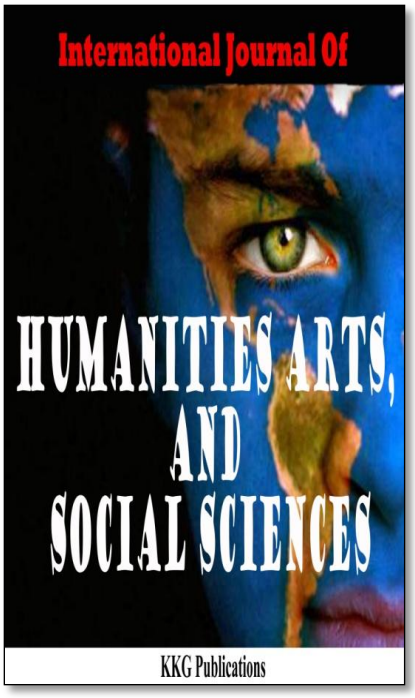

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Martha Chadyiwa[1], T. Mgutshini[2]

[1, 2] University of Johannesburg, South Africa

Published online: 15 August 2015

To cite this article: Chadyiwa, M., & Mgutshini, T. (2015). Using mobile handheld devices as tools of learning and teaching for Student EHPS: A blessing or a curse? *International Journal of Humanities, Arts and Social Sciences*, *1*(2), 85-91.
DOI: https://dx.doi.org/10.20469/ijhss.20005-2

To link to this article: http://kkgpublications.com/wp-content/uploads/2015/12/IJHSS-20005-2.pdf

KKG PUBLICATIONS

International Journal of Humanities, Arts and Social Sciences

IJHASS

2015, 1(2), 85-91

USING MOBILE HANDHELD DEVICES AS TOOLS OF LEARNING AND TEACHING FOR STUDENT EHPS: A BLESSING OR A CURSE

Martha Chadyiwa[1*], T. Mgutshini[2]

[1, 2] University of Johannesburg, South Africa

Keywords:
Specialised Education
Disciplines
Education Institutions

Received: 7 May 2015
Accepted: 10 June 2015
Published: 15 August 2015

Abstract. This paper presents a review of literature and emerging evidence on the use of handheld devices as tools for learning and teaching in the training of Environmental Health Practitioners (EHP). It will present an evidence based discussion on the use of handheld devices (HHDs) in the training of EHPs in tertiary education institutions and explore how compatible the use of HHDs devices is in the training and holistically preparing a functional EHP. In presenting this review, an introductory analysis of the current usage of HHDs in different disciplines in higher education is offered. The primary focus is on the specific usage of HDDs within the specialised education of Environmental Health Practitioners. The advantages of using HHDs include easy access to learning resources anytime at any place and interaction between learners and lecturers on discussion forums. Evidence on their use for EHP training concurs with the observed advantages from other discipline areas however, the specialised nature of EHP competencies presents unique challenges, each of which are explored in the context of widely accepted competencies of a functional graduate EHP. This paper presents the primary challenges that exist for EHP graduate training and within that, proposes the range of corrective actions that should be considered to maximise the benefits that may exist from the use of handheld devices (HHDs) in the training of EHPs in tertiary education institutions.

INTRODUCTION

The changes in the pedagogical and teaching practices globally have inevitably driven an increased use of Hand Held Devices (HHDs) as key tools of teaching in schools and institutions of higher learning. Several studies including (Sharples & Milrad, 2007; Cummings, Merrill & Borrelli, 2010; Baranin, 2014) offer empirical insights into the effectiveness of these tools in the teaching of all subject and discipline areas. Such is the promise from the use of these devices that, many literature sources have universally declared the modernization of teaching and learning through HDDs use represents one of the most promising developments in education (Ng & Nicholas, 2013). These optimistic assessments are broadly presented with little focus on the variations that may exist for the education and training of one discipline to the next. Driven by the need for a more critical evaluation of the contributory possibilities of HDDs, this paper presents debate review of studies that were conducted to explore the use of HHDs in learning activities at institutions of higher education with a specified emphasis on their utility for EHP training (Li, Han, Kang, Lu & Black, 2009).

