Use of mobile learning technology among final year medical students in Kenya

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Abstract

Introduction: Mobile phone penetration has increased exponentially over the last decade as has its application in nearly all spheres of life including health and medical education. This study aimed at assessing the use of mobile learning technology and its challenges among final year undergraduate students in the College of Health sciences, University of Nairobi. Methods: This was a cross-sectional descriptive study conducted among final year undergraduate students at the University of Nairobi, College of Health Sciences. Self-administered, anonymous questionnaires were issued to all final year students in their lecture rooms after obtaining informed consent. Data on demographics, mobile device ownership and mobile learning technology use and its challenges was collected. Data entry and analysis was done using SPSS®. Chi-square and t-test were used for bivariate analysis. Results: We had 292 respondents; 62% were medical students, 16% were nursing students, 13% were pharmacy students and 9% were dental surgery students. The majority were female (59%) and the average age was 24 years. Eighty eight percent (88%) of the respondents owned a smart device and nearly all of them used it for learning. 64% of the respondents used medical mobile applications. The main challenges were lack of a smart device, lack of technical know-how in accessing or using apps, sub-optimal internet access, cost of acquiring apps and limited device memory. Conclusion: Mobile learning is increasingly popular among medical students and should be leveraged in promoting access and quality of medical education.
**Introduction**

Mobile phone technology has been available in one form or another for about four decades now [1, 2]. In the late nineties and early noughties, smartphones were adopted for mass usage, first in Japan then in the rest of the world [3]. The last decade has seen an exponential rise in spread and functionality of smartphones [4]. Globally, there are now over 6.8 billion mobile telephone subscribers and 70% of these are in LMICs [5]. Sub-Saharan Africa has a mobile phone penetration of about 65%. In Kenya, mobile phone penetration is about 75% [6, 7]. Currently, over half of the mobile phones being sold in Kenya are smartphones [8]. In the health sector, Mobile health (mHealth) is taking root in diverse applications such as health information, patient care and collecting data [9-12]. International technical organizations such as World Health Organization (WHO) and International Telecommunication Union (ITU) are encouraging adoption of eHealth and other Information and communication technologies (ICTs) in health facilities. One of the targets set in 2003 by the World Summit on the Information Society (WSIS) in Geneva is to connect all hospitals and health centres with ICTs by 2015. It is therefore inevitable that today’s health practitioners will have to contend with widespread technology use in their practice for which they should be well prepared. Medical schools are a good place to undertake this preparation. Smartphones are now in use in medical education for various purposes - as sources of information and reference, a guide in rounding and for enhancing problem-based learning [13-16]. The use of mobile technology in medical education is a welcome development especially because it offers a good platform for continuous self-directed learning, an important skill for all health practitioners [17, 18]. Many young doctors across the world have shown a propensity to adopt to mobile technology fast [19, 20] and some medical schools are facilitating this by offering tablets or smartphones to their medical students [21].

In Kenya, data abounds on mobile telephone use in the general population. A national survey in 2012 showed that all healthcare workers had a mobile phone with 50% of them accessing internet on their phones [22]. However, to the best of our knowledge, there’s no data on smartphone use among medical students in the country. Mobile learning (ML) breaks the limits of space and time as learning can go on anytime and anywhere by use of various devices including laptops, mobile phones, tablet computers and audio players [23]. It can be online or offline. ML offers several advantages including portability and lower cost as compared to books and desktop computers as well as augmented learning through case simulation. It also offers versatility in content delivery ranging from text, videos, audio, graphics, animation, pictures and games to interactive platforms. This makes learning more interesting and effective. ML has been applied in medical education across several contexts to serve various functions and purposes. Mobile apps are now available for a vast number of subjects ranging from basic sciences like biochemistry and anatomy to drug information, patient education and bioethics [14, 16, 24-27]. These sources of reference can be helpful for medical students during pre-rounds or ward rounds, for regular studying, and preparing for exams. Mobile applications have also been employed for transparent and objective performance assessment and evaluation of medical students by their teachers. This includes performance in Objective Structured Clinical Examinations (OSCEs) and web-based courses [28]. In addition, mobile learning provides medical students a means to self-directed learning, an important tool in the medical practice where learning is continuous and life-long [17, 18]. It also facilitates evidence-based practice by promoting access to references for medical information such as journals.

