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Education in Industry 4.0: Effectiveness of Handheld Computer in Remote Learning

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Abstract:- Technologies are continuously advancing, processes are automated, and internet nowadays is a need. With this underlying facts industry 4.0 in education are inevitable, thus, this study aims to identify the effectiveness of handheld computer in remote learning education. This study used a descriptive-quantitative research design, and researcher's-made questionnaires are the main tool to gather data. Simple statistics are used to analyzed and interpret the data. Using simple random sampling a total of 341 respondents are chosen to answer in this research study. The result of the study shows that students have average knowledge on the functions of handheld computer valuable in remote learning, communications in terms of; learners to learners, learners to content; and learners to teachers were agreed to be effective when using handheld computer. Communication skills are said to be develop when using different application and internet in handheld computer. Lastly, focusing in educational task are hard for the students since they can simply access application that can distract or divert their attentions from their task.

Keywords:- *Handheld Computer, Industry 4.0, Learners, Teachers, Communications;*

I. INTRODUCTION

CELLPHONE is a wireless telephone using a system of low-powered radio transmitters, with each transmitter covering a distinct geographical area (cell), and computer equipment to switch a call from one area to another, thus enabling broad-scale portable phone service. Such a wireless telephone that has other functions, as text messaging or internet access (Thesaurus.com).

Base on the history, CELLulartele PHONE is the first ubiquitous wireless telephone. Originally analog, all cellular systems today are digital, which has enabled the cellphone to turn into a handheld personal computer (see smartphone and cellphones vs. smartphones). A cellphone is also called a "mobile," "mobile phone," "handset" or "cell."Introduced in the mid-1980s, cellphone sales exploded worldwide in the 1990s. By 2008, with three billion units in use, the cellphone became an addiction for many people, who would never leave their house without it (see nomophobia) (Your Dictionary).

Everyone is using technology, from children and teenagers to adults and elders. Technology is vital in today's world and makes everything easier. It has transformed our ways of communicating, socializing, playing, shopping and everything we do. These profound changes are placing increasing pressure on the traditional models of teaching and learning. Due to ever-increasing and diversified needs of the student's technological advancements are also taking place in the field of education every day. (Park Hyungsung). Liak (2011)

Mobile devices provide significant opportunities to help learners become more autonomous and also have the potential to change the delivery of teaching and learning in higher education. (Isil Boy and Gary Motteram, 2013). Mobile learning can both complement and conflict with the formal education processes. On the positive end, learners can extend their classroom learning activities to homework, field trips, and museum visits by reviewing teaching materials on mobile devices; and or collecting and analyzing information using handheld data probes (Park Hyungsung). Liak (2011).

Thus, those findings are the inspiration of the researchers to be able to know, certify or affirm whether the handheld computers or cellphones are evitable in the field of learning specially is times of pandemic. In fact, that is one of the goals of Education in Industry 4.0 to know the effectiveness of those technologies in advancing the education thru the used of internet and as the most common mode of communication is the handheld computer.

II. METHODOLOGY

This study used the Descriptive research designto be able to know if the learners can cope up in remote learning using cellphone as a digital tool for their education in college of Bachelor of Science in Business Administration major in Marketing Management and Bachelor of Science in Business Administration major in Entrepreneurship of Nueva Ecija University of Science and Technology. The researchers decided to use this design because according to Stangor (2011) "Descriptive research provides a relatively

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complete picture of what is occurring at a given time and at the same time allows the development of questions for further study".

Convenience sampling is applied in selecting the respondents with the total of three hundred and forty-one (341) students from A.Y. 2020–2021, 277 respondents from BSBA major in Marketing Management and 64 respondents from BSBA major in Entrepreneurship.

The researchers' primary means of gathering data is survey. Aself-made questionnaire is formulated by the researchers to gather information regarding the following: 1. Demographic profile of the students; 2. Knowledge of learners on different functions of cellphone useful for education; 3. Effectiveness of communication of learners using cellphone in education in terms of a. Learners to Content Communications, b. Learners to Learners Communications, and c. Learners to Teachers Communications; 4. Communication skills develop in using cellphone; 5.Challenges of using cellphone in remote learning educations.