Since the move towards the use of mobile devices and with mobile phones becoming a necessity and not a luxury among the young generation, universities and other institutions found themselves presented with an array of sophisticated mobile HHDs which the young regard as essential for carrying out a range of tasks including learning (Blackwood & Anderson, 2004). This was mostly common among the youth in the developed world. However in many African countries mobile phones were in the early 2000 being banned from schools amidst concerns regarding their inappropriate use during school hours. After the continued use of the mobile phones worldwide, the mobile phone became the most important networked knowledge exchange technology used internationally including also in Africa. Mobile devices became the most powerful universally-accessible computing device in the hands of Africans thus making it easy to adopt as a tool for learning and teaching (Ford & Batchelor, 2007).

When access to the mobile devices become a common phenomenon, an increasing number of school teachers also started using handheld, or palmtop, computers in the classroom as an integral means of facilitating education due to the flexibility, mobility, interactive learning capability, and comparatively

*Corresponding author: Martha Chadyiwa
E-mail: mchadyiwa@uj.ac.za

inexpensive cost (Wu & Zhang, 2010). This use of the HHD became wide spread from primary, secondary and tertiary institutions because there was a wide range of universally accessible computing devices. As such in this revolutionized world of technology, the need to introduce the use of HHDs was aimed at influencing students' attitudes and perceptions towards use of technology, creating an environment of a positive image surrounding the use of HHDs on campus, and facilitating the use of these devices.

The asserted viewpoint that the use of technology made learning easier and fun was supported by El-Gayar in his study where findings indicated that the use of HHDs created a positive learning environment amoung learners in institutions of higher education (El-Gayar, Moran & Hawkes, 2011). The use of these devices was obviously aimed at making learning more interesting and preparing the graduates for the work environment on completion of the diploma or degree. One of the first survey that was conducted to ascertain the use of HHD amoung scholars indicated that 20 percent of 208 respondents owned Internet-capable cell phones for academic and social use. The respondents indicated they wanted the following services: "booking group study rooms, checking hours and schedules, checking their borrower records and checking the catalogue." A second survey was conducted a year after the library had implemented a group study room reservation system, catalogue and borrower record services, and a computer/laptop availability service. Results of the follow-up survey showed a drastic increase in ownership of Internet capable cell phones (from 20% to 65%)(Cummings et al., 2010). A related study by Cheung and Hew, highlighted that the HHDs were used exclusively only for the following: multimedia access tools, as a communication tool, capturing tool, representational tool, analytical tool, assessment tool and task management tool (Cheung & Hew, 2009). Other uses where confirmed in related empirical evidence for example Cummings examined an academic library user population and the potential demand for using the library's catalogue with handheld mobile computing devices (Cummings et al., 2010). The results indicated that a total of 58.4 percent of respondents who owned a web-enabled handheld device used it to search library data bases.

Globally instructional designers and educators recognize the potential of using HHDs as learning tools for students and have incorporated them especially for mobile distance learning environment (Park, 2011). According to Park (2011) little research was done to categorize the numerous examples of use of HHDs for mobile learning in the context of distance education. However few instructional design guidelines based on a solid theoretical framework for mobile learning exist (Park, 2011). The use of the HHDs as supported by the studies above will enhance learning and teaching but are these the only basic competencies a graduate should possess on completion of a diploma?

There is literature showing that in some disciplines of sciences, the use of HHDs produces noteworthy benefit. Research that was conducted at an institution of higher education in a developed country found that the iPad, though it was not yet as integral to academic life as a computer, was a powerful tool in aiding collaboration, encouraging organization, and assisting learning regardless of field or level of academic achievement (Eichenlaub, 2011). There was a controlled research by Morris et al. (2012) investigating undergraduate biological sciences students' use of technology and computer devices for learning and the effect of providing students with a tablet device. This controlled study was conducted to collect quantitative and qualitative data on the impact of a tablet device on students' use of devices and technology for learning. Overall, it was noted that students made extensive use of the tablet device for learning, using it in preference to laptop computers to retrieve information, record lectures, and access learning resources easily (Morris, Ramsay & Chauhan, 2012).

