Effectiveness of Introductory Information and Communication Technology Module and its Implication on Academic Performance: A Study on Medical Entrants

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Abstract

Literacy in Information and Communication Technology (ICT) is vital in current medical education and practice to; better prepare future physicians for the changing behaviours of the patients and diseases, improve the quality of interventions and health care delivery, find information and change medical teaching practices. A descriptive study was designed to evaluate the effectiveness of the introductory ICT course and find out the factors affecting ICT literacy in medical entrants. A self-administered questionnaire was administered after receiving the informed consent of the students of the first and second batches of Faculty of Medicine, Wayamba University of Sri Lanka. ICT literacy was evaluated by administering a theory and practical based examination. A pre-course examination was held to a selected sub-sample in order to evaluate the effectiveness of the introductory course. Out of the consented students (n=126), 71.4% were females. All the students owned at least one IT equipment and browsed the internet daily. Having school ICT facility (p=0.001) and parental knowledge on ICT (p=0.04) have affected to the ICT literacy of the students while the external courses have not affected at all. The interaction between ICT evaluation marks and academic results are strongly significant. There was a significant improvement in ICT literacy of the students after conducting an introductory ICT course (p=0.001). It is required to increase ICT facilities at school levels and improve the quality of the introductory ICT courses in order to create skillful professionals who can challenge the changing behaviours of the future world.

Keywords: Medical Entrants, Information and Communication Technology, Introductory Course, Medical Education

INTRODUCTION

What is Information and Communication Technology?

Information Technology (IT) is defined as 'the use of any computers, storage, networking and other physical devices, infrastructure and processes to create, process, store, secure and exchange all forms of electronic data' by Rouse in year 2019 (Rouse & Bigelow, 2019). The extended synonym for the IT is Information and Communication Technology (ICT) which is defined as 'the varied collection of technological gear and resources which are made use of to communicate'. (Rajasekhar, 2012).

Recently, traditional teaching pedagogy is being replaced by the gradual development of ICT. Online classrooms using Zoom and Learning Management Systems (LMS), e-books, and e-resources are replacing the traditional face to face classroom interaction with white or blackboard and books or printed resources (Suryani, 2010). Using ICT methods as a teaching and learning tool has shown proven benefit over the traditional methods throughout the education from primary education to higher education. An undergraduate curriculum of ICT usually provides a broad view of the nature of technology, applying a variety of technologies in different settings, and the influence of ICT on self and society (Sarkar, 2012).

IMPACT OF ICT IN HIGHER EDUCATION

In higher education, ICT impacts on what is learning, method of learning; time and the place of learning, who is learning and who is teaching. ICT promotes student-centred learning which is more innovative than teacher-centered teaching method and encourages students to construct knowledge by learning with the process of personal understanding rather than transmitting knowledge (Sharma, 2011). ICT facilitates students to study regardless of the time and place. This promotes distance learning and provides equal opportunities for students to learn. As well as, ICT widens the scope of gained knowledge by saving time and providing a broad range of knowledge (Sharma, 2011). Other than that, ICT facilitates research in higher education where it promotes the improvement in teaching methodology. At the same time administration in higher education institutions are also facilitated by improvements in ICT by allowing to create new communication links and access e-libraries and databases (Sinha & Lamba, 2016). Evidence-based findings conclude that ICT has a significant impact on higher education to enhance students' performances and achievements by offering a variety of opportunities to students and teachers (Youssef & Dahmani, 2008).

ICT FOR MEDICAL EDUCATION

Medical education, practice, and research are increasingly dependent on ICT. Effective doctors are not those 'who have most knowledge' but those 'who have a sound core of knowledge', who can find out what they need to know quickly and effectively (Moberg & Whitcomb, 1999). Today, the stake holders in the field of medical education is under societal pressure and economic constraints to improve the quality of medical education and the safety of medical care (Moberg T F; Whitcomb, 1999). There are several uniting trends that have been identified to have implications for how medical educators might prepare for the decade. These trends include the explosion of new information including both new knowledge related to health and digitalizing the medical records (Robin *et al.*, 2011).