Online distribution was done thru the help of friends and collogues ofresearchers. The data was collected, analyzed and interpreted using frequency, scale, percentage, ranking and weighted mean.

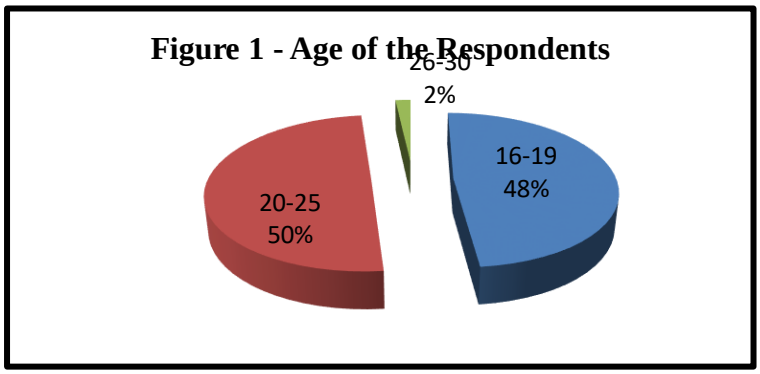
Scale of 1 – 4 was used with 1 as the lowest and 4 as the highest. The responses were given equivalent weights and corresponding verbal description as follows:

Scale of Values	Scale of Range	Availability of Resources and Environment	Knowledge of the Learners
4.00	3.26–4.00	Strongly Agree	Above Average
3.00	2.51–3.25	Agree	Average
2.00	1.76–2.50	Disagree	Below Average
1.00	1.00–1.75	Strongly Disagree	Poor

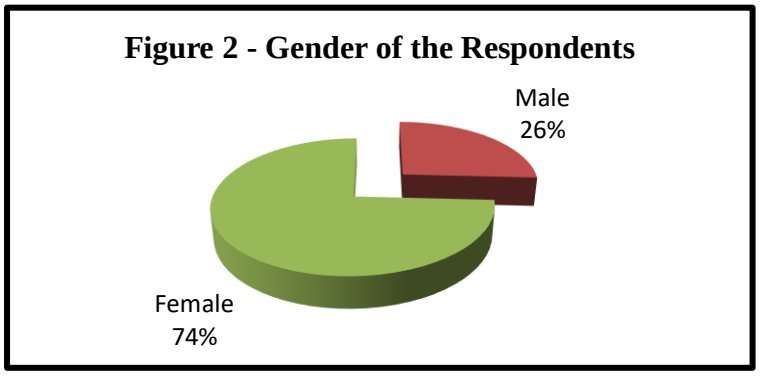
III. RESULTS AND DISCUSSION

This section presents the survey result conducted concerning the effectiveness of handheld computer in remote learning.

1. Demographic Profile of the Students;



It can be illustrated from data above that majority or 50% of the respondents are 20-25 years old. It can be attributed that students ages 20 – 25 are more technology inclined and uses handheld computer more often. According to Voges, E. (2019), More than 9 in every 10 millennials own smartphones. Furthermore according to Crompton and Burke (2018), the largest demographic of mobile device users are 18–29 years old which is also the typical age of college attendees.



