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Investigating the Use of Smartphones among Pre-service Science Teachers in Supporting Learning

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ABSTRACT

This study was to investigate the pre-service science teachers' utilization of smartphone to support their studies. The research design employed was the descriptive survey design. The target population for the study was pre-service science teachers in the colleges of education in Ghana. Purposive sampling technique was used in selecting 146 pre-service science teachers from the College of Education in Central Region of Ghana. The study found that though the pre-service teachers use their smartphone devices mostly for social networking and entertainment; making and receiving calls; and content creation and access information. The use of smartphones for study related activities were found to be rather minimal. The study also found that the interest of pre-service teachers in social networking and entertainment can be used as a means of encouraging pre-service teachers to use their smartphones for study related activities. The study therefore generated some recommendations for tutors, pre-service teachers and the government to deliberately adopt as a means of encouraging pre-service teachers to use their smartphones for study related activities.

Keywords : Smartphones, Pre-service Science Teachers, Learning Tool, Communication, Entertainment, Social Media, Educational Resources

I. INTRODUCTION

The increased exploitation of Mobile learning (m-learning) among pre-service teachers in colleges of education campuses in Ghana has the potential to create new options for the pre-service teacher to survey the mobility and social media as an instructional strategy. Mobile learning (m-learning) can be defined as using mobile technologies for educational purposes (Rodríguez- Arancón, Arús & Calle, 2013). There is no doubt that the booming of smartphones currently gives numerous opportunities for students to utilize mobile application in supporting learning activities (Wendeson et al, 2010).

In Ghana, the common mobile phone technologies mostly owned and used among young people is the smartphone. The smartphone can present students with an appropriate learning environment as there are a variety of mobile applications that students can use to support their learning experiences.

Linking the gap between Ghana's educational system and the world of work, the Colleges of Education Act, 2012 (Act 847) was enacted to upgrade the teacher training colleges from post-secondary institutions under the Ghana Education Service (GES) to tertiary education status as colleges of education under national council for tertiary education (NCTE). This transition seeks to achieve professional and academic competencies for Ghanaian citizens in the teaching profession and to provide for other related matters such as;

- Reducing the cost and years that teachers go through to get university degree after their initial diploma programmes

- Helping boost the quality of education in the country to meet world standards

(i.e. meeting the needs of the 21st century economy)

This means that Teacher Education should integrate mobile technology into pedagogical studies. However, teacher training continues to provide pedagogical skills to pre-service science teachers without emphasizing the integration of mobile technology. The pre-service science teacher therefore do not develop the skills of using their knowledge in mobile technology, experiences and personal characteristics and grow into capable teachers.

A research conducted by Gaskell & Mills (2010) proved that smartphones play a very important role in education, in that it offers a major chance in enhancing access to learning resources. This means that many higher institutions, especially in colleges of education, will be enabled to develop learner support models as well as learning opportunities in ways which would build on current methods of impacting knowledge.

Shuler (2009) pointed out that smartphones offer students opportunities to gather, access, and process information outside the classroom as well as support learning in a real-world context. Shuler (2009) maintained that smartphones promote collaboration, communication (as these are considered vital for 21st-century academic success) and can also help encourage instructions that are adaptable to individual and diverse learners.

It is true that science learning can be quite difficult to understand and also a demanding area, since it entails creating knowledge about abstract and complex concepts; consequently, there is a need to involve collaboration and co-construction of knowledge and ideas, which stresses on change in educational practices (Khoo et al, 2012). Vavoula et al (2007) affirms that students in higher education institutions when engaged in real-world activities that can represent the abstract concepts they are learning about, it can actually present a means of modifying and simplifying learning for them. This is especially crucial for science learning, in the sense that it involves increasing knowledge about complicated abstract concepts, which in turn can be more significant if students are able to build a relationship between their formal knowledge and their personal experiences (Vavoula et al, 2007).