A previous study at the University of Nairobi indicated that access to new medical information was sub-optimal [29]. ML has the potential to remedy this situation. ML is mounted on several technologies. One of these is mobile applications (apps) which are programs designed to run on mobile devices. These can be native apps or mobile web browsers. Once installed, native apps are used offline though they may require intermittent internet connection for updates. Web-based applications require an internet connection to function [30, 31]. Mobile apps are run on a mobile operating system. There are several of these including Android® by Google, Windows-Mobile® by Microsoft, iOS® by Apple, Blackberry-OS® by Research in Motion, LiMo® by Linux and Symbian® by Accenture. More than 80% of smart phone users currently are using either Android® or iOS®. Other platforms are Sailfish®, Firefox®, Palm-OS® and Bada® [30]. Operating systems can be open-source or closed-source. Open-source platforms such as Android® and LiMo® are distributed under free licence providing universal access of the source code thus allowing modifications or use by other users at no cost [32]. Closed-source platforms are proprietary software distributed under strict license rules and the user is not allowed to modify, share or redistribute it. The source code is usually not universally available [33]. There are now tens of thousands of mobile apps built to run on various platforms. They can be obtained...
from application stores for a fee or at no cost. These stores include Google Play™, iOS App Store™, Windows Phone Store™, Blackberry World™, and Amazon Appstore™, among others. This technology is designed for various devices; usually Smartphones, Tablet computers, Personal Digital Assistants (PDAs). Each device has its unique characteristics especially in regard to processor speeds, memory size, screen size, and battery life. However, there are general characteristics that cut across the categories. Each of them is hand-held and highly portable and has technical capacity to support mobile applications, full internet browsing, blue-tooth connectivity, Wi-Fi, and several other utility features. Notably, mobile apps cannot run on basic mobile phones, including high-end ones that have touchscreen, media player, camera and Bluetooth [31].

To our knowledge, there are no studies done in Kenya or sub-Saharan Africa to explore the use of mobile learning technology among undergraduate medical students or its challenges. Nevertheless, there are dozens of studies on mHealth innovations within sub-Saharan Africa that have been completed with positive results. All indications are that use of mobile technology will continue to grow thus unless medical schools incorporate ML into medical education, there’s a looming risk of producing health care workers who are under-prepared to utilize mHealth technology fully [13]. Data on mobile phone usage in Kenya is impressive. However, we do not know the patterns of use of mobile technology for education among students including medical students. This information is key in ML content development and improving access to mobile learning for the target group and other similar groups elsewhere. This study aimed to assess use of mobile learning technology among final year undergraduate students at the University of Nairobi College of Health Sciences. Students' preferences and challenges in accessing and using mobile learning technology were also be explored.

Methods

This was a cross-sectional descriptive study among final year undergraduate students in the University of Nairobi, College of Health Sciences (CHS). The college has five schools, three institutes and one centre and a total of about 4200 undergraduate and postgraduate students. In 2014, the college had 491 undergraduate final year students in the Schools of Medicine (331 students), Pharmacy (70 students), Nursing Science (60 students) and Dental Surgery (31 students). This study was designed to attain a 95% confidence interval, a power of 80%, and a 5% margin of error. We used convenience sampling issuing anonymous, self-administered questionnaires to students in their lecture rooms before or after lectures after obtaining informed consent. All students available in the lecture rooms were given the opportunity to participate. We collected data on demographics, device ownership, device use and challenges to mobile learning. The questionnaire was tested among 20 nursing students before data collection began. Data was entered into SPSS® for cleaning and analysis. Descriptive analysis for categorical data was done using frequencies and proportions, and for continuous data using measures of central tendency. Bivariate analysis to test differences or associations was done using student t-test for numerical variables and chi-square test for categorical variables. Where expected count for any cell was less than 5, we used Fishers Exact Test, in place of Chi-square Test. This study was approved by Kenyatta National Hospital- University of Nairobi Ethics and Research Committee.