In the field of engineering, HHDs were a preferred tool for learning as it facilitated to give precision to measurements to the last millimeter on a ruler. Enlarging small sections of equipment was probable on simulated machinery. This made it constructive to the learners as this would make it possible to scrutinize safely without fear of being injured by moving equipment as it is in the actual practical. The students that were studying Information technology were also appreciating the use of HHD for learning purposes as it gave them an opportunity to work with the devices that they would have to work with on completion of their studies. The hands on experience with the HHD during the learning process made them confident to face work environment where they were preparing then to endeavour into to work. The activities that they would do on simulation was possible to attempt on their HHDs.

In another discipline of Health science, students showed that the use of the HHDs in learning was a combination of both practical and not so much practical. In a related research by Mickan, some health science students in the field of medicine stated that handheld devices provided instant access to vast amounts and types of useful information for health care professionals. The reduced size and increased processing speed of the HHDs led to their rapid adoption in health care (Mickan, Tilson, Atherton, Roberts & Heneghan, 2013). It was interesting to note that wireless handheld devices (WHD) were an important tool in nursing environments that are undergoing rapid technological change.

However a study by Martyn, Larkin, Sander, Yuginovich and Jamieson-Proctor (2014) found that connectivity difficulties, technology literacy level, compatibility of study resources with the WHDs, and small screen size were all factors that impacted negatively on the use of iPods in educating of the nurses in distance courses. This study concluded that nursing students and nursing educators alike though in the field of health sciences, may experience problems when WHD's are introduced to courses as a platform for learning (Martyn et al., 2014).

Impact of the Use of HHDs on Learning and Teaching

In the recent years more South African matriculates qualify to further their education at institutions of higher education. This means that the lecturer: student ratios have increased over the years making the one on one interactions less and less. The introduction of HHDs makes it possible to improve the one on one contact as students are able to record lectures and view them on their own time and note questions which they can post on the interactive links for the different subjects. Access to the learning resources is available from anywhere at any time thus beneficial to the learner. Those that take time to understand even have an opportunity to review lectures and discuss with other colleagues the things they do not understand. In the past when people started using HHDs, another benefit of using HHDs is the improvement in the mobile communication and mobile collaboration amoung learners. Another pedagogical benefit of using HHDs is experienced mostly by part-time students that do not have to carry around heavy books to work then to school afterwards, now they only carry one device with all lectures, notes and e-books. The less attentive students in class also get to review lectures at their own pace. Use of HHDs encourages the participation of some passive students that feel at ease with the anonymity when answering questions and asking for clarity during online class sessions (Guthrie et al., 2004). These benefits are still being expressed by scholars even in 2015 according to an unpublished study from an institution of higher education in SA.

However the use of HHDs can make access to information available for all day resulting in an overload of theoretical information. The continued communication on the platforms by all students may also result in an overload of interaction which may cause confusion (Motiwalla, 2007). Since HHDs are personal, and access can be for twenty four hours over the whole week, this may result in headaches and chaotic behaviour amoungst learners. On the other hand some learners can experience unstable and unreliable connectivity which can paralyze learning. This can also impact on the updating of apps, resulting in other learners having outdated technology thus impacting on their learning experience. Outdated apps become unreliable and unstable on application of software (Rossing et al., 2012).

Students in South African institutions are coming from diverse backgrounds, with a majority coming from previously disadvantaged families. These are already struggling paying school fees and maintain their general up keep as a student. Their experience with the HHDs is restricted to learning and teaching on campus where there is free access to WIFI. It can therefore be concluded that the exposure to the use and interaction with the HHDs is limited. An enquiry by Rossing, Miller, Cecil and Stamper (2012) proved that there is an "app gap" between learners in the lower income group and those in the high income group (Rossing et al., 2012). The findings highlighted that those learners who do not have enough funds to access the learning resources on the different apps can have a sense of isolation on technology as they will not be familiar with current technologies. This is a huge challenge that has to be addressed especially with SAs history of discrimination of marginalised populations.

