and its extension campus in Oslob, Cebu (Table 1). Specifically, these students were the 1st, 2nd year and 3rd year students of Computer Technology and BSICT courses of the said campuses. These students respondent group were purposely identified as respondents since they have the most number of hours in their major and shop subjects to have computer and ICT-related learning experiences. The fourth year were not included as respondents since they are in the OJT phase of the program and they were not currently in the campus because they were in the establishments, companies, and agencies for their 1,800 hours on- the- job training. On the other hand, the faculty members of these courses were also being the faculty respondent group.

Table 1. Distribution of the Respondents

Computer Technology and BSICT Students	N	%
Argao Campus:		
CompTech BSIT-1D	36	9.84
CompTech BSIT-1E	39	10.66
CompTech BSIT-1H	38	10.38
CompTech BSIT-2D	36	9.84
CompTech BSIT-3D	34	9.29
CompTech BSIT-3E	26	7.10
BSICT-1	34	9.29
BSICT-2	36	9.84
BSICT-3A	34	9.29

BSICT-3B	17	4.64
Oslob Extension Campus:		
CompTech **BSIT-1**	**36**	**9.84**
Total	**366**	**100.00**
BSIT-Computer Technology and BSICT Instructors		
Male	7	87.50
Female	1	12.50
Total	8	100.00

The researcher used the researcher-made questionnaires in gathering the data from the faculty members and students of Cebu Technological University – Argao Campus and its Oslob Extension Campus. These questionnaires were validated from distinct research mentors. After the problem was finalized, the data was gathered and it was done first by asking permission from the Campus Director. With the aid of the letter of request, the researcher was granted to conduct the survey in all departments of the said campus. The research questionnaires were distributed to the identified respondents. After having been accomplished, they were retrieved and collated. The responses were tallied and interpreted to get the raw data which were treated statistically to generate quantitative and qualitative data.

RESULTS AND DISCUSSION

Status of the Campus' Wired and Wireless Local Area Network (LAN) Infrastructure

The number of computers in the campus wired and wireless network infrastructure revealed the total number of computers status as to: connected to the wired network; connected to the internet; and networked and installed in computer labs and training centers as shown in Table 2.

Table 2. No. of computers in the Wired Network Connections

Category	Quantity
connected in a wired network	**150**
connected to the Internet	**150**
networked and installed in computer laboratories	**94**

The data confirmed that because there were more computers being used to support the whole institution and were specifically placed in offices, the number of computers connected in a network and internet is way greater than the number of computers networked and installed in computer laboratories.

Number of available Wi-Fi Access Points

The Wi-Fi access points were the internet hot spots located in the designated offices

and/or instructional rooms inside the campus for wireless internet connection to the users.

There were currently twelve (12) running Wi-Fi access points that served the faculty, staff and students in the university and are strategically located in various locations (Table 3). Under RA 9744, converting the institution into a state university highly anchored on technology, it is expected for the institution to be more advanced with technology of which having an internet connection is one, a clear reason why currently there are more than ten (10) Wi-Fi Access Points in the university campus.

Table 3. Number of Available Wi-Fi Access Points

Location	Quantity
Academic Office	1
E-Research Office	1
Library	1
ICT Training Center	1
Technology Office	1
Production and Extension Office	1
Administration Office	1
Student Affairs Office	1
Agri-Forestry Office	1
Hospitality Management Office	1
IT Center	1
Electronic and Electricity Shop	1
Total	**12**

Ownership of ICT and/or Mobile Computing Devices by the Faculty and students

As shown in Table 4, all the ICT devices, both faculty and student respondents highly owned desktop PC. This is supported by the study of (Wood and Howley, 2012) which states that "Computers are now a ubiquitous part of US elementary school education. This implied also that at present, many of the faculty and students in the Computer Technology and Information and Communication Technology courses have laptops and even smartphones which are vital tools in doing research and acquiring new knowledge.