Results

Two hundred and ninety-two final year students participated in this study. Sixty two percent were medical students, 16% were nursing students, 13% were pharmacy students and 9% were dental surgery students. The majority were female (59%) and the average age was 24 years (Table 1).

Device ownership: Most of the respondents owned a smart device (88%, n=258/292). This was either a tablet or smart phone (including iPhones, and Blackberries). A similar number of students owned laptops too. Eighty percent of the respondents owned both a laptop and a smart device (n = 235/292) (Figure 1). Students who had a monthly income above KES. 5000 (USD. 55) were more likely to own a smart device (p = 0.047). Students who did not own a laptop were less likely to own a smart device (p<0.001). Reasons offered for not owning a smart device were cost (65%), preference (20%), loss or theft (15%). The most popular device makes were Samsung (46%), Tecno (12%) and Apple (10%). Other brands were Nokia (9%), Sony (8%), Huawei (7%), Alcatel (5%) and LG (5%), each of which were owned by under 10% of the respondents (n = 232).
Device platform: The most popular mobile operating systems for smart devices were Android (85%), Windows Mobile (10%) and iOs (Apple -10%). Other platforms were used by 2% of the respondents (n=250).

General Use of smart device: Nearly all participants used their smart devices for short messaging service (SMS), internet access, social media and email (Figure 2).

Educational use: Virtually all respondents who owned a smart device reported using it for learning (n=257/258). The major educational features accessed on smart devices were web browsers (87%), portable documents (81%), mobile applications (72%), images (60%) and eBooks (59%). Less commonly accessed materials were videos (47%) and podcasts (17%) (Figure 3). Smart device holders accessed learning materials for several purposes: Regular study (85%), revising for exams (74%), taking notes or images (62%) and accessing research journals (46%).

Mobile applications: Sixty four percent of all respondents had medical mobile applications (n=186/292). 72% of smart device holders (186/258) listed at least one app they had used on their device (an average of 1.5 apps, standard deviation = 1.56). 65% of smart device holders reported having 1-5 medical mobile applications on their device. The most commonly listed apps were Medscape™ (66%), drug index apps (9%), and medical dictionaries (7%). The most accessed app types were disease management apps (88% of respondents), procedure guides (88%), and medical dictionaries (87%). Other commonly accessed apps were for laboratory reference (81%), drug reference/index (73%) and medical calculators (31%) (Table 2).

Payment for medical apps: Fifteen percent (15%) of the respondents had ever paid for a medical app. 43% would be willing to pay for one in the future (n=292). There was no association between willingness to pay and the income of the respondent.

Proficiency: The majority of respondents reported moderate proficiency in mobile application use. Half of the respondents had installed several apps to test the experience. A few (1%), reported having developed their own app (Table 3).

Accessing Medical journals: Eighty six percent of all respondents (n=228/266) had ever accessed a medical journal. Respondents who owned a smart device were more likely to access medical journals though the association was not statistically significant (p = 0.058).

Cellular internet connection: The most popular cellular internet provider among the respondents was Safaricom (85%). Airtel Kenya had 15%, Orange 7% and Yu Mobile 2%.

Potentially harmful use of smart devices: Nearly a third (29%) of the respondents had ever used a mobile device while driving, 74% had used a device during sleep breaks and 85% during lectures (Table 4).

Limitations of mobile application use: Several limitations to the use of mobile applications were cited- 29% of the respondents did not know how to download apps, 28% had devices that could not support installation of new apps, 27% had limited internet access and 23% did not know which apps to download. A few felt that apps were expensive (16%) or downloading apps was expensive (5%). Ten percent reported limited device memory as a hindrance.

Desired information: Respondents reported that they would like to access medical journals on their devices (41%), 20% desired to have free access to ‘for-pay’ apps., 14% desired to have apps developed for Kenya while a similar number desired to access drug index apps on their device. Some students desired to access their exam results or transcripts (8%), to access clinical guidelines (8%), lecture notes (3%) or Free Wireless internet connection on their devices (3%).