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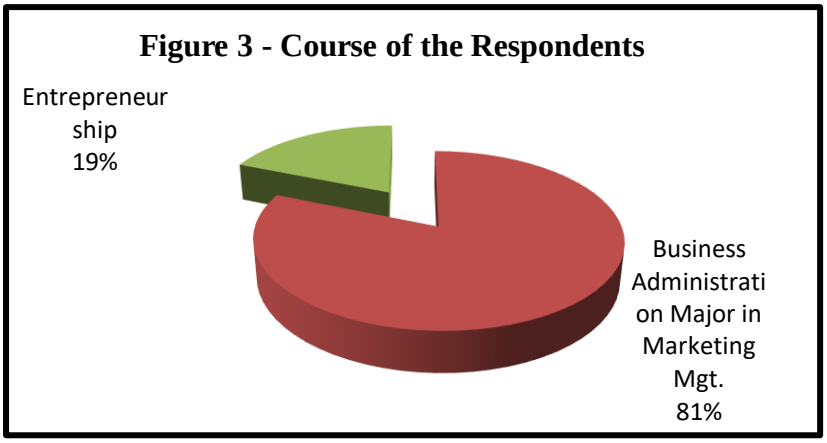
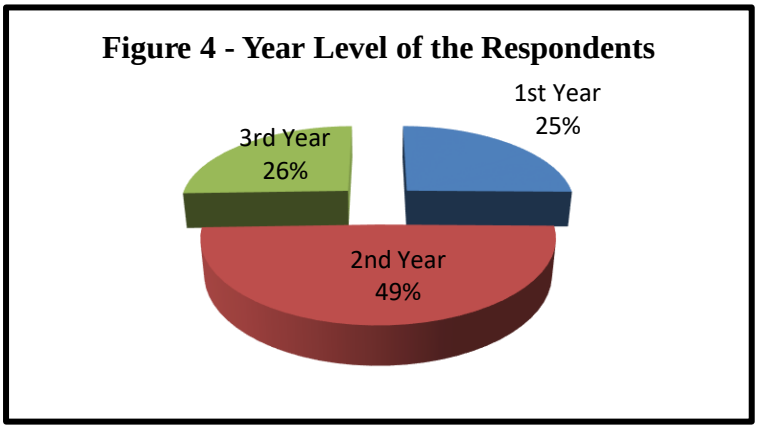
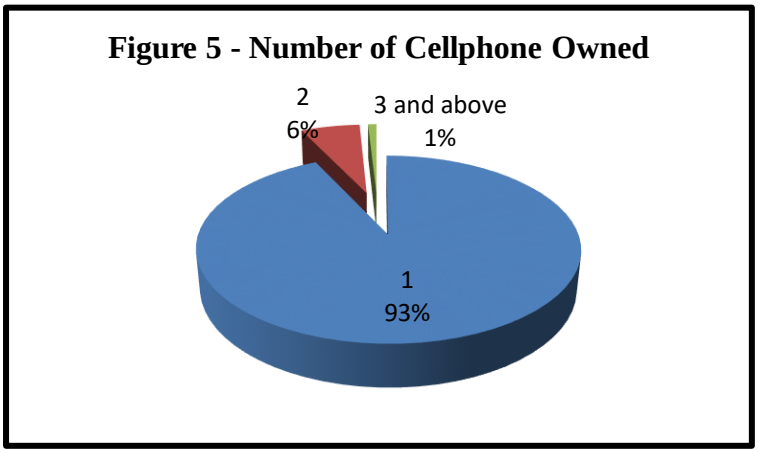
It can be illustrated from the data above that majority or 74% of the respondents are Female. This data implies that Females are more inclined in using handheld computers than male. In the study conduct by Gilroy M. (2017), This is when he noticed a large number of smartphone-dependent women. Around 1 in 3 of the samples were male addicts, while 2 in 3 were female. Thus, justifying why more of the respondents in the study are females.



The figure 3 above shows that majority of the respondents or 81% are enrolled in Business Administration. This program is a four–year course in the Philippines that would prepare the undergraduates for a Marketing career in various organizations and businesses (Course.com.ph, 2018). Students who major in marketing develop several skills that can be used across industries (Profita, 2020); due to this underlying facts justify why most of the respondents are enrolled in this program.



The figure 4 above shows that majority or 49% of the respondents are are 2nd Year students. This data shows that majority of the population are the second batch of the senior high school graduates. The students who graduate from the Senior High School are best positioned to equate students in the fields of jobs, industry, skills growth, technical-career training, and higher education with the skills, skills and value required for the future to succeed (Collmat, 2016).



It can be illustrated from the data above that majority or 93% of the respondents owned at least 1 handheld computers. This shows every single students in college owned a handheld computer or smartphone. A laptop or mobile is available to 95% of all students who have undergraduate studies (Seilhamer, R. et al. 2018). Thus, it is possible to use handheld computer in remote learning education.