ICT is not only a tool but also a goal in medical education. To become a better doctor, they need to have an appropriate awareness of the current needs of patients and how to access novel information via an automated way.

Medical colleges mostly in the developed countries have invested increasingly on ICT, not only to deliver education but also to expand the quality of medical services, by providing structured computer and ICT training for medical students while equipping them with the skills they need to practice up to date and evidence-based medicine in future. It has been proven that those are essential in improving the quality of medical care. Computer-assisted medical education will help them to become independent learners, information seekers, information managers, and proficient users of computer technology in their future practice as well as in their ever-continuing education (Kumar, 2012).

A major challenge identified is to raise awareness among physicians in the training about the benefits of using ICT to improve not only the quality of interventions and health care delivery but also, from a broader view, the whole structure of the health care system itself. Another challenge is to motivate medical students and practitioners to use ICT to find information, learn, and develop. It is projected that information literacy should be a compulsory skill for all medical students. Application of ICT to the health sector, from administration to health care delivery, or alternatively, health care practice has been supported by electronic processes and communication improvements (Karsenti & Charlin, 2008).

SITUATION IN SRI LANKA

The Government allocates more funds on the development of ICT infrastructure in education in order to produce efficient and talented individuals who can compete with the upgrading technology. (Imbulegama & Ranathunga, 2018).

In Sri Lanka, ICT plays a major role in medical education; both in undergraduate and postgraduate levels. Many universities have been using learning management systems, creating virtual learning environments which is known as electronic learning for teaching medicine. This facilitates for distance learning with all the activities such as; interactive learning, assessment, communication, uploading of content, return of students' work, peer assessment, administration of student groups, collecting and organizing student grades and questionnaires (Navinan & Rajapakse, 2011).

The Faculty of Medicine, Wayamba University of Sri Lanka also has a Virtual Learning Environment for teaching and learning medicine, with online lectures and educational materials. Thus, a considerable amount of ICT literacy is essential to follow the degree programme successfully and effectively.

Students of the Faculty of Medicine, Wayamba University of Sri Lanka belong to various cultural and socioeconomic backgrounds. Therefore, medical entrants of Wayamba University of Sri Lanka are offered an orientation program called Professional Transition Program (PTP) over 8 weeks in view of helping them to transit from the safe zone of an over protected life and spoon fed learning to an independent life with the main objective of transforming them to become active and self directed learners of medical undergraduate curriculum. This programme includes a special ICT module in order to provide them the basic knowledge needed to follow the degree programme successfully.

The main objective of this study was to assess the effectiveness of the introductory ICT module on ICT literacy of medical undergraduates. At the same time, the impact of the module on academic performences and the factors affecting to ICT literacy were assessed,

METHODOLOGY

STUDY DESIGN

A descriptive cross sectional study was conducted.

Study setting

The study was conducted at the Faculty of Medicine, Wayamba University of Sri Lanka.

Study population

All the first year medical students were included in the study.

Study sample

All the students registered and consented for participation were recruited for the study.

DATA COLLECTION METHOD

ICT literacy was evaluated by administering theory and practical based examination conducted by the ICT Centre, Wayamba University of Sri Lanka for two groups separately at the end of the introductory ICT course. The examination papers were standardized according to a common criterion. A pre course examination was held to a selected sub sample in order to evaluate the effectiveness of the introductory course. A self-administered questionnaire was designed and administered in order to find out the factors affecting to ICT literacy in medical entrants.

Data collection was done by the principle investigator using a self-administered questionnaire and obtaining examination results of the students. Student identity was revealed to compare the placement test and final examination of the induction programme.

ETHICAL CONSIDERATION

Informed written consent was obtained from all the students of the two batches to use their results for the study. Examination results were taken after obtaining approval from the relevant authorities. Ethical clearance was obtained from the Ethics Review Committee of the Faculty of Livestock, Fisheries and Nutrition of the Wayamba University of Sri Lanka.