This is therefore necessary to allow the pre-service science teachers to learn how to utilize mobile learning devices such as the smartphones, as these technologies could supplement a new dimension of science education considered as difficult (Taber, 2005). Smartphones can supplement learning in a number of ways. Complex chemistry concepts have been explained using animation and videos and such animations and videos are available on the internet at websites such as youtube.com and khan academy. By using smartphones to access such files they will be learning from other sources instead of sticking to notes taken during lessons. The internet also host millions of articles and notes on teaching methods and so by using the smartphone to access these articles and notes the pre-service science teachers will learn about the current teaching methods. Most often these teaching methods are explained in an easy to follow manner.

There was a study that focused on actual use of mobile technology tools in classrooms in secondary schools, and the results from the research revealed that Smartphones had numerous benefits to support learning in and out of class (Hartnell-Young & Heym, 2008). There is however, little applied research into how these tools are actually being used to support teaching and learning with few descriptions of how smartphones are used by the pre-service teachers in Colleges of Education in Ghana. According to Buabeng-Andoh (2012) the teachers' integration of

Mobile IT into teaching, is low and has been restricted to the preparation of lesson notes.

The work of Wu et al., (2012) also suggested that mobile computing devices and social media are still rather new and evolving; research has tended to focus on evaluating the effectiveness of implementing mobile computing devices. This paper therefore focuses on investigating the use of smartphones among pre-service science teachers in the Colleges of Education in the Central region of Ghana. This study investigated the pre-service science teachers' utilization of smartphones, the frequency of using their smartphones for some researcher defined activities and lastly establish whether the pre-service science teachers use their smartphones to support their studies.

II. METHODS

In order to investigate the use of smartphones among pre-service science teachers in Foso College of Education, a descriptive survey research design was employed. This is because the variables have occurred easily in the population so supervision came from the normal classroom settings which was considered relatively inexpensive, easily administered, replicable, and a large amount of data could be got from a lot of respondents in a fairly short time. This helped to analyze, interpret data and describe information the way it existed in natural form. The total sample used was 146 pre-service science teachers. The pre-service science teachers comprised of 107 (72.14%) males and 39 (28.647%) females. These 146 respondents were purposively sampled from the College's pre-service science teachers in the Chemistry classes for both levels 100 and 200. Of the 146 pre-service science teachers, 107 (72.14%) were males and 39 (27.86%) were females. The age distribution shows that most of the pre-service science teachers were within the age range of 20-24 (75.71%) and the majority of the respondents 75 (53.57) were in level 100.

Smartphone Use Questionnaire (SUQ) consisting of three sections; Sections A, B and C was used to collect data. The first section (Section A) of the questionnaire contained the demographic information of the respondent. This includes; age, gender, smartphone type and ownership by respondents. Section B was on the pre-service science teachers' proficiency in using smartphones and section C explored their frequency of using their smartphones for some pre-defined activities. The validity of the instruments was enhanced through intensive inspection by the researchers and other colleague tutors whose contribution helped to strengthen the validity of the instrument. Reliability coefficients of the varous sections were computed as follows:

Section A: Demographic information, 0.76

Section B: Smartphone Proficiency Usage Questionnaire 0.59

Section C: Frequency of Use 0.61

III.RESULTS

The completed questionnaires were serially numbered, coded and tabulated with the aid of SPSS computer programme to illustrate the relative proportions where applicable (Creswell, 2009). The analysis involved coding, organizing, describing, interpreting and drawing conclusions using simple pie chart, frequencies and percentages for the responses of the pre-service science teachers' views on their use of smartphones.

A. Ownership of smartphone by Pre-service science teachers

The study first found out whether the pre-service teachers owned smartphones or not. From the data analyzed, 140 (95.89%) of the pre-service science teachers owned smartphone out of the total 146 sampled pre-service science teachers. To further explore the type of operation system the pre-service science teachers prefer to use they were asked to

indicate the whether their smartphones were Android based, Iphone based, Windows based or Blackberry based. The results has been displayed in figure 1.