Discussion

This study aimed at assessing the use of mobile learning technology by final year undergraduate students at the College of Health Sciences, University of Nairobi as well as exploring the challenges that impede adoption of mobile learning technology in the target population. We found that most of the students owned smart devices, a majority of which run on the Android™platform. Nearly all students who owned a smart device used it for learning. The main educational uses were regular study, revising for exams, taking notes or images and accessing research journals. About three quarters of the students with smart devices were using medical mobile applications. These were mainly disease management apps, procedure guides, medical dictionaries, laboratory references, drug
indexes and medical calculators. The main challenges were lack of a smart device, lack of technical know-how in accessing or using apps, lack of internet access, cost of acquiring apps and limited device memory. Our findings show that smart device ownership among medical students is higher than in the general Kenyan population (88% versus 51%) [8]. As their cost goes down, smartphones are becoming increasingly popular among university students. Our findings compare with studies from South Korea [34] and Saudi Arabia [35] which showed that nearly all university students own a smart phone. In the United Kingdom (UK) [20] and the United States (USA) [36], about 80% of medical students own a smart phone. Mobile learning, though relatively a new concept, is highly popular among medical students in Kenya. This reflects findings from work done in other countries such as the UK, [20] and USA [37]. Limitations to adoption of mobile learning technology described in this study such as cost and sub-optimal internet connection are similar to those depicted elsewhere. Some limitations are technical such as short battery life, small screen size, and application incompatibility across various operating systems. Cost, privacy and security concerns also limit the use of mobile technology as does the rapid growth that often leads to gadget obsolescence as new apps may be incompatible with older devices. Sub-optimal penetration of broadband internet connectivity is also a limitation [31]. Lack of awareness of available applications or how to access and use them is also a hindrance [15, 20, 38]. ML also requires institutional readiness and human and infrastructural resources that may not always be available in low and middle-income countries [39]. A limitation for this study is that technological jargon is not always clear to everyone. Although every effort was made to make the questionnaire as simple and unambiguous as possible, it is possible that some respondents may have misunderstood some of the questions. In this regard, a questionnaire administered by trained personnel, in place of self-administered questionnaires may have offered more accurate responses. This was not possible due to resource limitations.

**Conclusion**

This study shows that mobile learning is popular among medical students. It also shows key challenges to the adoption of ML in medical education. This information should be useful to modern-day medical educators that are seeking to exploit mobile technology to improve access to and quality of medical education. Mobile learning is likely to increase among medical students. There's need to apply more effort in developing mobile technologies that fit the needs of students. These may include local national clinical guidelines, national drug index/formulary, university organization and administration information such as timetables, exam results and lecture notes among others. University campuses should also provide students with easy-to-connect, yet secure, free internet access.

**Competing interests**

The authors declare no competing interests.

**Authors’ contributions**

All authors were involved in design, data interpretation and manuscript preparation for this paper. M Masika, G Omondi, D Natembeya and E Mugane also undertook, data collection, entry and analysis.

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References

1. Lippi G, Plebani M. Laboratory applications for smartphones: risk or opportunity?. Clinical biochemistry. 2011 Mar;44(4):273-4. PubMed | Google Scholar

2. Ozdalga E, Ozdalga A, Ahuja N. The smartphone in medicine: a review of current and potential use among physicians and students. Journal of medical Internet research. 2012;14(5):e128. PubMed | Google Scholar

3. Bertel TF. Mobile Communication in the Age of Smartphones. IT University of Copenhagen. 2013. PubMed | Google Scholar

4. Wikipedia. Smartphone: Wikipedia; Online Encyclopedia; 2014 (cited 2014 9th June). Available from: http://en.wikipedia.org/wiki/Smartphone. PubMed | Google Scholar

5. ITU. International Telecommunication Union: Statistics 2014 (cited 2014 24th June). Available from: http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx. PubMed | Google Scholar

6. CCK. Communications Commission of Kenya - Annual Report 2012 - 2013. Nairobi, Kenya: Communications Commission of Kenya, 2013. Google Scholar

7. InfoDev. Mobile Usage at the Base of the Pyramid in Kenya. Washington DC, USA: International Bank for Reconstruction and Development / The World Bank, 2012. Google Scholar