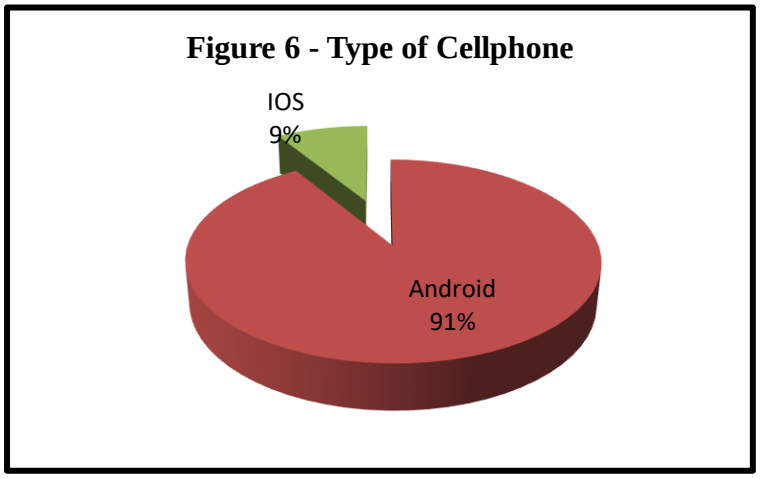
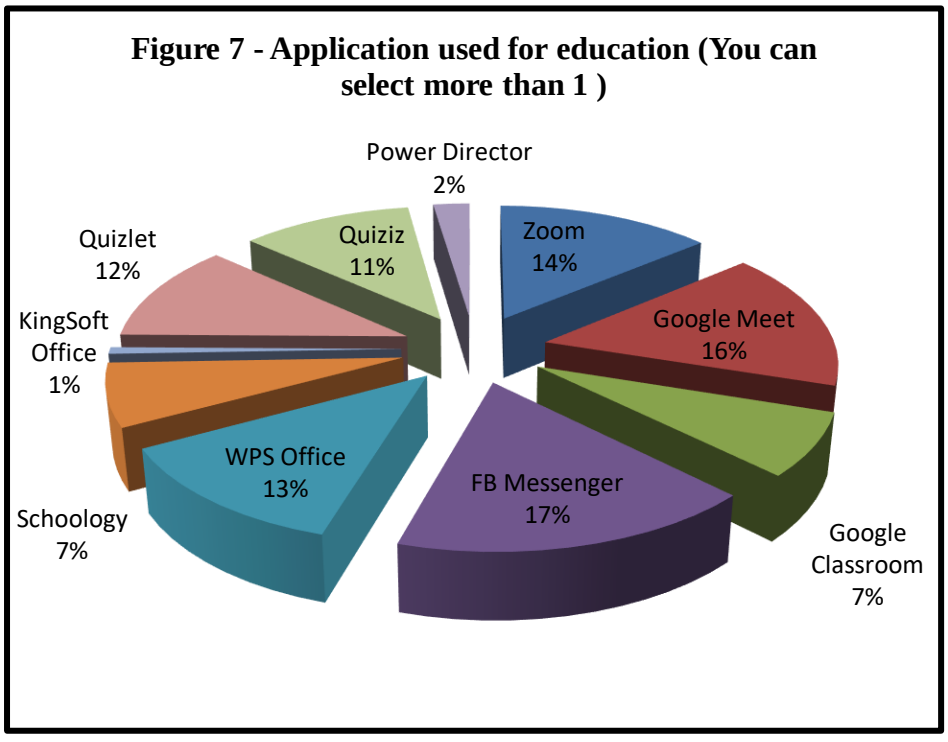


Figure 6 above shows that majority of the respondents are using Android types of Cellphone or Handheld computer. Android cellphones are user-friendly and easy to use type of cellphones. A user-friendly mobile phone is a convenient and easy-to-use phone for personal setup and functionality. Simple use of a camera and intuitive access to Internet-based services must be made possible by user friendly smartphones (smartphonesrevealed.com). Due to this underlying facts use of handheld computer in remote learning education would be possible.