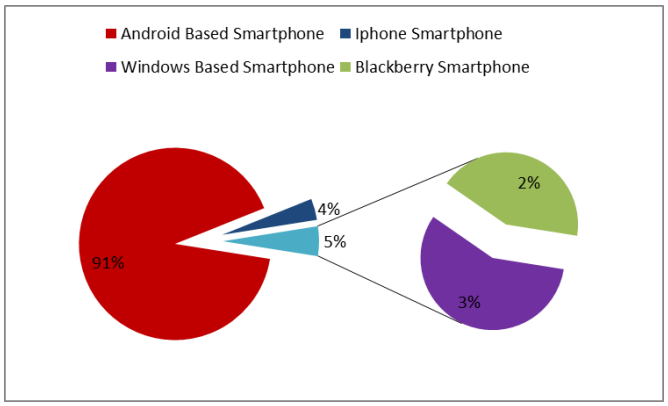


Figure 1: Pie-chart showing Smartphone types

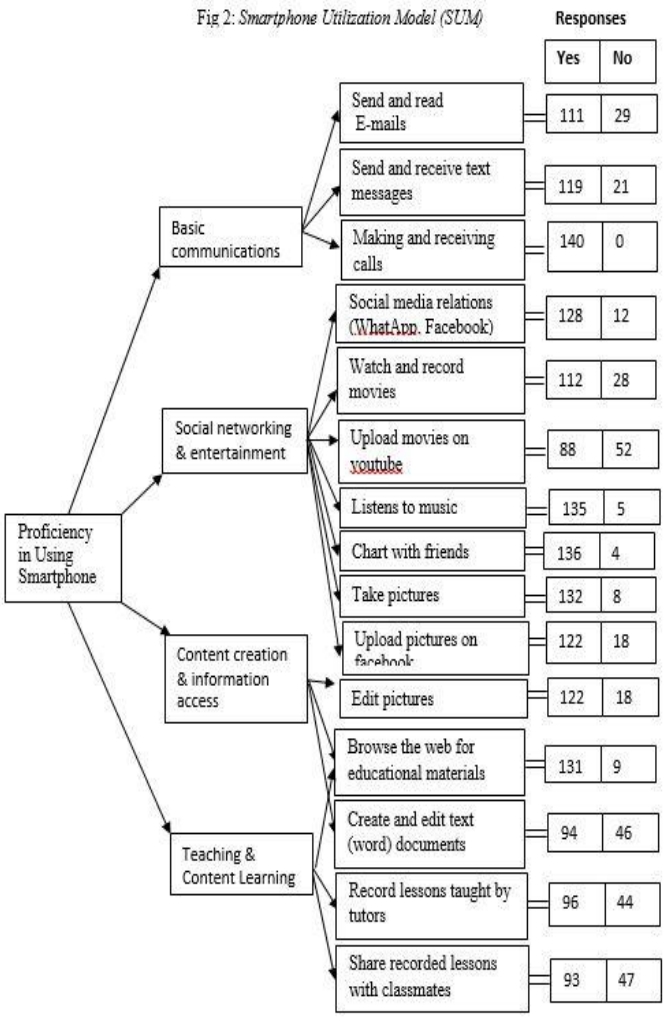
The study revealed that a high percentage (91%) of respondent pre-service teachers used the Android smartphone facility; 4% used the iphone; whereas very low (2%) used the Blackberry smartphone type and 3% used the Windows smartphones. When asked why their preference for Android phones to the rest, respondents indicated that they can easily use their android phones for "everything" phones normally do. The android based smartphones are relatively cheap as compared to the other three. Also the applications and functions in the android based smartphones are easily accessible. Usage of Smartphone by Pre-service science teachers

The pre-service teachers were asked to indicate whether they use their phones for the activities listed in Figure 2. Their responses have been presented in figure 2.

The figure 2 shows Smartphone Utilization Model by pre-service science teacher under the following four categories; basic communications, social networking and entertainment, content creation and information access and teaching-content learning.

The common responses in relation to the use of smartphones for basic communication are as follows: 79.3% (111) of the respondents use their devices to send and read E-mail messages; 85.0% (119) use their smartphones for sending and receiving text messages; all the 140(100%) subjects who owe smartphone, used them for making and receiving calls.