Table 4. Ownership of ICT and/or Mobile Computing Devices

ICT DEVICES	Desktop PC		4	
	Laptop	2	25	84
Desktop PC	4	50	160	41
Laptop	2	25	84	21
Netbook	2	25	41	10
Smartphone	-	-	80	20
Game consoles	-	-	14	3.6
Ultra-mobile Personal Computers	1	12.5	8	2.1
portable media players	1	12.5	41	10
Other Devices	-	-	28	7.2

Level of Usage of the Internet

The level of usage of the internet covered three areas which were determined as to: 1. the frequency of the respondents in using the internet services for instructional purposes (e.g. for lessons); 2. The frequency of the respondents to use the internet services for educational development purposes (e.g. to locate information); and 3. The frequency of the respondents to use the internet services for personal purposes (e.g. communication and entertainment).

As shown in Table 5, he table showed the faculty members who used the internet services for instructional purposes. This implied that browsing the internet to view documents for information is the most often ubiquitous computing and access to information activity by faculty members for research and other instruction related activities. This is also supported by the study of (Long and Long, 1998) which indicated that the internet can be accessed by people in organizations with established links to the Internet and by individuals with PCs.

Table 5. Faculty's Level of Perceived Internet Use for Instructional Purposes

Internet Services (for Instructional Purposes)	WM	Description
1. Electronic-mail (e-mail)	3.25	Sometimes
2. Online videos (youtube, etc.)	3.13	Sometimes
3. Browsers to view documents like pdf, docs, html, etc.)	4.00	Often
4. Online News	3.00	Sometimes
5. Social Network (facebook, twitter, etc.)	2.89	Sometimes
6. Instant Messaging with text, voice, and video Chat: (Messenger, skype, etc.)	2.38	Rarely
Average Weighted Mean	**3.12**	**Sometimes**

Table 6 shows how often the faculty members used the internet services for professional and educational development purposes. Overall, the level of usage of the internet services for professional and educational development was described as used **sometimes.** This again implied that browsing the internet for access to information as well as viewing online videos and emailing are the most often ubiquitous computing activities by faculty members for research and other professional and educational development related information.

Table 6. Faculty's Level of Perceived Internet Use for Professional and Educational Development

Internet Services (for Professional and Educational Development Purposes)	WM	Description
1. Electronic-mail (yahoomail, gmail,etc.)	3.63	Often
2. Online videos (youtube, etc.)	3.63	Often
3. Browsers to view documents like pdf, docs, html, etc.)	3.88	Often
4. Online News	3.25	Sometimes
5. Social Network (facebook, twitter, etc.)	2.75	Sometimes
6. Instant Messaging with text, voice, and video Chat: (Messenger, skype, etc.)	2.50	Rarely
Average Weighted Mean	**3.27**	**Sometimes**

As shown in Table 7 result revealed the frequency of the faculty members in using the internet services for personal purposes. Only the electronic mail was used **often** by the faculty members for personal purposes. Overall, these internet services were used **sometimes** by the faculty members for personal purposes. This also implies that e-mail is most often the most ubiquitous activity which is mostly for personal purpose in which personal information and other personal data are kept and stored.

Table 7. Faculty's Level of Perceived Internet Usage for Personal Purposes

Internet Services (for Personal Purposes)	WM	Description
1. Electronic-mail (yahoomail, gmail, etc.)	3.50	Often
2. Online videos (youtube, etc.)	3.25	Sometimes
3. Browsers to view documents like pdf, docs, html, etc.)	3.25	Sometimes
4. Online News	3.13	Sometimes
5. Social Network (facebook, twitter, etc.)	3.13	Sometimes
6. Instant Messaging with text, voice, and video Chat: (Messenger, skype, etc.)	2.75	Sometimes
Average Weighted Mean	**3.17**	**Sometimes**

Table 8 shows how often the students used the internet services for instructional purposes. Overall, these internet services were used by the students **sometimes** for instructional purposes (e.g. for their lessons). This implied that the access to social networking sites, e-mail, online videos, and using the internet browsers to view documents for research and other instruction related purposes were the ubiquitous access to internet of the students.