STATISTICAL ANALYSIS

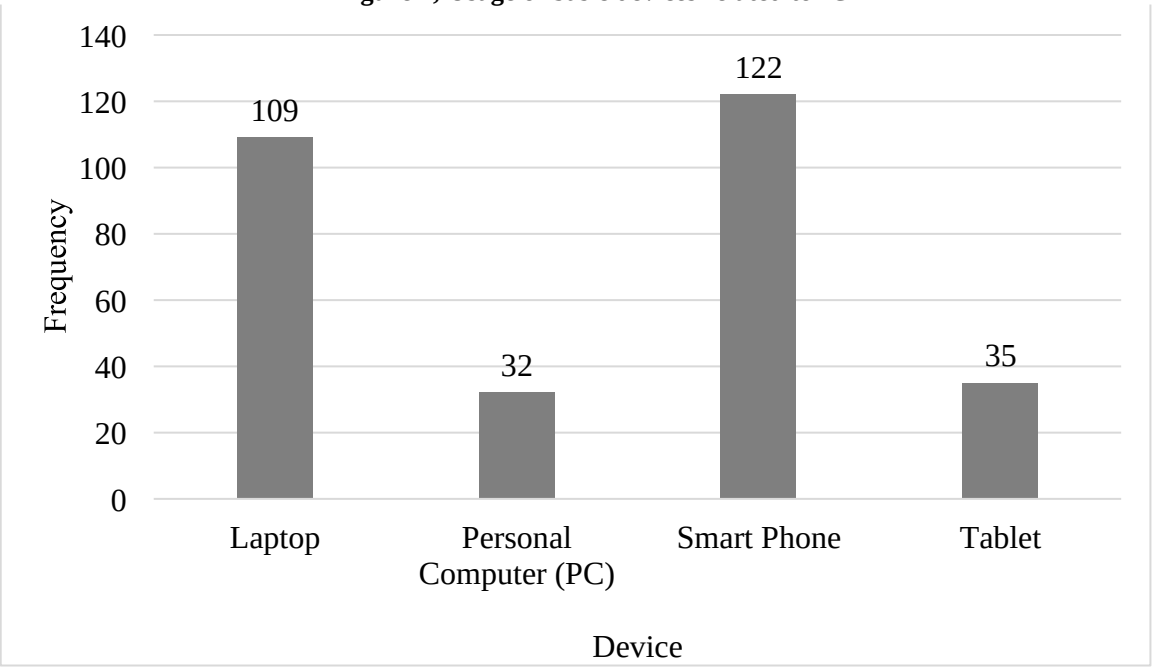
Data was entered into a Microsoft Excel sheet and analyzed using the SPSS data analysis software (version 20). Descriptive statistics, Paired sample t test Analysis of Variance (ANOVA) and Linear regression were used for the analysis.

RESULTS AND DISCUSSION

CHARACTERISTICS OF THE STUDY SAMPLE

There were two batches of students in two consecutive years (2017/2018 intake and 2018/2019 intake) comprising of 71 and 69 students respectively. Out of them, 124 students consented to participate in the research study. Majority (71.4%) of the sample were female students. The age range of the cohort is 18 – 24 years. The group of students represented all the provinces in Sri Lanka. Out of the total number of students, 96.8% have had basic ICT facilities in their schools.

Figure 1; Usage of basic devices related to ICT



Students were using laptops, personal computers, smart phones and tablets as the devices for academic activities and browsing internet (Figure 1). Each and every student in the sample was using at least one electronic device with the facility of ICT at the time of data collection. All the students except one student (who has owned only a laptop) were browsing internet daily from any device they are using. From the total sample, 95.2% of the students personally owned a device while the others were using shared devices. More than 5% of the students are using smart phones as ICT device.