The data above can illustrated that 17% of the respondents are using FB Messenger app, 16% are using Google Meet and 13% are using WPS Office App. These 3 with the highest percentage shows are the most commonly used app for education. They are using the mobile version of this application. Thus, what we can do on a desktop or Laptop are also able to do in a cellphone that's why it is now called handheld computer. Moreover, For any kind of handheld computer, a mobile device is a general term. These devices are incredibly portable and often fit into your hand. Some handheld devices – such as tablets, electronic readers and smartphones – can do many of the same things that you can do with a desktop or laptop (GCFGlobal.com).

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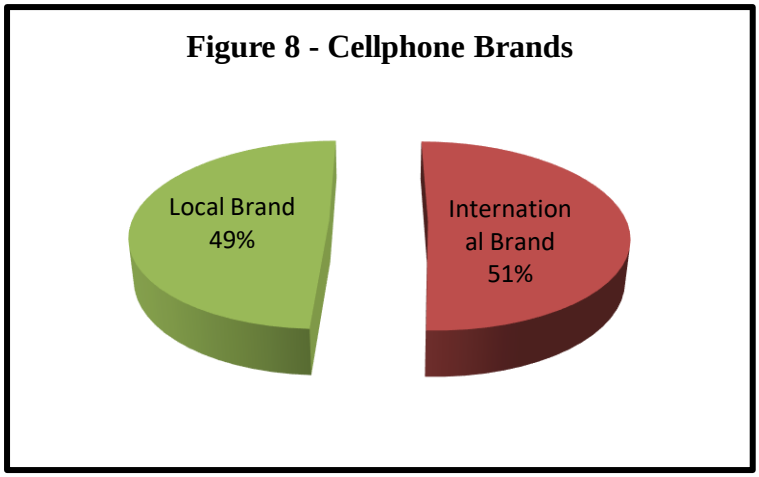

It can be illustrated from the data above that majority or 51% of the respondents are using International Brand of Cellphones or Handheld Computer. International brand of mobile phones are more trusted in brands in the Philippines. In the Philippine smartphone industry, big names from abroad have always played a major role. Such household names such as Samsung, Apple, Sony and LG are only a handful of the most renowned brands in and outside of the mobile industry.