Fig 2: *Smartphone Utilization Model (SUM)*



In terms of the use of Social networking and entertainment, majority 91.4% (128) engage in social relations such as "whatapping and facebooking"; 80% (112) used their smartphones to watch and record movies; 62.86% (88) were able to upload movies from the youtube; the study further revealed a very high percentage 96.43% (135) of respondent pre-service science teachers who used their smartphone for Listening to music; again, another large number 136 out of the 140 used their device to chat with friends; 94.29% (132) take pictures with their smartphones and 87.14% (122) of the respondents could upload pictures on facebook.

With regards to content creation and information access, 87.14% (122) edit pictures with their phones; 93.57% (131) browse the internet with their smartphones for educational materials; and finally, 67.14% (94) were able to create and edit text (word) documents with their smartphone. Ultimately on teaching and content learning, 68.57% (96) of respondents indicated they record lessons taught by tutors with their phone devices and 66.43% (93) share recorded lessons with classmates.

B. **Rating the various ways pre-service teachers use their smartphones**

The pre-service science teachers were asked to indicate on a six-point scale, 0 to 5; with 0 as (lowest) meaning do not use their smartphones at all, while 5 (highest) means use their smartphones very frequently at least twice everyday on the activities enumerated Figure 2. From Table 1, it could be seen that responses relating to the use of smartphones for basic communications as indicated by the pre-service teachers were as; 74 (52.9%) and 69 (49.3%) used their smartphones very frequently to make and receive calls; and send or receive text messages respectively for at least twice a day. As 32 (22.9%) rarely make and receive calls, 18 (12.9%) occasionally send and receive text messages. On the contrary, 40 (28.6%) do not use their smartphones to send or read emails at all.

Table 1: Frequency of use of smartphones

	Frequent use of smart phones for at least twice a day											
	Not at all (0)		Very Rarely (1)		Rarely (2)		Occasionally (3)		Frequently (4)		Very Frequently (5)	
Activities	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Make and receive calls	4	2.9	6	4.3	32	22.9	13	9.3	11	7.9	74	52.9
Send and receive text messages	10	7.1	19	13.6	15	10.7	18	12.9	9	6.4	69	49.3
Send and read E-mail	40	28.6	18	12.9	17	12.1	13	9.3	13	9.3	39	27.9
Chat with friends	6	4.3	10	7.1	5	3.6	15	10.7	18	12.9	86	61.4
Add comments in social media e.g. Facebook, WhatApp	13	9.3	16	11.4	16	11.4	14	10.0	11	7.9	70	50.0
Listen to music?	7	5.0	15	10.7	10	7.1	22	15.7	11	7.9	75	53.6
Take pictures?	16	11.4	12	8.6	16	11.4	20	14.3	14	10.0	62	44.3

Record movies?	41	29.3	19	13.6	20	14.3	12	8.6	11	7.9	37	26.4
Upload pictures on the web e.g. facebook?	31	22.1	19	13.6	15	10.7	15	10.7	12	8.6	48	34.3
Upload movies on the web e.g. youtube?	50	35.7	10	7.1	28	20.0	14	10.0	10	7.1	28	20.0
Create and edit texts documents e.g. word document?	44	31.4	24	17.1	19	13.6	10	7.1	12	8.6	31	22.1
Edit pictures	30	21.4	18	12.9	16	11.4	20	14.3	11	7.9	45	32.1
Browse the web for educational materials?	15	10.7	5	3.6	9	6.4	15	10.7	27	19.3	69	49.3
Record lessons taught by tutors?	38	27.1	20	14.3	20	14.3	12	8.6	7	5.0	43	30.7
Share recorded lessons with classmates?	42	30.0	21	15.0	14	10.0	9	6.4	12	8.6	42	30
Read pdf and word documents	17	12.1	12	8.6	8	5.7	9	6.4	20	14.3	74	52.9

From Table 1, it could be seen that responses relating to the use of smartphones for basic communications as indicated by the pre-service teachers were as; 74 (52.9%) and 69 (49.3%) used their smartphones very frequently to make and receive calls; and send or receive text messages respectively for at least twice a day. As 32 (22.9%) rarely make and receive calls, 18 (12.9%) occasionally send and receive text messages. On the contrary, 40 (28.6%) do not use their smartphones to send or read emails at all.