8. Gicheru M. Smartphones are now 50% of mobile phones sold in Kenya: TechWeez: Technology News and Reviews; 2014 [cited 2014 9th June,]. Available from: http://www.techweez.com/2014/01/23/smartphones-now-50-mobile-phones-sold-kenya/. PubMed | Google Scholar

9. Lester RT, Ritvo P, Mills EJ, Kariri A, Karanja S, Chung MH et al. Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WeiTel Kenya1): a randomised trial. Lancet. 2010 Nov 27;376(9755):1838-45. PubMed | Google Scholar

10. Maddison R, Pfaeffli L, Stewart R, Kerr A, Jiang Y, Rawstorn J et al. The HEART Mobile Phone Trial: The Partial Mediating Effects of Self-Efficacy on Physical Activity among Cardiac Patients. Frontiers in public health. 2014;2:56. PubMed | Google Scholar

11. Morrison J, Shrestha NR, Hayes B, Zimmerman M. Mobile Phone Support for Rural Health Workers in Nepal through ‘Celemedicine’. JNMA; journal of the Nepal Medical Association. 2013 Jul-Sep;52(191):538-42. PubMed | Google Scholar

12. Brouard B, Bardo P, Vignot M, Bonnet C, Vignot S. eHealth and mHealth: current developments in 2014 and perspectives in oncology. Bulletin du cancer. 2014 Oct;101(10):940-50. PubMed | Google Scholar

13. Gaglani SM, Topol EJ. iMedEd: the role of mobile health technologies in medical education. Academic medicine : journal of the Association of American Medical Colleges. 2014 Sep;89(9):1207-9. PubMed | Google Scholar

14. Albrecht UV, Folta-Schoofs K, Behrends M, von Jan U. Effects of mobile augmented reality learning compared to textbook learning on medical students: randomized controlled pilot study. Journal of medical Internet research. 2013;15(8):e182. PubMed | Google Scholar

15. Ehteshami A, Hachesu PR, Esfahani MK, Rezazadeh E. Awareness and using of medical students about mobile health technology in clinical areas. Acta informatica medica : AIM : journal of the Society for Medical Informatics of Bosnia & Herzegovina : casopis Drustva za medicinsku informatiku BiH. 2013;21(2):109-12. PubMed | Google Scholar
16. Parsons K, Woolley AB. Use of an instant messaging application to facilitate pharmacy students' learning during medical rounds. American journal of health-system pharmacy : AJHP : official journal of the American Society of Health-System Pharmacists. 2013 Oct 1;70(19):1654-5. PubMed | Google Scholar

17. Alegria DA, Boscardin C, Poncelet A, Mayfield C, Wamsley M. Using tablets to support self-regulated learning in a longitudinal integrated clerkship. Medical education online. 2014;19(0):23638. PubMed | Google Scholar

18. van Schaik S, Plant J, O’Sullivan P. Promoting self-directed learning through portfolios in undergraduate medical education: the mentors’ perspective. Medical teacher. 2013;35(2):139-44. PubMed | Google Scholar

19. Garritty C, El Emam K. Who’s using PDAs? Estimates of PDA use by health care providers: a systematic review of surveys. Journal of medical Internet research. 2006;8(2):e7. PubMed | Google Scholar

20. Payne KB, Wharrad H, Watts K. Smartphone and medical related App use among medical students and junior doctors in the United Kingdom (UK): a regional survey. BMC medical informatics and decision making. 2012;12(1):121. PubMed | Google Scholar

21. Casey M. New age app doctors: world hospitals and health services. The official journal of the International Hospital Federation. 2013;49(3):22-4. PubMed | Google Scholar

22. Zurovac D, Otieno G, Kigen S, Mbithi AM, Muturi A, Snow RW et al. Ownership and use of mobile phones among health workers, caregivers of sick children and adult patients in Kenya: cross-sectional national survey. Globalization and health. 2013;9:20: 1-7. PubMed | Google Scholar

23. Savill-Smith C, Attewell J, Tribal GS. Mobile learning in practice. London, UK: Learning & Skills Network. 2006. Google Scholar