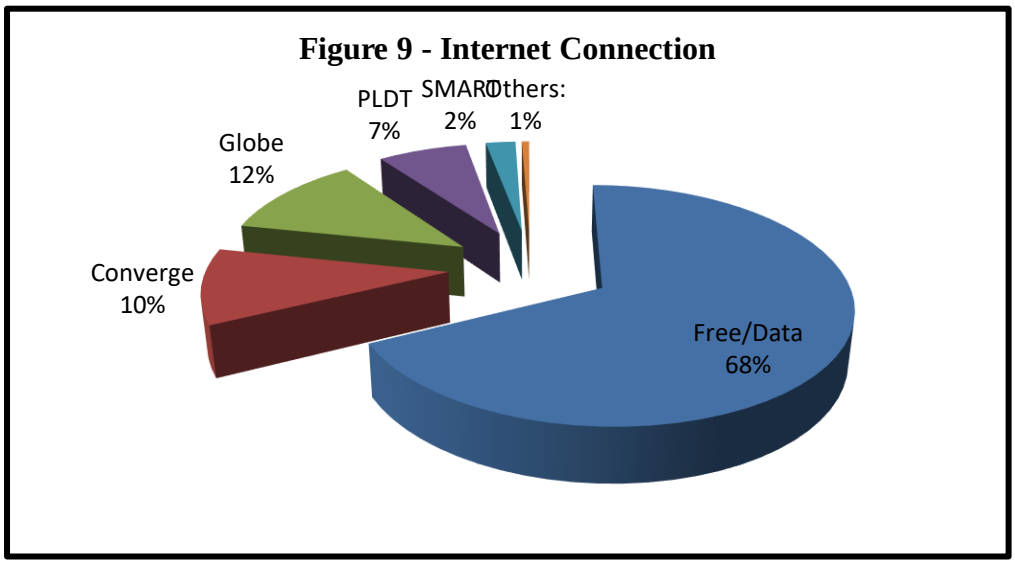

Figure 9 above shows that majority or 68% of the respondents are dependent to Free Data/ Data Connection. The data can imply that most of the students does not have an internet subscription. Free Data / Data Connection on handheld computer are enough to download and search files and information from the internet. Mobile data allows your phone even if it isn't on Wi-Fi to access the Internet. Mobile data provide you with an internet connection anywhere you are linked to a mobile network. Think of software, the web browser, email and cloud sync.Mobile data consumption in megabytes and gigabytes is calculated (GB). Anything you send (download) or receive (download) from the Internet would require a certain amount of information (Ottoni C. 2019).

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2. Knowledge of Learners in Handheld Computer Functions Useful for Education

Table 1 – Knowledge of Learners in Handheld Computer Functions Useful for Education

No.	Indicators	Weighted Mean	Verbal Interpretation
1.	WI-FI and Data are a function of Cellphone useful for browsing and communication on the internet.	**2.69**	**Average**
2.	My cellphone/s have Play Store or Apps Store default application installed for different downloadable applications.	**2.97**	**Average**
3.	My cellphone/s can open and do an MS Word, PDF, Excel, PPT file, and other documents using WPS Office application.	**2.91**	**Average**
4.	I can screenshot or screen record my cellphone/s screen anytime I want to use different applications.	**2.33**	**Below Average**
5.	I can take picture and record videos or even edit videos and pictures of my accomplishment or activities using my cellphone/s.	**2.94**	**Average**
6.	Google Classroom, Schoology, and other Virtual Learning Apps can be open using a cellphone/s. This VLA has a cellphone version.	**2.78**	**Average**
7.	I can use my cellphone/s to print documents and files using a USB Cable.	**2.01**	**Below Average**
8.	I can call or/and text to communicate with my classmates and teachers regarding our subjects.	**3.19**	**Average**
9.	I can use cellphone/s to calculate, save date of activity/events to calendar app, I can watch videos, and open internet links like google forms.	**3.10**	**Average**
10.	I can use different social media apps in my cellphone/s to join video conferencing, video chat, live stream, watch videos, and movies related to education.	**2.91**	**Average**
Average Weighted Mean		**2.78**	**Average**

Table 1 above shows the average weighted mean of 2.78 with verbal interpretation "Average". Question numbers 1,2,3,5,6,8,9 and 10 have a verbal interpretation "Average", while question number 4 "**I can screenshot or screen record my cellphone/s screen anytime I want to use different applications.**" has a verbal interpretation "Below Average" and question number 7 "**I can use my cellphone/s to print documents and files using a USB Cable.**"

The data above on table 1 shows that respondents have an "Average" knowledge about the function of handheld computer useful for education. This only implies that respondents are aware of the functions of handheld computer for education. Detailing the data above it can also realized that question number 4 "**I can screenshot or screen record my cellphone/s screen anytime I want to use different applications.**" is below average knowledge this reveals that respondent rarely use screenshots and screen record during their learning engagement in their remote learning education. Furthermore question number 7, has the same implication that this functions are not common to the respondents, but in general the respondents are aware functions of handheld computer that is mostly used when engaging in remote learning education.

Lastly, as for the advantages brought by using social media and mobile application tools in ICT class, exchange of information between students was the most prominent advantage which made contribution to the cooperative works between students (Denizalp and Ozdamli, 2019). Thus, Mobile learning has become a significant component of higher education technology. M-learning helps students, through the internet and technological advancement, to learn, interact and share their ideas (Al Emran et. Al. 2015).