On activities pertaining to social networking and entertainment, many pre-service science teachers 86 (61.4%) and 75 (53.6%) frequently use their devices to chat with friends and listen to music respectively. 11 (7.9%) and 15 (10.7%) frequently and occasionally add comment on social media platform and upload pictures on the internet respectively. 41 (29.3%) and 50 (35.7%) do not at all use their smartphones to record movies and upload movies on the web respectively.

Interestingly, results drawn from the Table 1 on content creation and information access also show that 31 (22.1%) very frequently create and edit word document, whereas 44 (31.4%) certainly do not at all create and edit text documents with their smartphones. 45 (32.1%) and 20 (14.3%) very

frequently and occasionally edit pictures with their smartphones respectively. 12 (8.6%) and 74 (52.9%) rarely and very frequently read pdf and word documents with their smartphones.

On teaching and content learning, sixty nine (49.3%) and 43 (30.7%) very frequently browse the internet for educational materials and record lessons that their tutors teach in class. 15 (10.7%) and 20 (14.3%) occasionally and rarely browse the web for educational materials and record lessons taught by tutors respectively. 15 (10.7%) and 38 (27.1%) never at all use their smartphone devices for educational materials from the internet and record lessons taught in the classroom. Equal number 42 (30.0%) used their smartphone very frequently and not at all share recorded lessons with their classmates.

In general terms, use of smartphones for basic communication registered the highest rate of recurrence responses as 74 (52.9%) and 69 (49.3%) respectively for making and receiving calls; and sending and receiving text messages. The majority 86 (61.4%) and 75 (53.6%) also registered the highest rate of recurrence responses on social networking for chating with friends and listening to music respectively. The highest rate of recurrence responses the data registered on content creation and information access were 74 (52.9%) and 45 (32.1%) for reading pdf and word document, and editing pictures respectively. Finally the highest rate of recurrence responses on teaching and content learning registered as 69 (49.3%) and 43 (30.7%) respectively for browsing for educational materials and recording lessons taught by tutors.

IV. DISCUSSION

The results of this study have shown that many pre-service science teachers 140 (95.89%) have acquired and put to use a variety of smartphones devices. Indeed the advent of smartphone technology has caught up with us in our schools and colleges and is welcoming news. The smartphones seems to popularize the mobile devices and has reduced the use of desktop or laptop computers that ought to be more suitable for academic work. It is therefore common to see most pre-service science teachers in classrooms, buses and relaxation spots glued to their phones playing and manipulating them at leisure. These leisure-based activities have also been observed in other countries (Marriott, Marriott, & Selwyn, 2004; Usun, 2003; Walmsley, White, Eynon, & Somerfield, 2003; Selwyn, 2008).

The pre-service science teachers are also used their smartphone on social networking and entertainment, as majority 86 (61.4%) and 75 (53.6%) in this study registered the highest rate of recurrence with respect to the range of activities the smartphone devices were used for in a day. Those pre-service science teachers who did not bother to use their smartphones for social networking and entertainment were only 6(4.3%) and 7(5.0%) respectively for chatting and listening to music respectively in a day. The use of smartphones for basic communication registered the second highest rate of responses because 4(2.9%) and 10(7.1%) pre-science teachers who did not make or receive calls and send or receive text messages at all in a day. Content creation and access to information was rated third because 44 (31.4%) and 30(21.4%) respectively did not create or edit text messages and edit pictures. Using the smartphone in supporting academic activities such as teaching and content learning however, was ranked fourth by registering 42 (30.0%) and 38 (27.1%) for respondents who neither share recorded lessons nor record lessons taught respectively.