EFFECTIVENESS OF THE INTRODUCTORY ICT COURSE

The second batch of students were selected as the sub sample and conducted a placement test before commencing the introductory ICT course in order to evaluate the effectiveness of the course. The standards of the pre and post examinations were maintained and the results were compared with paired sample t test. There was a significant improvement in the ICT knowledge of the student after the induction programme with a p value of 0.001. (Table; 1)

Table 1: Pre and post examination results of the subsample of students

Marks (n = 65)	Mean	Significance (p value)
Marks of the Placement test (pre test)	50.31 (SD ± 21.022)	p = 0.001
Marks of the Evaluation test (post test)	82.72 (SD ± 13.164)	

FACTORS AFFECTING TO ICT LITERACY IN MEDICAL ENTRANTS

According to the traditional belief, boys are more active in using internet and devices related to ICT than girls and most of the times they are with higher levels of technology proficiency (Throndsen & Hatlevik, 2013). Results of this study shows that the gender difference has no effect on the ICT literacy of the students (Table 2). This finding emphasizes that in the modern world the gender difference has no impact on the technology related education and it encourages the teachers and policymakers to develop technology based curriculums without gender based disparity. According to a research study conducted in Norwegia, the girls on average, achieve higher marks for the tests which were designed to evaluate the ICT literacy while the boys show higher levels of interest for ICT. And also it has found that both girls and boys are using internet in equal frequancies. (Throndsen & Hatlevik, 2013).

ICT literacy level of the parents was evaluated by using the questions to evaluate their ability to use Microsoft Word, Microsoft Excel, Microsoft PowerPoint, search engines, graphic editing and databases. Out of the total number, 5.55% of the parents are unable to use above applications at all. According to the results, ICT literacy of the parents has a positive impact on the student's power of gaining new knowledge in the field. According to a study conducted in United States, there was a significant positive association with the ICT literacy of the parents with their children's knowledge on ICT. It is also proved that if the educational level of parents are higher, the offsprings of them used to perform well (Gooding, 2001). A research study conducted in Turkey shows that there is a positive but less significant relationship between students' ICT literacy and their parents computer literacy (Dincer, 2012). The cultural, educational and technological differences between these two countries may be affected for these slightly different findings. The possible explanation on this finding could be that the literate parents, can teach their children at home whenever necessary and most importantly, they encourage them to get that knowledge irrespective of the availability of the facility at home or school.

Table 2: Factors affecting to ICT literacy

Variable	Categories	Mean	Significance (p value)
Gender	Male (n = 36)	77.53 (SD ± 16.911)	p = 0.388
	Female (n = 88)	74.32 (SD ± 19.387)	
	Total (n = 124)	75.25 (SD ± 18.692)	

ICT literacy of the parents	Group 1[1*] (n = 115) Group 2[2*] (n = 9) Total (n = 124)	76.18 (SD ± 17.466) 63.33 (SD ± 29.193) 75.25 (SD ± 18.692)	p = 0.04
Having basic ICT facilities at schools	Yes (n = 120) No (n = 4) Total (n = 124)	76.27 (SD ± 18.052) 44.75 (SD ± 10.813) 75.25 (SD ± 18.692)	p = 0.001
Following external ICT courses	Yes (n = 34) No (n = 92) Total (n = 126)	75.2941 (SD ± 19.43681) 73.5978 (SD ± 21.37579) 74.0556 (SD ± 20.80742)	p = 0.68

[1] - Group one in the table 2 indicates the group of parents who are having at least a minimal ability to use ICT applications and devices.*

[2] - Group 2 indicate the group of parents who are not able to use them at all.*

The Ministry of Education in Sri Lanka has initiated a project to improve the ICT facilities in schools island wide with the aims of, teaching ICT as a subject targeting the students awareness and familiarity with ICT, learning other subjects with ICT and making school administration efficient (Ekanayake & Fernando, 2018). Therefore, it is important to find whether the school basic ICT facilities have satisfactory improvement in the student's ICT knowledge and practices. According to the results of the study, basic ICT facilities in schools have given a significant influence on students' ICT literacy where the students from schools where they had the ICT facility has performed better than the student who did not have (Table 02). A research study conducted in Malaysia revealed that there is a significant relationship of the ICT literacy between rural and the urban students (Umar & Jalil, 2012). It is advisable to improve ICT facilities in the school level to improve the knowledge of students on technology, thereby supporting their higher education at universities.