Another shortcoming of using these HHDs is that they all come in different types and lack homogeneity. It becomes difficult to integrate the existing software and systems with a wide range of HHDs. An example of such a software is A.D.A.M. for the teaching of anatomy and physiology for health science students. This software is compatible with some handheld devices and not apple products. Meanwhile the learning is expected to be from case studies and simulations uploaded on to these devices. This is where the question is being posed, are they getting enough exposure as EHP's to be able to practice on completion of their Diploma. As described in the scope of practice, this profession is mostly based on interaction with people and being able to establish relationships with the community where one will be working.

There are opportunities that can be exploited from the use of HHDs in institutions of higher education. Lecturers can be recorded and watched over and over again which can be beneficial to the understanding of concepts that are not easy to comprehend. Some case studies that can be uploaded can have instructions to follow in an assignment making them self-directed thus easy to follow. According to Blackwood, lectures can be pre-recorded and these can be used for part-timers and distance learning students, even those that would miss class due different reasons will get the opportunity to watch the pre-recorded sessions on the HHDs and be on the same stage as those present on the day of the lecture (Blackwood & Anderson, 2004). The use of HHDs also encourages creative learning, collaborative critical and communication engagement amongst students as supported by a study by (Cobcroft, Towers, Smith & Bruns, 2006). In other studies, the use of handheld devices opened room for discovery thus opportunity for research in the real world problem solving. A study by Rossing (2012) highlighted a number of opportunities when using handheld devices which include collaborative learning, introduction of new learning tools with dynamic learning, designing of elements that include more learning styles and a variety of apps (Rossing et al., 2012)

It must be noted that the use of HHDs may be more effective in other domains than in others. For example, in the training of students that are studying information technology and other also other health sciences programmes but there is need to assess if it will be as beneficial for student EHPs. The focus on the simulations and case studies used on HHDs may deprive some students' hands on practical human interaction required to make a functional practitioner. The development of interpersonal skills will not be well developed as real life situations may not be as perfect and predictable as simulations used during training on handheld devices. Another threat that can prevail is over reliance on technology for solutions when common sense can be applied

to solve problems in the community by EHPs.

A Case of HHDs Use in Training Student EHP at a University

Reference is given to a comprehensive University in South Africa that has also joined the global world in the implementation of the use of HHDs in learning and teaching. At this institution, all faculties rolled out the use of HHDs for learning and teaching in 2014. These included the faculty of Health Sciences where the department of Environmental Health is housed. In the Faculty of Health Sciences all the departments have embraced the roll out handheld devices as a tool for learning and teaching. Emphasis was being put on the lecturers to use the handheld devices as a mode of presenting lecturers and also assessing students' competences of knowledge taught in classrooms.

To determine the perception of student EHPs on the use of HHDs in the department, a qualitative study was conducted at an institution of higher education that introduced the use of HHDs for learning purposes in 2014. A total of 115 students who fall under the age group of 18- 25 years old and registered for first and second years was used. A questionnaire was administered to the sample that is supposed to be exclusively using the HHDs in 2015.

TABLE 1
Composition of the Graduate Sample

Department	Year of study	Total number of students
Environmental Health	2nd	62
Environmental Health	3rd	53
		115

Out of these students, 100% had HHD devices which they used every day for class activities and general communication. This outcome clearly supports the notion by Cummings (2010) and Blackwood and Anderson (2004) that the young generations considers having a HHD as a necessity. The issue of access to internet seems to be a global challenge as results of this study showed that 75% of the students had access to the HHD on and off campus via WIFI and data from several service providers, which included MTN, CELLC and Vodacom to mention just but a few. This means that although students have HHDs, they may not be able to use them if WIFI and data is not available. The students that are likely to the disadvantaged are those coming from the marginalised family where affordability is an issue.