Table 8. Student's Level of Perceived Internet Use for Instructional Purposes

Internet Services (for Instructional Purposes)	WM	Description
1. Electronic-mail (yahoomail, gmail, etc.)	2.821	Sometimes
2. Online videos (youtube, etc.)	2.632	Sometimes
3. Browsers to view documents like pdf, docs, html, etc.)	2.941	Sometimes
4. Online News	2.23	Rarely
5. Social Network (facebook, twitter, etc.)	2.713	Sometimes
6. Instant Messaging with text, voice, and video Chat: (Messenger, skype, etc.)	2.601	Rarely
Average Weighted Mean	**2.653**	**Sometimes**

As reflected in Table 9, result shows how often the students used the internet services for professional and educational purposes such as locating information. Overall, these internet services were generally described by the students as used **sometimes** for professional and educational purposes. This implied that the access to social networking sites, e-mail, online videos, and using the internet browsers to view documents for locating information as part of

their professional and educational development were the ubiquitous access to internet of the students.

Table 9. Student's Level of Perceived Internet Use for Professional and Educational Development

Internet Services (for Professional and Educational Development Purposes)	WM	Description
1. Electronic-mail (yahoomail, gmail, etc.)	2.887	Sometimes
2. Online videos (youtube, etc.)	2.629	Sometimes
3. Browsers to view documents like pdf, docs, html, etc.)	3.01	Sometimes
4. Online News	2.349	Rarely
5. Social Network (facebook, twitter, etc.)	3.151	Sometimes
6. Instant Messaging with text, voice, and video Chat: (Messenger, skype, etc.)	2.307	Rarely
Average Weighted Mean	**2.724**	**Sometimes**

Table 10.Student's Level of Perceived Internet Use for Personal Purposes

Internet Services (for Personal Purposes)	WM	Description
1. Electronic-mail (yahoomail, gmail, etc.)	2.875	Sometimes
2. Online videos (youtube, etc.)	2.762	Sometimes
3. Browsers to view documents like pdf, docs, html, etc.)	2.722	Sometimes
4. Online News	2.414	Rarely
5. Social Network (facebook, twitter, etc.)	3.459	Often
6. Instant Messaging with text, voice, and video Chat: (Messenger, skype, etc.)	2.573	Rarely
Average Weighted Mean	**2.801**	**Sometimes**

Table 10 shows how often the students used the internet services for personal purposes such as in communication or entertainment. Only the social network was described by them as used **often**. This would mean that for their personal uses, they **often** use the social networking sites. However, the electronic mail, online videos, and browsers to view documents were used **sometimes** and the online news and instant messaging were used **rarely**. And overall, these internet services were generally described by the students as used **sometimes** for personal purposes. This implies that the most ubiquitous access to the internet for personal purposes is the use of the social networking sites for communication and other personal information related data.

Place of Access to the Internet

This part of the perceptions of the respondents has determined as to what places the respondents often have access to the internet (Table 11). Overall, the faculty members described to have access in the different places **sometimes.** This implied that faculty members have often

accessed in the internet and have more time accessing it and having ubiquity in internet access in their offices and faculty rooms and accessed sometimes in their classrooms, computer labs and even in their home. This is also supported by the study of (Wiesenmayer and Koul, 1999) which indicated that "classroom access, instructional experience of using Internet with students, availability of resource support and number of teacher users at school are the best predictors of teacher's Level of Use".

Table 11. Faculty Member's Place of Access to the Internet

A. How often do you have access to the internet at these places?	WM	Description
1. in your home	3.38	Sometimes
2. in your office	3.50	Often
3. in the classroom	3.13	Sometimes
4. in computer lab	3.38	Sometimes
5. in the internet cafe	2.25	Rarely
Average Weighted Mean	**3.13**	**Sometimes**

Table 12 shows that students have their access to the internet **sometimes** in the following places: in the classroom, in the computer lab, and in the internet cafes. However, the students described to have access to the internet **rarely** in their homes, and **never** have access in offices since they don't have offices yet. Overall, the students described to have **rarely** access to the different places. This implied that students have more time accessing the internet and having ubiquity in computing in their classrooms, computer laboratories and in the internet cafes since they are in school most of the time daily and weekly.