Even though the ICT facilities in the schools had a significant impact on the students' ICT literacy, the external paid ICT courses did not show any difference in the performances at the ICT pre evaluation xamination when compared with the other students. That emphasizes the short courses on ICT have not being able to improve the knowledge of the children and it need to evaluate those courses whether they are running with acceptable educational grounds. The sample may be not large

enough to get a conclusion on this external course and therefore this fact need to be investigated further.

ACADEMIC PERFORMANCE AND ICT LITERACY

Academic performance of the students was evaluated using the Continuous Assessment Test (CAT) marks and the ICT post evaluation test results which was held after the completion of the ICT introductory course. There was a significant positive correlation with the CAT marks and the ICT post evaluation results of the students (Table 03).

Table 3: Correlation of the ICT marks and the CAT results

		CAT marks[1*]	Z score[2*]
ICT marks (n=124)	Spearman's Correlation Coefficient	.347	.134
	Sig. (2-tailed)	.009	.138

[1] - CAT marks – Marks for the Continuous Assessment Tests*

2 - Z score – marks of the G.C.E. Examination Results*

These results indicate that it is supportive to have a good ICT literacy to improve the academic performance of medical entrants. Offering a basic ICT course for the medical entrants need to be reinforced further to have a better outcome. At the same time, there was an independent positive relationship with the ICT literacy and the academic performance after controlling for confounding effect of the capacity of a student in learning by using z score achieved at the advanced level examination as the confounding factor (Table 04).

TABLE 4: SUMMARY OF THE LINEAR REGRESSION ANALYSIS USING CAT MARKS AS THE DEPENDENT VARIABLE

Variable	**Coefficient**	**Standard Error**	**t statistics**	**Significance** (p value)
Constant	88.084	25.315	3.480	0.001
ICT marks	0.235	0.098	2.402	0.020
Z score	8.684	14.935	0.581	0.563

A research study conducted in Rathnapura District has also concluded the same finding on ICT literacy and academic performance. It shows that simple and moderate ICT literacy plays a significant role than others pertaining to the students and conversely (Imbulegama & Ranathunga, 2018). A study conducted in Sri Lanka, to explore the influence of internet usage on academic performance of the undergraduates revealed that the academic performance and the Internet usage has a positive

correlation with each other (Madhavika and Kodithuwakku, 2019). Another research conducted involving undergraduates of an educational technology programme at Federal University of Technology, Minna, Nigeria found that ICT background exposure and accessibility of ICT learning facilities have not shown any relationship with the academic achievement of the students (Falode *et al.*, 2018). This finding may be related to the study sample. Students with low literacy in ICT may not be able to show better academic achievements in the same subject stream related to technology.

CONCLUSION

The introductory ICT course is effective for new entrants to improve their ICT literacy. ICT facilities at schools significantly improve the students' ICT literacy. It is proved that the ICT literacy has an influence on the academic performance of the medical students. Provision of structured ICT training for medical students would equip them with the skills they need to practice up to date and evidence-based medicine in future, which are essential to improving the quality of medical care.

RECOMMENDATIONS

ICT course included in the induction programme of the new entrants of the Faculty of Medicine, Wayamba University of Sri Lanka needs to be continued with this standard and students should be motivated to follow the course actively. ICT facilities of the schools should be increased and it is necessary to provide ICT facilities for all the schools in Sri Lanka. Computer assisted medical education will help them to become independent learners, information seekers, information managers, and proficient user of computer technology in their future practice as well as in their ever-continuing education.

LIMITATIONS

Faculty of Medicine, Wayamba University of Sri Lanka is a newly established faculty with only two batches of students at the time of the study. Hence, the number of participants in the cohort is less. It was a limitation for this study. In finding the factors affected to ICT literacy of the students, it showed that there was no significant influence by following external ICT courses. But we were unable to find the evidences to measure the standards of the external ICT courses followed by the students. That was a limitation to comment strongly about the finding. Having basic ICT facilities at schools has shown a positive effect on ICT education. But it was not measured according to the accessibility for each student and the extent of the facility. At the same time, the ICT literacy of the parents was not objectively measure to assess the degree of the proficiency of them. Therefore, those limited data need to be expanded and evaluated by further research in to the area.

