Assessing College of Education Tutors Readiness to Integrate Hand Held Devices in Teaching and Learning of Science, Mathematics and Ict

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Abstract
The purpose of the study is to understand tutors knowledge, skills and current practices that are considered secured, emerging and aspirational in integrating hand held devices (HHDs) in teaching of science, mathematics and ICT in colleges of education. The convenient sampling technique was used, since the focus was on Science, Mathematics and ICT tutors in the College. Ten (10) Tutors who were available and willing to participate were conveniently sampled for the study. Questionnaires were the major tools used for data collection. It is concluded from the findings of the study that the knowledge and skills of the college of education tutors as far as the use of hand held devices to support learning are concerned is very high (secured). However, majority of the tutors needed knowledge and skills to effectively integrate HHDs in their practices as well as understand how to use YouTube videos as a resource for learning topics that are challenging to them. More so, tutors want to incorporate technological tools to plan sessions carefully to ensure productive use of time and meaningful learning in lesson delivery and to break down difficult concepts to make the subject accessible to pre-service teachers via HHDs.
Keywords: Handheld devices, ICT integration. Knowledge, skill, practices

Introduction
Governments over the world have increased funding as well as developed policies for information and communications technology (ICT) development. This is geared towards the improvement of teaching and learning using innovative technological strategies in institutions of learning, with which colleges of education are not left out. Handheld devices (HHD) are effective devices that have the ability to support learners in participating in multifaceted mathematical progressions (Zbeik, Heid, Blume & Dick, 2007). With the presentation of innovative technological advancements, there is an upsurge of awareness in training students to become knowledgeable and skilled, technologically, in preparation for their future involvement in a progressively computer inundated environment. Many schools today are starting to integrate technology as an integral portion of their course outline, thus technology incorporation in science, technology and mathematics is imperative in education. But the challenge is: Are tutors in our colleges of education in Ghana ready to integrate HHDs into their professional practice?

To ensure a successful take off and integration of HHDs into their practice, needs assessment is needed to identify what knowledge, skills and practices that they have which we could consider secured (thus, what tutors already have and can be used in their professional practice); emerging (thus, what tutors want to consolidate/know more about and to use in their practices) and finally Aspirational (thus, what they lack and want to acquire and use in their practices). The National Mathematics Advisory Panel (2008), is advocating for the crucial to expansion of the value of mathematics education obtained by all learners. This calls for innovative teaching strategies, with which integration of HHDs cannot be ruled out. Numerous components influence mathematics learning such as instructors' technical abilities and attributes of learners and their family members. One feature in which many school administrations have glossed over is integration of HHDs and whether college tutors are ready to effectively integrate same into their professional practice.

Far too many of us have witnessed how educational administrators spend so much money in more expensive technologies such as computers, projectors and huge monthly subscriptions for internet service which either collecting dust or not effectively used, but left out simple technologies which are readily available in the hands of tutors and students. Another serious challenge is the huge investment in computer labs, which in most cases are locked because there is no one trained to run them; students playing non-educational games on computers for hours on end. Literally millions of dollars and in cedis are being spent on providing computers, much of which are being wasted because teachers are not trained to use technology effectively.

It appears, around the world in developing and industrialized countries have shown that teacher training in the use and application of technology is the key determining factor for improved student performance (in terms of both knowledge acquisition and skills development enabled by technology). Educational technology is not an end in itself, but transformative on its own. It requires teachers who can integrate technology into the curriculum and use it to improve student learning. In other words, computers cannot take the place of tutors, but teachers are

the key in opening up the doors of technology in appropriate and effective ways that will harnessed the full potential of our students. That said, knowing the needs of tutors make imperative and a first step to transform teacher education for the 21st century. If teachers are to remain the gatekeepers for students' access to educational opportunities afforded by technology, then the knowledge, skills and practices of teachers in the technological age cannot and should not be ignored. Even though providing technical skills training to teachers in the use of technology is not enough, teachers need professional development in the pedagogical application of those skills to improve teaching and learning.