Table 12. Student's Place of Access to the Internet

A. How often do you have access to the internet at these places?	WM	Description
1. in your home	2.242	Rarely
2. in your office	1.358	Never
3. in the classroom	2.654	Sometimes
4. in computer lab	3.084	Sometimes
5. in the internet cafe	2.928	Sometimes
Average Weighted Mean	**2.453**	**Rarely**

Level of Expertise in Internet Use

Table 13 revealed that the faculty member's perceived level of expertise in the use of the internet. It showed the faculty member's level of internet skills in the following applications namely: receive and send emails, browse the world wide web, use the remote login, create a webpage on the web, use search engines, Upload/download file to/from internet, participate in on-line chat rooms, Instant Messaging with text, voice, and video Chat, participate in online forums, Logged on to Social Networking sites, and Use online educational software like LMS or e-

learning. The faculty members were described as **expert** only in the use of search engines such as google, yahoo, etc. On the other hand, they were described to be **advanced** users in the following applications namely: browse the world wide web, Upload/download file to/from internet, participate in on-line chat rooms, Instant Messaging with text, voice, and video Chat, Logged on to Social Networking sites, and the Use of online educational software (e-learning programs, LMS, etc.). However, they were **intermediate** users in the Use of remote login, Create a webpage on the web, and participate in online forums. But overall, the faculties were described to be **advanced** users in the use of the internet. This is supported by the study of (Bhatti, 2010) entitled: "Internet use among faculty members in the changing higher education environment at the Islamia University of Bahawalpur, Pakistan" which showed that Internet has radical impact on the changing higher education environment. It is interesting that Internet use among faculty members is much higher than expected and it is broadly used for teaching and research purposes. And they are making most use of the internet facility and showed an increased interest into internet resources. This is also supported by another study by (Thanuskodi, 2011) entitled: "Internet use among the faculty members and the students in the Professional Colleges at Tirunelveli Region: an analytical study" in which the study reveals that more than one third of the respondents (37.23%) acquired their internet skill through training from the college. The Internet facility has enabled the teachers and students to enhance their academic excellence by providing them the latest information and access to worldwide information.

Table 13. Faculty Member's Perceived Level of Internet Skills

Internet skills	WM	Description
1.Receive and send-email (email with attachments)	4.25	Expert
2. Browse the World wide Web (WWW)	4.13	Advanced
3. Use remote login (TELNET)	2.88	Intermediate
4. Create a webpage on the web (WWW)	3.00	Intermediate
5. Use search engine (yahoo, Google, etc.)	4.25	Expert
6. Upload/download file to/from internet	4.00	Advanced
7. participate in on-line chat rooms	3.88	Advanced
8. Instant Messaging with text, voice, and video Chat: (Messenger, skype, etc.)	3.63	Advanced
9. participate in online forums	3.13	Intermediate
10. Logged on to Social Networking sites (Facebook, twitter, etc.)	4.00	Advanced
11. Use online educational software (e-learning programs, LMS, etc.)	3.88	Advanced
Average Weighted Mean	**3.73**	**Advanced**

Table 14 shows the students' level of internet skills in the following applications namely: receive and send emails, browse the world wide web, use the remote login, create a webpage on the web, use search engines, Upload/download file to/from internet, participate in on-line chat rooms, Instant Messaging with text, voice, and video Chat, participate in online forums, Logged on to Social Networking sites, and Use online educational software like LMS or e-learning. The students were not expert in any of the applications but they were advanced users in the applications namely: Receive and send email (email with attachments), Browse the World wide Web (WWW), Use search engine (yahoo, Google, etc.), Upload/download file to/from internet, and Logged on to Social Networking sites (Facebook, twitter, etc.). On the other hand, they were

intermediate users in participating in on-line chat rooms, Instant Messaging with text, voice, and video Chat: (Messenger, skype, etc.), and the Use of online educational software (e-learning programs, LMS, etc.). They were beginners in the use of remote login, create a webpage on the web, and participate in online forums. Overall, they were generally described as intermediate users in the use of the internet in terms of their skills in the different applications. All these were supported by the study of (Cleary et al, 2006) entitled: "Closing the digital divide: understanding racial, ethnic, social class, gender and geographic disparities in Internet use among school age children in the United States" in which the analysis found that a broad range of demographic, geographic and economic factors significantly influence Internet use among children.