3. Effectiveness of Communication of learner using Handheld Computer in terms of;

a. Learners to Learners Communication

Table 2 – Learners to Learners Communication

No.	Indicators	Weighted Mean	Verbal Interpretation
1.	I can call or/and text using cellphone/s to communicate with my friends and classmates.	**3.27**	**Strongly Agree**
2.	My cellphone/s can open social media apps to make a video chat, video conferencing, chat and messages to communicate with my classmates, group members, and friends.	**3.16**	**Agree**
3.	I use a cellphone/s to send my part in any cooperative activities.	**3.35**	**Strongly Agree**
4.	Using cellphone/s, I can collaborate with the group activities that I have in my subjects.	**3.26**	**Strongly Agree**
5.	Cellphone/s creates flexibility in communications, it can be thru text, call, video chat, video call and also can be used in emails.	**3.30**	**Strongly Agree**
Average Weighted Mean		**3.27**	**Strongly Agree**

Table 2 above shows the average weighted mean of 3.27 with verbal interpretation "**Strongly Agree**". Questions number 1,3,4, and 5 have a verbal interpretation "**Strongly Agree**" while question number 2 has a verbal interpretation "**Agree**".
Based on the result shown on the table 2 above, the respondents "strongly agree" that communication between learners to learner in education are effective using handheld computer. Detailing the table above it shows that respondents strongly agree that handheld computer creates flexibility in communication, they can easily text, call, chat, and video call their classmates. Thus this results provides a clear indication that learner to learners communication in remote learning education are effective using handheld computer. Moreover, M-learning enables students, through the internet and the technology growth, to learn, collaborate and exchange ideas with one another (Al Emran et. al, 2015).

b. Learners to Content Communication

c.

Table 3 - Learners to Content Communication

No.	Indicators	Weighted Mean	Verbal Interpretation
1.	I can easily access my activities, modules and other learning materials using a cellphone.	**2.96**	**Agree**
2.	I can do word, excel, and power point presentation using my cellphone/s.	**2.55**	**Agree**
3.	I can search information on the internet easily in my cellphone/s.	**3.04**	**Agree**
4.	It is easy to read my modules and learning materials in my cellphone/s.	**2.65**	**Agree**
5.	I prefer to take down notes and save information using my cellphone/s.	**2.72**	**Agree**
Average Weighted Mean		**2.79**	**Agree**

Table 3 above shows the effectiveness of communication between learners and content. An average weighted mean of 2.79 with verbal interpretation "**Agree**". Respondents agree that using handheld computer is effective in terms of their communication to learning content such as activities, modules, and other learning materials. They also agree that reading modules and learning materials in handheld computer are easy; this is because it is handy and can carry anywhere. In addition, as these devices are highly specialized and interactive communication tools, they provide tertiary education institutions with versatile instruments to augment existing technology, and to improve learning from remote areas such as trains or bus stations outside classrooms and homes where students have no access to computers (Klimova and Poulova, 2016).

d. Learners to Teachers Communication

Table 4 – Learners to Teachers Communication

No.	Indicators	Weighted Mean	Verbal Interpretation
1.	I use my cellphone/s to attend the online class discussion.	**3.25**	**Agree**
2.	It is easy to use my cellphone in sending files, documents, videos and pictures of my activities/ requirements for my teachers.	**2.88**	**Agree**
3.	I can chat my teachers on social media like Facebook messenger through cellphones.	**3.38**	**Strongly Agree**
4.	I can easily check updates, and respond easily using my cellphone/s.	**3.21**	**Agree**
5.	I use my cellphone/s to consult with my teachers on subject matters that I find challenging to understand.	**3.29**	**Strongly Agree**
Average Weighted Mean		**3.20**	**Agree**

Table 4 above shows the effectiveness of Learners to Teachers Communication using handheld computers. An **average weighted mean** of **3.20** with verbal interpretation "**Agree**". Majority of the indicator in table 4 have a verbal interpretation "**Agree**". Respondents agree that handheld computer can be use to attend online class discussion and is easy to use in sending files, documents and videos. Discussing more on the table 4 shows that respondents "Strongly agree" that teachers are easy to reach using social media like Facebooks and messengers which is always available in any handheld computers. Furthermore, students can consult with their teachers just by using handheld computers on the topics they find challenging. Thus, showing that communication between learners and teachers using handheld computers is effective. Lastly, the social networks and mobile apps used by students have been shown to have a positive effect on communication among students and students and instructors (Denizalp and Ozdamli, 2019).