Across the globe, portable handheld devices are seen to be pervasive in business and social contexts in today's society and are now gaining grounds in educational contexts. ICTs; including cell phones, smart phones and other personal digital assistant devices continues to surge in usage. The United Nations (2010) report on cell phones had hit a record high of 67% by 2009, representing one of the most prevalent ICTs in the world. Currently, the ICT facts and figures for 2017 indicate that about '830 million young people representing more than 80 per cent of the youth population in 104 countries are online'. In developed countries, more than 90% of young people aged 15-24 years use the Internet compared with about 65% in developing countries and only about 30% in Least Developed Countries. Out of the about 800 million young people who are online, 320 million (39%) are in China and India. Nearly 90% of young individuals not using the Internet live in Africa or Asia and the Pacific which are relatively less developed as compared to China and India. The functions available through ICTs have also increased dramatically from simple call-only functions to texting, emailing, Internet access, multimedia services and the ability to download applications to personalize the use of the device to the needs of the individual user (Lefebvre, 2009; Woodcock, Middleton, & Nortcliffe, 2012). This gain of popularity, affordability, portability and flexibility of such devices is making it possible for educators to start considering and harnessing same for within and beyond the classroom (Crippen & Brooks, 2000; Liu, 2007; Motiwalla, 2007; Sharples, Arnedillo-Sánchez, Milrad, & Vavoula, 2009; Sharples, Taylor, & Vavoula, 2007).

The desire to incorporate new technologies as part of instructional practice has been brought about by observations which support their ability to motivate students, encourage persistence on challenging tasks, and personalization of the learning environment (Gee, 2009; Hartnell-Young, 2009; Looi et al., 2009; Specht, 2010; Specht, Howell, & Young, 2007). Incidental with these views about the potential of technological devices is educational reform which is shifting from viewing learners as passive receptors of information to a view that understands learners as self-regulated, active participants in the construction of knowledge (Abrami, 2001; Perry, VandeKamp., Mercer & Nordby , 2002; Scott, Cole, & Engel, 1992; Staub & Stern, 2002; Vygotsky, 1978). Mobile technology has the potential to support and encourage the view of the student as a "self-regulated learner" and constructivist approaches to pedagogy both within and beyond the classroom by assisting the learner to interact with his/her environment, make independent choices and regulate their own learning (Bishuzen, 2008; Perry & VandeKamp, 2001). In addition, Chen and Kinshuk, 2005; Evans and Johri, 2008; Hoppe, Joiner, Milrad, and Sharples, 2003; Norris and Soloway, 2008 have all espoused the potential for "anywhere, anytime", creative, collaborative construction of knowledge by students.

However, the potential promise of mobile technology as an innovative educational resource tool, there are concerns regarding whether tutors have the knowledge, skills and professional practices to integrate them successfully in educational environments. In addition, there are concerns that functions available through mobile technologies might inhibit or be detrimental for learning.

The Ghanaian education sector has identified the key role that ICTs can play in widening access to education, literacy education, facilitating educational delivery and training at all levels as recorded in the Ghana ICT for Accelerated Development Policy (ICT4AD, 2003). More so the Information and Communication Technology in Education (ICTE, 2015) recognises that the policy document must be centred around three (3) pillars, each of which should receive slightly different policy intervention and strategy to ensure effectiveness, namely: 'ICT as a learning and operating tool ; ICT as integrated into the teaching and learning; and ICT as a career option for students' . This is an acknowledgement of the need for ICT training and education in the schools, colleges and universities, and to improve the educational system as a whole. The education sector has fashioned the ICT Policy for Education to boost the use and development of ICT in service delivery particularly in education and vocational training. Two key objectives among several others are:

To facilitate the deployment, utilization and exploitation of ICTs within the educational system to improve on educational access and delivery and to support teaching and learning from primary school upwards; To modernize the educational system to improve the quality of education and training at all levels of the educational system and expanding access to educational, training and research resources and facilities (page 38).