Table 14. Student's Perceived Level of Internet Skills

Internet skills	WM	Description
1. Receive and send email (email with attachments)	3.504	Advanced
2. Browse the World wide Web (WWW)	3.509	Advanced
3. Use remote login (TELNET)	1.923	Beginner
4. Create a webpage on the web (WWW)	2.193	Beginner
5. Use search engine (yahoo, Google, etc.)	3.694	Advanced
6. Upload/download file to/from internet	3.41	Advanced
7. participate in on-line chat rooms	2.736	Intermediate
8. Instant Messaging with text, voice, and video Chat: (Messenger, skype, etc.)	2.687	Intermediate
9. participate in online forums	2.407	Beginner
10. Logged on to Social Networking sites (Facebook, twitter, etc.)	3.681	Advanced
11. Use online educational software (e-learning programs, LMS, etc.)	2.859	Intermediate
AVERAGE WEIGHTED MEAN	**2.969**	**Intermediate**

Table 14 shows the students' level of internet skills in the following applications namely: receive and send emails, browse the world wide web, use the remote login, create a webpage on the web, use search engines, Upload/download file to/from internet, participate in on-line chat rooms, Instant Messaging with text, voice, and video Chat, participate in online forums, Logged on to Social Networking sites, and Use online educational software like LMS or e-learning. The students were not expert in any of the applications but they were advanced users in the applications namely: Receive and send email (email with attachments), Browse the World wide Web (WWW), Use search engine (yahoo, Google, etc.), Upload/download file to/from internet, and Logged on to Social Networking sites (Facebook, twitter, etc.). On the other hand, they were intermediate users in participating in on-line chat rooms, Instant Messaging with text, voice, and video Chat: (Messenger, skype, etc.), and the Use of online educational software (e-learning programs, LMS, etc.). They were beginners in the use of remote login, create a webpage on the web, and participate in online forums. Overall, they were generally described as intermediate users in the use of the internet in terms of their skills in the different applications. All these were supported by the study of (Cleary et al, 2006) entitled: "Closing the digital divide: understanding racial, ethnic, social class, gender and geographic disparities in Internet use among school age children in the United States" in which the analysis found that a broad range of demographic, geographic and economic factors significantly influence Internet use among children.

Relationship Between the Respondents' Level of Internet Skills and Their Level of Internet Use

This part explained the relationship between the respondents' level of internet skills and their level of internet usage. This would give the chi-square value of significance which would mean significant if the computed value of t-test will be greater than tabled value of 1.98 at 0.05 level.

Table 15. Relationship between Faculty Member's Level of Internet Skills and Their Level of Internet Use

Faculty member's level of internet use for the following purposes	Faculty member's level of internet skills				
	chi-square	c	t-test	t.v.	Decision
Instructional Purposes	61.15	0.94	6.77	1.98	**Reject Ho**
Professional and Educational Development	87.39	0.96	8.10	1.98	**Reject Ho**
Personal purposes	69.47	0.95	7.22	1.98	**Reject Ho**

Results in Table 15 shows that the faculty members' level of internet skills and their level of internet use were significantly correlated in its item as to how often the faculty members use the internet services for instructional use (e.g. for their lessons). On the other hand the faculty members' level of internet skills and their level of internet use were significantly correlated in the item as to how often do the faculty members use the internet services for professional and educational development (e.g. to locate information). This means that the faculty members' level of internet skills and their level of internet use were significantly correlated in the item as to how often do the faculty members use the following internet services for personal purposes (e.g. communication or entertainment). This is supported by the study of (Igun,2005) which showed that the respondents rated their internet skills between average and very high and claimed that they have acquired these skills either online or through teaching by colleagues or friends, and continuing education and self-study were the most preferred ways to acquire new skills.

The students' level of internet skills and their level of internet use were significantly correlated in its item as to how often the students use the internet services for instructional use (e.g. for the lessons). Moreover, the students' level of internet skills and their level of internet use were significantly correlated in the item as to how often do the students use the internet services for professional and educational development (e.g. to locate information In same way the students' level of internet skills and their level of internet use were significantly correlated in the item as to how often do the students use the following internet services for personal purposes (e.g. communication or entertainment). This is supported by the study of (Luambano and Nawe, 2004) which revealed that the students who had access to the Internet were not using it effectively. They used it mainly for communication with friends and relatives more than for academic purposes. The cause of this was found to be lack of skills required for effective use of the internet. This is also supported by the study of (Galapon and Pardo, 2010) which concluded that the respondents' skills in personal computer operations are significantly influenced by their

knowledge in personal computer operations, the higher the knowledge of the respondents in the personal computer operations, the more competent they are in the use of those applications.