4. Communication skills develop in Using Cellphones (Handheld Computer)

Table 5 – Communication Skills Develop in using Cellphones (Handheld Computer)

No.	Indicators	Weighted Mean	Verbal Interpretation
1.	I can construct grammatically correct statements using grammar checker applications and internet in my cellphone/s.	**2.67**	**Agree**
2.	I can gain more confidence in speaking in the class while using cellphone in attending online class.	**2.55**	**Agree**
3.	Cellphone have applications like Dictionary, Thesaurus, and Encyclopaedia that improved my vocabulary.	**2.91**	**Agree**
4.	I can easily search information that can support my ideas anytime using my cellphone/s.	**3.11**	**Agree**
5.	I can improved my digital communication skills such as making an email, letters, using my cellphone/s.	**2.99**	**Agree**
Average Weighted Mean		**2.85**	**Agree**

Table 5, shows the communication skills develop by students in using handheld computer. The data shows an average weighted mean of 2.85 with verbal interpretation "**Agree**". All five indicators shown on the table 5 have a verbal interpretation "**Agree**". This shows that respondents agree that their communication skills are development by using handheld computer. Detailing the table above shows that respondent agrees that they can construct grammatically correct statement just by using grammar checkers and internet in their handheld computers. They can also access mobile versions of Dictionary, Thesaurus, and Encyclopaedia that improves their vocabularies. Moreover, respondents agree that they can easily search information that can support their ideas anytime using their handheld computers. At the end, the ease of use is the key factors for incorporating any technology; hence, the psychological acceptance of the learners was demonstrated by own mobile. The use of digital devices also allowed the study to practice beyond the context of classrooms (Darni and Albion, 2017).

5. Challenges of using Cellphone (Handheld Computer) in Remote Learning Education

When respondents were ask about the challenges of using handheld computers in remote learning education they honestly responded that 60% or 205 students are hard to focus on remote learning education when using handheld computer because of the application such as Facebook, Messenger, Instagrams that can easily access anytime on it. Thus, focusing are the main challenge that respondents are facing when using handheld computers. Another reasons that 25% or 86 students said that they have low specification or low memory of handheld computer, thus limits them from downloading different applications useful for remote learning education, in addition, phones have limited resources (RAM, CPU, etc.) that need to be divided between background tasks and high priority functions. Thus, many items running in the background will slow down your device

for an app like gaming, which is more complex (Triggs, 2018). Lastly, 10% of the respondents said that they have low/slow/no internet connection which limits them from accessing information from the internet and other social media apps used for education. 5% are the other challenges of the respondents in using handheld computer in remote learning education. Thus, this common challenges above should be address to effectively implement remote learning education using handheld computers alone.

IV. CONCLUSION AND RECOMMENDATION

This study aimed to identify the effectiveness of handheld computer in remote learning education as one of the trend in Industry 4.0 in education. From data discuss above a conclusion was made. The knowledge of the respondents on handheld computer functions useful for education are average, they are aware of the different functions, applications and uses of handheld computer useful in education. Majority of the respondents agree and strongly agree on the effectiveness of communication using handheld computer in terms of; Learners to Learners, Learners to Content, and Learners to Teachers, highlighting that handheld computer are handy and pocket sizes that can easy to bring anywhere. Laptop or desktop computer functions are mostly available to handheld computers. Moreover, respondents agree that their communication skills are develop using handheld computer, they can assess different application that is useful in communication such as Dictionary, Thesaurus, and Encyclopaedia. Lastly, of all the benefits of using handheld computer in remote learning education there are also challenges in using it. The major challenge of the respondent is hard to focus because they can simply access social media app in their handheld computer which distract them from their educational task. Another challenge is the low specification or low memory handheld computer because it limits them from downloading application useful in remote learning education and slow down the performance of their handheld computer.

The researchers strongly suggest the use of handheld computer in remote learning education. The universities should explore how they can include the use of handheld computer to address problem occurring in remote learning education. Since majority of the students in tertiary level have at least one handheld computer, student must explore more functions that can help them in coping up in remote learning just by means of handheld computer. Lastly, teacher should be inclined on using handheld computers to help students who are not good at using this device in remote learning.

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