Another key issue is the mobile penetration in Ghana. As in other countries around the world, the deployment of mobile telephones has been dramatic; Ghana had 21.2million mobile subscribers (Research ICT Africa [RIA] Ghana Survey, 2008). Despite this laudable policy objective and deployment of ICT, its implementation is slow and the adoption rate of mobile solutions in high schools is a non starter and also very slow at the tertiary level, notwithstanding the high usage of mobile phones. Currently in Ghana, there is

insufficient evidence based information on how mobile learning can be adopted in institutions of learning. A guiding approach that could be followed in implementing emerging technologies particularly in low resource areas is lacking. This is why it is worthwhile to conduct a need assessment among our tutors at the colleges of education on the knowledge, skills and practices on how HHD technology can be integrated into their professional practice.

Despite the availability of HHDs, the rapid growth in HHD access by teachers, availability of educational software, most Science, Mathematics and ICT Tutors appear to be reluctant in adapting and integrating them in teaching. Several limitations exist in its implementation: the theoretical and pedagogical underpinnings, sustainable integration into the colleges of education context; and, particularly, tutors' awareness in the knowledge, skills and current practices (e.g. Kearney & Maher, 2013). Others include lack of teacher support and training (Cochrane, 2012; Peng, Su, Chou, & Tsai, 2009). More so Tutors' knowledge, skills and current practices as well as Tutors support and training have been the least explored topics in HHDs research (Ekanayake & Wishart, 2014). Challenges related to teachers' adoption of HHDs have emerged from the fact that they are not prepared to be ready adopt and use efficiently the HHDs in the classroom.

It appears there is the need to have fuller understanding of the knowledge, skills and current practices of Tutors and to provide them with effective technology integration skills and best practices. It is against this background that needs assessment be conducted to identify the gray areas and to possibly provide a professional development program that can be implemented to address the challenges in integrating HHDs in science, Mathematics and ICT teaching in Colleges of Education in Ghana.

Purpose of the Study
The main purpose is to understand tutors knowledge, skills and current practices that are considered secured, emerging and aspirational in integrating HHDs in teaching of science, mathematics and ICT in colleges of education.

Research Question
1. What are the knowledge, skills and practices possessed by college of education tutors on the use of hand held devices in teaching and learning?
2. What are the skills, knowledge, and practices that are needed by college of education tutors as far as the use of hand held devices are concern in teaching and learning?

Research Design
The researchers employed a survey design. The survey questionnaire is based on three components, namely knowledge, skills and current practices. The data was then analysed for descriptive statistics using the statistical software package called Statistical Package for the Social Sciences (SPSS version 16).

Population and Sample
The convenient sampling technique was used, since the focus was on Science, Mathematics and ICT tutors in the College. Ten (10) Tutors who were available and willing to participate were conveniently used for the study.

Reliability of Instruments
The survey instrument format was adapted from the TESSA Skills to support active participation in learning. The survey instrument was modified so as to make the statements suitable to the context of integrating HHDs into teaching. The survey instrument was a Likert scale (1–3) with interpretation from 1 being "Secure" 2, - 'Emerging' and 3- 'Aspirational' were used for all constructed items. The Cronbach alpha (α) reliability was conducted and was found to be .935 for the 23 items, suggesting a very high reliability of acceptance.

Results and Discussion
In order to respond to the needs of the study, descriptive statistics by way of frequency counts and percentages were ran. The findings and discussions are broadly put into two categories namely Knowledge, Skills and Practices possessed by College Tutors (secured) and Knowledge, Skills and Practices that are needed by College Tutors (Emerging and Aspirational).

Knowledge, Skills and Practices possessed by College Tutors
To assess the knowledge of college Tutors in considering pre-service teachers as individuals and needed different strategies to learn, they were asked to indicate whether they have knowledge that are considered secured, emerging and aspirational to the statement *'My knowledge of pre-service teachers as individuals allows me to make them search for text, audios and videos of relevance to course content'*. The result is presented in Table 1.