Table 16. Relationship between Student's Level of Internet Skills and Their Level of Internet Use

Students' level of internet use for the following purposes	students' level of internet skills				
	chi-square	c	t-test	t.v.	Decision
Instructional Purposes	613.73	0.79	24.66	1.98	Reject Ho
Professional and Educational Development	699.95	0.81	25.72	1.98	Reject Ho
Personal purposes	585.03	0.78	24.30	1.98	Reject Ho

Significant at 0.05 level > 1.98

Problems Encountered While Using the Internet

Table 17 reflects ranking of the problems encountered by the respondents while using the internet in which the faculty respondent group identified two (2) problems which include: 1) "slow access speed" and the, 2) "it takes too long to view/download pages". The rest of the problems namely: "Difficulty in finding relevant information", "Overload of information on the Internet", and the "Privacy problem" were considered by them as secondary problems. On the other hand, the students' respondent group ranked accordingly the identified problems. The "Slow access speed" ranked number one for them, this was followed by the "it takes too long to view/download pages" as the second, the "Overload of information on the Internet" was third, then followed by the "Difficulty in finding relevant information" as fourth, and the "Privacy problem" in the fifth place as the least persistent problem encountered. This is supported by the study of (Husain, 2006) entitled: "Internet Use by the Faculty Members of Kuwait University" in which the findings of the study also considers the slow speed, lack of time, and lack of access from home are the major problems. Also a support is the study of (Fasae and Aladeniyi, 2012) entitled: "Internet Use by Students and Faculty of Science in Two Nigerian Universities" in which 96 percent of the respondents claimed that "Slow Access Speed" was the leading problem encountered by them.

Table 17. Problems Encountered while using the internet

PROBLEMS	Faculty			Students	
	f	%	Rank	f	%
Slow access speed	8	100	1.5	335	85.7
Difficulty in finding relevant information	2	25	4	111	28.4
Overload of information on the Internet	2	25	4	113	28.9
It takes too long to view/download pages	8	100	1.5	232	59.3
Privacy problem	2	25	4	87	22.3
Any other (Please Specify)	-	-	-	-	-

CONCLUSIONS

The existence of the new ICT devices have helped the respondents to own their ICT devices as revealed in the data of the ownership of ICT and/or Mobile Computing devices for use in their internet related and ubiquitous computing activities which have helped them to comply with their subject related projects and outputs. It was evident that the faculty as well as the students is now starting to use the e-learning applications for instruction. Thus, both the faculty and students can now use the internet for a variety of purpose such as instruction, communication, entertainment, and to locate information in the World Wide Web. There was a relationship between respondents' level of internet use with their internet skills. The ubiquitous computing in the campus has been evident since the internet has been accessible by faculty, staff and students and the emergence of the new wireless ICT and/or mobile computing devices for computer and online related applications.

RECOMMENDATIONS

Based on the findings of the study, the following are the recommendations:

1. Adopt the proposed network infrastructure development plan proposal to properly implement the ubiquitous computing learning environment of the university campus of CTU-Argao Campus including its Oslob Extension Campus.

2. The MIS-ICT Department shall propose to the Campus Director and the board of management of CTU-Argao Campus through the result of this study, a budgetary requirement for the needed upgrades of the existing network infrastructure as well as **the upgrading of the internet bandwidth** by applying for additional ISPs inside the university campus.

3. Initiate a requirement for all faculty and students in the professional development courses to acquire a prescribed laptop computer and/or other ICT device for a **BYOD** (bring your own device) Program for use throughout their academic preparation and other teaching and learning experiences.

4. A **regulation on the proper use of the internet** particularly on e-learning as well as other online applications should be implemented.

5. After the implementations of these recommendations, it is suggested that a further assessment study will be conducted to determine the impact of the ubiquitous computing learning environment as well as the assessment of the Management Information System (MIS) of CTU-Argao Campus and its Extension Campuses.