24. Dayer L, Heldenbrand S, Anderson P, Gubbins PO, Martin BC. Smartphone medication adherence apps: potential benefits to patients and providers. Journal of the American Pharmacists Association : JAPhA. 2013 Mar-Apr;53(2):172-81. PubMed | Google Scholar

25. Lewis TL, Burnett B, Tunstall RG, Abrahams PH. Complementing anatomy education using three-dimensional anatomy mobile software applications on tablet computers. Clinical anatomy (New York, NY). 2014 Apr;27(3):313-20. PubMed | Google Scholar

26. Markman TM, Sampognaro PJ, Mitchell SL, Weeks SR, Khalifian S, Dattilo JR. Medical student appraisal: applications for bedside patient education. Applied clinical informatics. 2013;4(2):201-11. PubMed | Google Scholar

27. Teri S, Acai A, Griffith D, Mahmoud O, Ma DW, Newton G. Student use and pedagogical impact of a mobile learning application. Biochemistry and molecular biology education : a bimonthly publication of the International Union of Biochemistry and Molecular Biology. 2014 Mar-Apr;42(2):121-35. PubMed | Google Scholar

28. Ferenchick GS, Solomon D. Using cloud-based mobile technology for assessment of competencies among medical students. Peer J. 2013;1:e164. PubMed | Google Scholar

29. Gituma A, Masika M, Muchangi E, Nyagah L, Otieno V, Irimu G et al. Access, sources and value of new medical information: views of final year medical students at the University of Nairobi. Tropical medicine & international health : TM & IH. 2009 Jan;14(1):118-22. PubMed | Google Scholar

30. Bowen K, Pistilli MD. Student Preference for Mobile App Usage. EDUCAUSE Centre for Applied Research. 2012. Google Scholar

31. Brown J, Haag J. Mobile Learning Handbook: Advanced Distributed Learning (ADL); 2011. Available from: http://milhandbook.adlnet.gov. PubMed | Google Scholar
32. LINFO. Open Source Definition 2006 [updated Jan 03, 2007]. Available from: http://www.linfo.org/open_source.html.. PubMed | Google Scholar

33. LINFO. Proprietary Software Definition: The Linux Information Project; 2004 [cited 2014 16th June,]. Available from: http://www.linfo.org/proprietary.html.. PubMed | Google Scholar

34. Nam S-Z. Evaluation of University Students? Utilization of Smartphone. International Journal of Smart Home. 2013;7(4). PubMed | Google Scholar

35. Alfawareh HM, Jusoh S. Smartphone Usage Among University Students: Najran University Case. Internal Journal of Academic Research. 2014;6(2). PubMed | Google Scholar

36. eMarketer. College Students Adopt Mobile across the Board - Nine in 10 college students to own a smartphone by 2016: eMarketer; 2012 [cited 2014 27th June,]. Available from: http://www.emarketer.com/newsroom/index.php/college-students-adopt-mobile-board/#qCMzPhPec4C7UuGQ.99.. PubMed | Google Scholar

37. Bruce-Low SS, Burnet S, Arber K, Price D, Webster L, Stopforth M. Interactive mobile learning: a pilot study of a new approach for sport science and medical undergraduate students. Advances in physiology education. 2013 Dec;37(4):292-7. PubMed | Google Scholar

38. Walton G, Childs S, Blenkinsopp E. Using mobile technologies to give health students access to learning resources in the UK community setting. Health information and libraries journal. 2005 Dec;22 Suppl 2:51-65. PubMed | Google Scholar

39. Frehywot S, Vovides Y, Taib Z, Mikhail N, Ross H, Wohltjen H et al. E-learning in medical education in resource constrained low- and middle-income countries. Human resources for health. 2013;11(1):4. PubMed | Google Scholar
Table 1: Respondents’ demographic characteristics