The general perception of students on the advantages of using HHD was mostly biased towards it being convenient to use and carry around campus and home. This was very important for students as the HHDs has multipurpose which include communication via social media. The students did not think the use of HHDs made the learning experience any better, however 47% of the students indicated that the use of HHDs made the learning experience more interesting and easy to comprehend concepts.

The young generation considers using HHDs as crucial and this was proven by the fact that even though they did not think that it made learning any easier, 93% of the students said they would strongly recommend the continued use of the HHDs in the teaching of their course as the world is moving towards that technology era and they would want to be able to fit in. This phenomenon is supported by El-Gayar et al. (2011) in his research where he established that indeed scholars thought that the use of HHDs brought fun to learning.

There was an interesting outcome from this research which was unexpected; asked whether students thought using HHDs for learning yielded any benefits for them as practitioners in the field, 78% of them strongly disagreed citing the fact that other than for planning and communication purposes they do not see any other function of an EHP that requires the use of HHDs. Although emphasis on possessing the gargets was given stating that it was a good to have for every practitioner.

This survey opened opportunities for further enquiry to check if on completion of the National Diploma in environmental Health, would the skills acquired during the learning process using HHDs any good at all for an EHP in the field. This further assessment will be conducted to practicing EHP who would have gone through the curriculum where HHDs are used for learning and teaching.

Scope of Practice of EHPs

The scope of practice for EHPs in South Africa is defined by the Health Professions Council of South Africa (HPCSA) and this was reviewed in the regulation No. R 123 of 8 February 2008 (Gazette, 2008). According to this regulation the key performance areas of an EHP are as follows:

1. Water quality monitoring
2. Food control
3. Solid waste management

4. Health surveillance and prevention of communicable diseases excluding immunisation
5. Vector control
6. Environmental pollution control
7. Disposal of the dead
8. Chemical safety
9. Noise control
10. Radiation and ionising and non-ionising monitoring and control
11. Port health
12. Malaria control
13. Control of hazardous substances

Looking at these key performance indicators it means that a functional EHP must be able to penetrate communities to collect samples, information and analyse that for implementation of control measures. From the above statement it means that exposure to HHDs will only help in the analysis of the collected data and organisation as these are the highlighted main use of HHDs during learning and teaching at higher education according to (Nie, 2006). This means that there are other fundamental competency other than that learnt from use of HHDs, that an EHP need to possess. An example is the interpersonal skills to establish rapport with relevant members of the society to gain access and collect samples, collect data, implement mitigatory measures, implement surveillance programmes and control of disease outbreak.

General Graduate Competencies

To be able to establish the relevance of the use of HHDs in learning and teaching of student EHPs, we need to look at the scope of practice of the EHP in the field and compare it to the general competencies that a university graduate is expected to have. In order to do that, a compilation of the graduate competencies was done.

Work competences are not a likelihood of success when carrying out work, but rather the real and demonstrable ability to do things (Freire Seoane & Teijeiro Alvarez, 2010). It is the productive ability of an individual defined and measured in terms of performance during a particular work context, and not only of knowledge, skills, abilities and aptitudes; these are necessary but not sufficient by themselves to effectively perform a job.

According to Seoane and Alvarez (2010) competences are classified as generic and specific:

- Generic competences are those referring to transversal competences, transferable to many functions and tasks.
- Then, specific competences are those directly related to a particular occupation.

This is also supported by other authors who state that generic or transversal competences are common to most professions and are related to the implementation of aptitudes, personality traits, acquired knowledge and values, required in various occupational areas and are transferable between different activities within a sector (Lee et al., 2010). When we look at the learning and teaching in higher institutions of learning transversal competences are usually forgotten and neglected. However, the competence in transversal skills is considered by employers thinking about hiring a university graduate as important as technical knowledge. Studies that were conducted by Sanchez supported this perception when they looked at the assessment that were given to engineering students on completion of their studies (Sanchez et al., 2011).