LITERATURE CITED

Ron Price, 2007. Fundamentals of wireless networking, 1st Edition. The McGraw -Hill/Irwin Companies, Inc. New York.

Larry Long & Nancy Long, 1998. Introduction to Computers & Information Systems, The internet edition, Prentice Hall Int'l. Singapore.

Raymond R. Panko, 2009. Business Data Networks and Telecommunications, Seventh Edition. Pearson Prentice Hall. United States of America.

Smith, Ted, 2003. Ubiquitous Computing in Higher Education. The Observatory on Borderless Higher Education.

Luker, Mark A. and Barone, Carole A., 2006. The Role of Advanced Networks in the Education of the Future.

Paul F. Cleary, Glenn Pierce, Eileen M. Trauth, 2006. "Closing the digital divide: understanding racial, ethnic, social class, gender and geographic disparities in Internet use among school age children in the United States". Universal Access in The Information Society - UAIS , vol. 4, no. 4, pp. 354-373.

George D. Kuh and Shouping Hu, 2001. The Relationships Between Computer and Information Technology Use, Selected Learning and Personal Development Outcomes, and Other College Experiences. Journal of College Student Development.

Hashim, Ahmad Sobri and Ahmad, Wan Fatimah Wan, 2011. A study on generic conceptual framework for customized mobile learning management system (CMLMS). Control System, Computing and Engineering (ICCSCE), IEEE International Conference

Luyi, Li et al, 2005. A CONCEPTUAL FRAMEWORK OF COMPUTER-SUPPORTED UBIQUITOUS LEARNING ENVIRONMENT.IASTED international Conference Web-based Education, Grindelwald, Switzerland.

Lawrence Wood and Aimee Howley, 2012. Dividing at an early age: the   hidden digital divide in Ohio elementary schools. Learning, Media and Technology , vol. 37, no. 1, pp. 20-39.

Paul F. Cleary, Glenn Pierce, Eileen M. Trauth, 2006. Closing the digital   divide: understanding racial, ethnic, social class, gender and geographic disparities in Internet use among school age children in the United States. Universal Access in the Information   Society - UAIS , vol. 4, no. 4, pp. 354-373.

Randall L. Wiesenmayer, Ravinder Koul, 1999. Level of Internet Use Among Science Teachers Involved in a Professional Development Project. Journal of Science Education and Technology - J SCI EDUC TECHNOL, vol. 8, no. 2, pp. 123-135.

Ireneus Luambano, Julita Nawe, 2004. Internet Use by Students of the University of Dar es Salaam. Library Hi Tech News, vol. 21, no. 10, pp. 13-17.

Fasae, Joseph Kehinde and Aladeniyi, Fasa Rachael, 2012. Internet Use by Students and Faculty of Science in Two Nigerian Universities. Library Philosophy and Practice (e-journal) Libraries at University of Nebraska-Lincoln.

Husain, Al-Ansari, 2006. Internet Use by the Faculty Members of Kuwait University. Electronic Library, Vol. 24 Iss: 6, pp. 791-803.

Bhatti, Rubina, 2010. Internet use among faculty members in the changing higher education environment at the Islamia University of Bahawalpur, Pakistan. Library Philosophy and Practice.

Igun, Stella E., 2005. Users and Internet Skills: A Report from Delta State University, Abraka, Nigeria. Electronic Journal of Academic and Special Librarianship. V.6 no.3.

Galapon and Pardo, 2010. Computer Literacy of the Second Year Teacher Education Students in the University of Northern Philippines. REDTI Journal Volume 7, pp. 73-79.

Thanuskodi, S., 2011. Internet use among the faculty members and the students in the Professional Colleges at Tirunelveli Region: an analytical study. Educational Research (ISSN: 2141-5161) Vol. 2(13) pp. 1868-1875.

Seimens, George 2004. Connectivism: A learning Theory for the Digital Age. http://www.elearnspace.org/Articles/connectivism.htm. Retrieved on October 2012.

Robbie McClintock, 1999. Renewing the Progressive Bond with Posterity through the Social Construction of Digital Learning Communities. The Educators Manifesto. http://www.ilt.columbia.edu/publications/manifesto/contents.html.

Mark Weiser, 1991. The Computer for the 21st Century: Specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence. Scientific American.