Table 1: Tutors knowledge of pre-service teachers as individuals with various modes of learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	7	70.0	70.0	70.0
	Emerging	3	30.0	30.0	100.0
	Total	10	100.0	100.0	

Majority of the respondents indicated that they were familiar with individual differences and might not be considering a fit for all methodology for all manner of students.

To assess the college Tutors awareness of HHDs as powerful learning tool, they were asked to indicate whether they have knowledge that are considered secured, emerging and aspirational to the statement '*My knowledge of HHDs as powerful learning tool*'. Table 2 shows how they responded to the item.

Table 2: college tutors knowledge of HHDs as powerful learning tool

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	8	80.0	80.0	80.0
	Emerging	2	20.0	20.0	100.0
	Total	10	100.0	100.0	

The result showed that college 80% of the Tutors are much aware of the educational benefits of HHDs except that they might not have been skilled enough to integrate them into their practices. This assertion suggests that instructional strategies are important for effective integration of HHDs. Besides HHDs have the tendency to motivate, engage and to offer opportunities to pre-service teachers regulate their own learning. This view is espoused by Bishuzen (2008); Perry and VandeKamp (2001), when they concluded that mobile technology is not only offering them the potential to support and encourage independent learning but also independent choices. It appears Researchers need to focus on how to integrate mobile devices with instructional strategies. Doing so will not only make HHDs more visible but position tutors to use them to enhance learning outcomes.

To assess College Tutors knowledge of HHDs as a tool to support learning everywhere, they were asked to indicate whether they already have this knowledge/skill, and are using it regularly in their practices. The result is presented in Table 3.

Table 3: College Tutors knowledge of HHDs as a tool to support learning everywhere

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	6	60.0	60.0	60.0
	Emerging	3	30.0	30.0	90.0
	Aspirational	1	10.0	10.0	100.0
	Total	10	100.0	100.0	

The result showed that 60% thought they were well secured in that view with 40% indicating they needed to acquire that idea by way training. Majority of the respondents are mush aware of potential of HHDs to support learning everywhere, have various distinctive features such as individualized interfaces, real-time access to information, context sensitivity, instant communication, and feedback, but are not putting that into practice. This might just be that they do not know how instructions could be arranged to offer pre-service teachers such affordances.

To ascertain college tutors skill in downloading educational materials onto their HHDs, they were asked select among secure, emerging and aspirational in terms of their knowledge, skill and practices to downloading educational materials onto their HHDs. Table 4 gives a summary of the results.

Table 4: College Tutors skill in Downloading educational materials onto HHD

	Frequency	Percent	Valid Percent	Cumulative Percent
Secure	7	70.0	70.0	70.0
Emerging	3	30.0	30.0	100.0
Total	10	100.0	100.0	

As much as 70% of the respondent said they could do that, but find it difficult to make it mandatory in their teaching profession. Personal communications with some of the respondents indicate that for topics that are challenging, they resort to the internet for extra briefing before going to teach. One may wonder why such knowledge, skills and practices are not extended to their students such that, when certain concepts are not well understood in class, they could also search the net as when the need arises. Technology in the classroom should extend beyond voice calls, social media engagement and web browsing, to tools that allow more learners to master difficult concepts as they explore and interact with data and ideas in real time.

'I can download, store and retrieve relevant text and graphics in appropriate formats for use in lesson delivery' was used to assess College Tutors skill in downloading, storage and retrieval of relevant text and graphics in appropriate formats for use in lesson delivery. Table 5 contains the result of the generality of their skills.