The other important competences of a graduate are instrumental competences. These are cognitive, methodological, technological and linguistic abilities(Freire Seoane & Teijeiro Alvarez, 2010). These are necessary for understanding, construction, operation and critical use in different professional activities. These competences are the skills and training of a university graduate and can be summarized as:

- Basic general knowledge.
- Basic knowledge of the profession.
- Ability to analyse and synthesize.
- Ability to organize and plan.
- Problem solving.
- Decision making.
- Oral and written communication in the native language.
- Oral and written communication in a second language.
- Basic skills in handling a computer.
- Skills in managing information.

Apart from having the above mentioned instrumental competences, a graduate should also possess interpersonal competences. These are related to one's ability to relate with others socially and to form part of different groups, as well as the ability to carry out work in specific or multidisciplinary groups. They are summarized as:

- Ability to critique and self-criticism.
- Teamwork.
- Interpersonal skills.
- Ability to work in interpersonal groups.
- Ability to learn.
- Leadership qualities.
- Ability to adapt to new situations.
- Ability to work independently.
- Responsibility at work.
- Motivation about work.
- Self-esteem.

The final competences that a graduate is expected to have are systemic competences. These are skills relative to the systems (combination of understanding, sensitivity and knowledge), but require prior acquisition of instrumental and interpersonal skills (Clarke, 2010). In general, they refer to the individual qualities, as well as to having motivation for work:

- Ability to apply theoretical knowledge to practical situations.
- Research skills.

Competences of Graduate EHP

On scrutinising the graduate competences and the scope of practice of an EHP, one can appreciate that functional EHPs do not only require the hard graduate competences to execute their duties but also the soft ones. From the description outlined above, it can be concluded that the hard skills can be learnt via the use HHDs whereas the soft skills require practical experience and personal interaction. It is apparent that the use of HHDs as a tool for learning and teaching has benefits to the students. They may offer a learning experience that will add value to the hard skills of a functional EHP. On the other hand, case studies and work integrated learning provide the platform for learning the soft skills.

In summary from my point of view, the key competencies that a functional EHP should possess are outlined in table 2 with the activities that they have to perform in field.

TABLE 2
Key Competencies Required by EHPS

EHP Competencies	Activities Performed by EHP
Precise	Sample collection
Excellent interpersonal skills	Communication with different levels of people in the society for effective surveillance
Observant	Anticipate potential hazards
Critical thinker	Implement control programmes
Analytical	Data analysis

RECOMMENDATIONS

From the findings of this review I recommend a balance on the use of HHDs for learning and teaching and work integrated learning that promotes human interactions. Such kind of exposure will develop a holistic practitioner with all the required competences in the field in line with their scope of practice. The development of the curriculum for EHP training should incorporate the two aspects, use of technology and interpersonal skills development.

The entire dependency on the simulation exposure on the HHDs is a western behaviour that may not complement the African tradition of 'Ubuntu'.

For example, one of the key competencies that an EHP should possess is being able to communicate effectively with relevant figures in the society which is in line with the African tradition. A good example would be the need to communicate with the heads in the society such as chiefs so as to penetrate the village and provide health education.

CONCLUSION

In conclusion the use of HHDs in the learning and teaching of student EHP has both advantages and disadvantages. As noted, student EHPs prefer to continue learning with the use of HHDs although there is limited evidence that it produce a more suited candidate for the working industry as such. It was observed that the exclusive use of HHDS without work integrated learning tends to indirectly limit the human interaction aspect which are regarded as crucial for a qualified EHP. Comparing the scope of practice of EHPs and the excepted competences of a university graduate we can clearly see that the use of HHDs without personal experience during work integrated learning may not add any significant benefit to the graduate required competences. Although there are several advantages to the use of technology, human interaction must not be neglected in the learning and teaching at institutions of higher education. A combination of both use of technology and exposure to real life situations will produce a holistic graduate with all the necessary competences and will be able to function in the field on completion of the diploma/degree.

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— This article does not have any appendix. —