This result is inconsistent with earlier studies done by Mensah (2017), Addy and Ofori-Boateng (2015), and Yeboah, and Ewur (2014) who had reported that students were not using their computers (tablets and smartphones inclusive) to support their studies. In another survey conducted by Educause Center for

Applied Research [ECAR](2012) on Mobile IT in higher education, they explained that students are driving the adoption of mobile computing devices, such as cell phones, smartphones, and tablet computers, in higher education, and that 67% of surveyed students believe mobile devices are important to their academic success. The results in this particular study however, show that pre-service science teachers currently are using of their phones to support their studies.

Jegede et al. (2007) and Lau and Sim (2008) found teachers to be more proficient in word processing than the other computer applications. Marwan (2008) further pointed out that teachers' lack of knowledge and skills has become a primary factor in failing to integrate mobile technology into teaching and that the benefits of this technology integration can only be attained if teachers can use the technology well, both technically and pedagogically

In Ghana many students in tertiary institutions like those in the colleges of education use their smartphones more on personal and social activities and less for educational purposes. This technology however, can help the pre-service science teacher to improve their learning, especially when used appropriately. When pre-service science teachers are encouraged and taught on how to properly utilize and navigate their smartphone in this present Mobile Age for educational purposes, then we are sure to produce skilled and confident teaching workforce to drive the nation's agenda for industrialization and modernization. Deliberate efforts by way of encouraging the pre-service science teachers on other applications of the smartphone, would able them to use their phones in reading science news, books and articles online as well as utilize science dictionaries and calculators available on their phone for excellent teaching and learning process.

V. CONCLUSION

This current study revealed that pre-service science teachers use smart phones as commonly done by most tertiary students in Ghanaian. These technology devices particularly android smart phones tended to be used more for communication, entertainment and social/leisure activities than academic purposes. This constitutes a distraction from learning and typifies societal problems that usually accompany advances in science and technology.

Re-orienting teacher training environment by way of technological integration that promotes reflective practices are vital to support beneficial pedagogical. In short, promoting smartphone integration as a technology tool, in colleges of Education in Ghanaian school systems may be less expensive and a major step in promoting academic competencies, and innovation in teaching and learning curriculum.

VI. RECOMMENDATIONS

The inclusion of ICT into the Ghanaian basic school curriculum as a subject has not seen any policy binding schools to use and integrate it in classroom teaching and learning process. This is probably due to high cost involved in providing enough computers and other technological resources to all the schools. Based on the study findings, the following recommendations are made;

The Government should adopt the provision of smartphones in place of other computing devices. This is because some of the teachers own their personal smartphones but do not know how to integrate it in their lessons.

Tutors in the colleges of education must be encouraged to design activities that allow pre-service science teachers to appropriately use their smartphones during lectures (through a college based

mobile policy- such as rules around usage and etiquette). These technologies can provoke the interest of the teachers and make science learning more interactive. As a result, science tutors should explore different ways mobile phone technologies can be used to support learning. Tutors can also formulate automatic alerts to their students on important information, such as quiz dates, additional required readings as well as links to helpful websites.

Pre-service science teachers should be made aware and take keen interest in using smartphones to support their learning experiences. Science students should be more encouraged by their tutors to use chat room, such as viber and whatsapp for group discussions, share images through Bluetooth for explaining scientific concepts and processes, read eBooks and download scientific materials from the internet. This will make the pre-service science teachers more aware of the full potential the smartphone can be used to enhance their learning.

Finally, the pre-service science teachers should be given task that demands the use of smartphone technology to accomplish.

VII. REFERENCES

[1] Addy, N. A., & Ofori-Boateng, P. (2015). ICT and education: An analysis into Ghana's universities. *International Journal of ICT and Management*, *3*(2), 23-28.

[2] Buabeng-Andoh, C. (2012). Factors Influencing Teachers' Adoption and Integration of Information and Communication Technology into Teaching: A Review of the Literature. *International Journal of Education and Development using Information and Communication Technology*, *8*(1), 136-155.

[3] Creswell, J. W., & Zhang, W. (2009). The application of mixed methods designs to trauma research. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies*, *22*(6), 612-621.