| Characteristic          | School of Pharmacy | School of Nursing | School of Dental Surgery | School of Medicine | Total       |
|-------------------------|--------------------|-------------------|--------------------------|-------------------|-------------|
| Respondents             | 37 (13%)           | 48 (16%)          | 25 (9%)                  | 182 (62%)         | 292         |
| Sex:                    |                    |                   |                          |                   |             |
| Male                    | 13 (36%)           | 19 (41%)          | 9 (36%)                  | 75 (43%)          | 116 (41%)   |
| Female                  | 23 (64%)           | 27 (59%)          | 16 (64%)                 | 101 (57%)         | 167 (59%)   |
| N                       | 36                 | 46                | 25                       | 176               | 283         |
| Age                     |                    |                   |                          |                   |             |
| Mean                    | 23.3               | 24.0              | 23.5                     | 24.2              | 23.9        |
| Standard deviation      | 0.944              | 1.15              | 1.25                     | 1.05              | 1.12        |
| Minimum                 | 22                 | 22                | 21                       | 22                | 21          |
| Maximum                 | 26                 | 28                | 27                       | 28                | 28          |
| Fee payment mode:       |                    |                   |                          |                   |             |
| Self-sponsored          | 17 (46%)           | 24 (51%)          | 10 (40%)                 | 126 (70%)         | 177 (61%)   |
| Government-sponsored   | 20 (54%)           | 23 (49%)          | 15 (60%)                 | 55 (30%)          | 113 (39%)   |
| N                       | 37                 | 47                | 25                       | 181               | 290         |
| Income (KES)*           |                    |                   |                          |                   |             |
| Less than 2500          | 12 (34%)           | 20 (44%)          | 6 (24%)                  | 19 (12%)          | 57 (21%)    |
| 2500 – 4999             | 7 (20%)            | 11 (24%)          | 7 (28%)                  | 27 (17%)          | 52 (20%)    |
| 5000 - 10,000           | 13 (37%)           | 14 (30%)          | 8 (32%)                  | 69 (43%)          | 104 (39%)   |
| Over 10,000             | 3 (9%)             | 1 (2%)            | 4 (16%)                  | 45 (28%)          | 53 (20%)    |
| N                       | 35                 | 46                | 25                       | 160               | 266         |

* KES = Kenya shillings, $ One United States Dollar = KES. 85.00

Table 2: Frequency of mobile application use by type

| Application category       | Never used | Rarely used | Occasionally used | Often used | Constantly used | Ever used | n  |
|----------------------------|------------|-------------|-------------------|------------|-----------------|-----------|----|
| Disease management         | 12%        | 7%          | 25%               | 43%        | 13%             | 88%       | 239|
| Procedure guide            | 12%        | 12%         | 36%               | 33%        | 7%              | 88%       | 242|
| Medical dictionaries       | 13%        | 15%         | 30%               | 30%        | 12%             | 87%       | 243|
| Lab reference              | 19%        | 13%         | 28%               | 31%        | 10%             | 81%       | 231|
| Drug index                 | 27%        | 17%         | 25%               | 24%        | 6%              | 73%       | 240|
| Medical calculators        | 31%        | 20%         | 28%               | 15%        | 7%              | 69%       | 234|

This table shows how frequently University of Nairobi medical students use different Mobile Application types.
Table 3: Medical students’ proficiency in mobile application use

| Statement                                      | Respondents | Percent |
|------------------------------------------------|-------------|---------|
| I do not use mobile apps                      | 10          | 4%      |
| I use a few factory installed apps            | 18          | 6%      |
| I have installed a few apps that I have seen or heard about | 106 | 38%     |
| I have installed many apps to test the utility | 143 | 51%     |
| I have developed my own apps                  | 3           | 1%      |

This table shows how medical students self-rated their skills in use of Mobile Applications.

Table 4: Potentially harmful use of mobile devices by medical students at the university of Nairobi

| Device Use          | Never | Rarely | Occasionally | Often | Always |
|---------------------|-------|--------|--------------|-------|--------|
| During lectures     | 15%   | 26%    | 35%          | 19%   | 5%     |
| During sleep breaks | 26%   | 14%    | 22%          | 22%   | 16%    |
| While driving       | 71%   | 13%    | 11%          | 3%    | 2%     |
Figure 1: device ownership

Figure 2: General uses of mobile devices by medical students at the University of Nairobi
Figure 3: Educational use of smart devices by medical students at the University of Nairobi