Table 5: College Tutors skill in downloading, storage and retrieval of relevant text and graphics in appropriate formats for use in lesson delivery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	8	80.0	80.0	80.0
	Emerging	1	10.0	10.0	90.0
	Aspirational	1	10.0	10.0	100.0
	Total	10	100.0	100.0	

This statement appeared to be very familiar with most respondents. It is an admission of how knowledgeable and skillful they are in this respect, but are woefully failing to extend that knowledge and skill to their students. This state of affairs requires conscious effort to make this a learning resource either than for the fun of it.

To assess College Tutors skills in the use of various strategies to save YouTube videos, they were asked to indicate how secured they were in doing so or want to consolidate/know more about this or want to acquire this skill and use it in their practice. The outcome of their preferences is shown in Table 6.

Table 6: College Tutors' strategies to save YouTube audios and videos

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	6	60.0	60.0	60.0
	Emerging	2	20.0	20.0	80.0
	Aspirational	2	20.0	20.0	100.0
	Total	10	100.0	100.0	

Sixty percent (60%) of the college tutors indicated how able they are in using various strategies to save YouTube audios and videos, but same is not being put into their professional practices. The key question is: are they trained enough to easily integrate it into the teaching and learning environment.

To ascertain College Tutors skills in locating relevant information on the internet, Tutors were asked to indicate how skilful they were in searching for information on the internet and the result is presented in Table 7.

Table 7: College tutors ability to search for information on the internet

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	7	70.0	70.0	70.0
	Emerging	3	30.0	30.0	100.0
	Total	10	100.0	100.0	

Although most Tutors indicted how knowledgeable and skillful they were in the items stated in Table 1 to Table 7, none of them were actually using the knowledge and skills in their practice. To use digital technology as a cognitive tool in knowledge construction, tutors showing signs of acknowledging technology as a learning tool and will need to be giving some kind of training to be able to incorporate it into the classroom.

Knowledge, Skills and Practices that are needed by College Tutors
Although the statements were many, five statements that warrant our attention is reported here because of the larger percentage of tutors who needed to have the knowledge, skills and practices in teaching and learning.

Table 8: Tutors ability to break down difficult concepts to make the subject accessible to pre-service teachers through the use of HHDs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	4	40.0	40.0	40.0
	Emerging	5	50.0	50.0	90.0
	Aspirational	1	10.0	10.0	100.0
	Total	10	100.0	100.0	

Six (6) tutors representing 60% indicated they want to acquire this knowledge and to use it in teaching (as in Table 8). As many as 5 of the 6 tutors want to consolidate/know more about this and use more in their practice. This suggests that tutors are more interested in how to present concepts in smaller bits and easily available to

students anywhere they find themselves for easy referencing.

In order to measure tutors professional practice in using the various affordances of HHDs in learning, they were asked to indicate whether they were familiar with the difficulties in the use of the various functions of HHDs as a learning aid. Their responses are presented in Table 9. From Table 9, it can be seen that majority of the tutors were not quite sure of the difficulties pre-service teachers face in using the various functions of the HHDs. However the expressed interest in understanding these difficulties in order to eliminate or reduce the difficulties.

Table 9: Tutors knowledge of difficulties in the use of the various functions of HHDs as a learning aid.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	2	20.0	20.0	20.0
	Emerging	7	70.0	70.0	90.0
	Aspirational	1	10.0	10.0	100.0
	Total	10	100.0	100.0	

To determine whether tutors were equipped enough to effectively manage the potential distractions that may occur in the use of HHDs, tutors were required to indicate how secured, emerging or aspirational their knowledge, skill and practices were. Majority of the tutors (70%) of them as in Table 10 said they want to consolidate/know more about this and to acquire the knowledge or skill as well as use it in their practice. The potential distraction of HHDs is not something they can manage and needed to learn more or acquire some kind of skill to guide against that.

Table 10: Tutors ability to planning sessions carefully to ensure a productive use of time and meaningful learning in to incorporating HHDs in lesson delivery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	3	30.0	30.0	30.0
	Emerging	5	50.0	50.0	80.0
	Aspirational	2	20.0	20.0	100.0
	Total	10	100.0	100.0	

To test how competent college tutors were in incorporates technological tools to enhance lesson delivery, they were asked to indicate how secured, emerging or aspirational they agree to the statement 'My practice of how to ensure that every lesson I plan incorporates technological tools to enhance lesson delivery'. The result is presented in Table 11.