[4] Dahlstrom, E., & Bichsel, J. (2014). ECAR Study of Undergraduate Students and Information Technology, 2014. *Educause*.

[5] Gaskell, A., and Mills, R. (2010). Can we really learn from mobile handheld devices? Theme: Social Justice. Sub-theme: Scaling up Quality Education for all, 2010.

[6] Gentile, D. A., Swing, E. L., Lim, C. G., & Khoo, A. (2012). Video game playing, attention problems, and impulsiveness: Evidence of bidirectional causality. *Psychology of Popular Media Culture*, *1*(1), 62.

[7] Hartnell-Young, E., & Heym, N. (2008). How mobile phones help learning in secondary schools. *Coventry: Becta*.

[8] He, Z., Zhong, C., Su, S., Xu, M., Wu, H., & Cao, Y. (2012). Enhanced power-conversion efficiency in polymer solar cells using an inverted device structure. *Nature photonics*, *6*(9), 591.

[9] Jegede, P. O., Dibu-Ojerinde, O. O., & Ilori, M. O. (2007). Relationships between ICT competence and attitude among some Nigerian tertiary institution lecturers. *Educational Research and Reviews*, *2*(7), 172-175.

[10] Keith Taber (2005). Developing teachers as learning doctors, *Teacher Development*, **9**, 2, (219),

[11] Lau, B. T., & Sim, C. H. (2008). Exploring the extent of ICT adoption among secondary school teachers in Malaysia. *International Journal of Computing and ICT research*, *2*(2), 19-36.

[12] Marriott, N., Marriott, P., & Selwyn, N. (2004). Accounting undergraduates' changing use of ICT and their views on using the Internet in higher education–a research note. *Accounting Education*, *13*(sup1), 117-130.

[13] Mensah, J. (2017). Pre-service teachers' use of laptops and tablets: A case study at Foso College

of Education. *Journal of Educational Management, 8,* 209 – 221.

[14] Murphy, A., Farley, H., & Koronios, A. (2013). Understanding the use of smart mobile technologies for learning in higher education. In *ASCILITE-Australian Society for Computers in Learning in Tertiary Education Annual Conference* (pp. 602-606). Australasian Society for Computers in Learning in Tertiary Education.

[15] Pilar, R. A., Jorge, A., & Cristina, C. (2013). The Use of Current Mobile Learning Applications in EFL. *Procedia-Social and Behavioral Sciences*, *103*, 1189-1196.

[16] Porter, G., Hampshire, K., Milner, J., Munthali, A., Robson, E., Lannoy, A.,& Abane, A. (2016). Mobile Phones and Education in Sub-Saharan Africa: From Youth Practice to Public Policy. *Journal of International Development*, *28*(1), 22-39.

[17] Selwyn, N. (2008). An investigation of differences in undergraduates' academic use of the internet. *Active learning in higher education*, *9*(1), 11-22.

[18] Shuler, C. (2009). Pockets of Potential: Using Mobile Technologies to Promote Children's Learning, *retrieved from:* http://www.joanganzcooneycenter.org/Reports-23.html.

[19] Usun, S. (2003). Undergraduate Students Attıtudes towards Educatıonal Uses of Internet. *Interactive educational multimedia: IEM*, (7), 46-62.

[20] Vavoula, G., Sharples, M., Lonsdale, P., Rudman, P., & Meek, J. (2007). Learning Bridges: a role for mobile technologies in education. *Educational Technology*, 33-37.

[21] Walmsley, A. D., White, D. A., Eynon, R., & Somerfield, L. (2003). The use of the Internet within a dental school. *European journal of dental education*, *7*(1), 27-33.

[22] Wendeson, S., Ahmad, W. F. W., & Haron, N. S. (2010, June). Development of mobile learing tool. In *Information Technology (ITSim), 2010 International Symposium in* (Vol. 1, pp. 139-144). IEEE.

[23] Yeboah, J., & Ewur, G. D. (2014). The impact of WhatsApp messenger usage on students performance in Tertiary Institutions in Ghana. *Journal of Education and practice*, *5*(6), 157-164.