Table 11: Tutors ability to incorporates technological tools to enhance lesson delivery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	4	40.0	40.0	40.0
	Emerging	5	50.0	50.0	90.0
	Aspirational	1	10.0	10.0	100.0
	Total	10	100.0	100.0	

Six (6) tutors said they want to consolidate/know more about this and to acquire the knowledge or skill as well as use it in their practice. This shows that respondents do not have the know how to incorporates technological tools to enhance lesson delivery.

Table 12: Tutors practice of how to use YouTube videos as a resource for learning topics that are challenging them

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secure	4	40.0	40.0	40.0
	Emerging	4	40.0	40.0	80.0
	Aspirational	2	20.0	20.0	100.0
	Total	10	100.0	100.0	

A total of six (6) tutors indicated they want to acquire the skills in using YouTube videos as a resource for learning topics that are challenging to teach. This means that majority of the tutors do not have the requisite skills in using YouTube videos as a resource for learning topics that are challenging to them.

Findings

The findings of the descriptive survey are that:

1. Knowledge possessed (secured):
    a. Majority of the respondents indicated that they were familiar with individual differences and might not be considering a fit for all methodology for all manner of students.
    b. Tutors are much aware of the educational benefits of HHDs except that they might not have been skilled enough to integrate them into their practices.
    c. Most Tutors were quite familiar with HHDs as a tool to support learning everywhere.
2. Skills possessed (secured):
    a. 70% of the respondent said they could download educational materials into HHDs.
    b. Majority of College Tutors were very skillful in downloading, storage and retrieval of relevant text and graphics in appropriate formats for future use in lesson delivery.
    c. 60% of the college tutors indicated how able they were in using various strategies to save YouTube audios and videos, but same is not being put into their professional practices.
    d. Most college tutors were skillful enough to search for information on the internet.
3. Practices needed (emerging and aspirational):
    a. Sixty (60%) of the Tutors said they want to be able to break down difficult concepts to make pre- service teachers easily access the content using HHDs.
    b. Most tutors were not quite sure of the difficulties pre-service teachers face in using the various functions of the HHDs
    c. The potential distraction of HHDs is not something they can manage and needed to learn more or acquire some kind of skill to guide against that.
    d. Respondents did not have the know how to incorporates technological tools to enhance lesson delivery.
    e. Majority of the tutors did not have the requisite skills in using YouTube videos as a resource for learning topics that are challenging to teach.

Conclusions

The purpose of the study was to understand tutors knowledge, skills and current practices that are considered secured, emerging and aspirational in integrating HHDs in teaching of science, mathematics and ICT in colleges of education. It is concluded from the findings of the study that the knowledge and skills of the college of education tutors as far as the use of hand held devices to support learning are concerned is very high (secured). However, majority of the tutors needed knowledge and skills to effectively integrate HHDs in their practices as well as understand how to use YouTube videos as a resource for learning topics that are challenging to them. More so, tutors want to incorporate technological tools, to plan sessions carefully to ensure productive use of time and meaningful learning in lesson delivery and to break down difficult concepts to make the subject accessible to pre-service teachers via HHDs.

Implications

Based on the findings of this study, it is proposed that more elaborate instructional design development is needed to make HHDs more thoroughly exploited to bring out the educational benefits there in. We believe that when tutors are well equipped with knowledge, skills and professional practices on how to plan, implement and evaluate this innovative strategies, the benefits could be very immerse. There could also be policy implications for class room practices and management as to how to guide and direct HHDs in our Colleges of education.

Limitation of the Study

The views shared here were derived from ten tutors who are teaching Science, Mathematics and ICT and might not necessarily be reflecting the total views of College tutors across all courses in Ghana.

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