REFERENCES

Dincer, S. (2012). A study of the Relationship between Pupils and Parents' Computer Literacy Level and Use, *Procedia - Social and Behavioral Sciences*, 46, 484–489. doi: 10.1016/j.sbspro.2012.05.146.

Ekanayake, M.B. & Fernando, M.G.N.A.S. (2018). Sustainable Quality Improvement of ICT Education in Secondary School curriculum of Sri Lanka, *Foundation & Operational Research for Development Conference, Colombo, Sri Lanka*

Falode, O.C., Gambari, A.I, Alabi, T.O., & Falode, M.E. (2018). Relationship between students' ICT background exposure, access to ICT learning facilities and academic achievement in undergraduate educational technology programme, *International Journal for Innovative Technology Integration in Education, 1*(1), 127–134.

Gooding, Y. (2001). The relationship between parental educational level and academic success of college freshmen. Retrospective Theses and Dissertations. 429, retrieved from http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1428&context=rtd

Imbulegama, I.G.D. & Ranatunga, R.V.S.P.K. (2018). Impact of Information and Communication Technology in Secondary Education: An Empirical Study in Rathnapura District, *7th International Conference of the Sri Lanka Forum of University Economists (SLFUE), Sabaragamuwa University of Sri Lanka*

Karsenti, T. & Charlin, B. (2008). Education and Practice: The Major Challenges, International *Journal of Technologies in Higher Education, 5*(2), 68-81. doi: https://doi.org/10.7202/037475ar.

Kumar, P. (2012). Application of information and communication technology (ICT) by medical students: A study of Government Medical College, Chandigarh, India, *International Journal of Library and Information Science*, *4*(3), 45–51. doi: 10.5897/IJLIS12.001.

Madhavika, W.D.N. & Kodithuwakku, K.C. (2019). Internet Usage and Academic Performance of Sri Lankan Undergraduates, *International Journal of Academic Research in Business and Social Sciences*, *9*(7), 761–783. doi: 10.6007/IJARBSS/v9-i7/6177.

Moberg, T. F. & Whitcomb, M. E. (1999). Educational technology to facilitate medical students' learning, *Academic Medicine, 74*(10), 1145–50. doi: 10.1097/00001888199910000-00020.

Navinan, M.R. & Rajapakse, S. (2011). ICT in Medical education, *Student Medical Journal*, *3*(1), 41–43. Retrieved from https://med.cmb.ac.lk/SMJ/VOLUME 3 DOWNLOADS/Page 41-43 - ICT in medical education.pdf.

Rajasekhar, D.Y.R. (2012). The Role of Information and Communication Technologies (ICTs) in Higher Education, *International Journal of Scientific Research*, 3(3), 83–85.

Rouse, M. & Bigelow, S.J. (2019). Definition: *Information Technology (IT),* Retrieved from, https://searchdatacenter.techtarget.com/definition/IT.

Robin, B.R., McNeil, S.G., Cook, D.A., Agarwal, K.L., & Singhal, G.R. (2011). Preparing for the changing role of instructional technologies in medical education, *Academic Medicine*, *86*(4), 435–439. doi: 10.1097/ACM.0b013e31820dbee4.

Sarkar, S. (2012). The Role of Information and Communication Technology (ICT) in Higher Education for the 21st Century, *The Science Probe*, *1*(1), 30–40. doi: 10.1.1.463.2380&rep=rep1&type=pdf.

Sharma, K. (2011). The Role of ICT in Higher Education for the 21st Century : ICT as A Change Agent for Education, *VSRD International Journal of Computer Science & information Technology*, *1*(6), 382–391. Retrieved from http://www.vsrdjournals.com/pdf/VSRDIJCSIT/2011_8_August/6_Kusum_Sharma_Research_Communication_Aug_2011.pdf

Sinha, S. & Lamba, S. (2016). Role of ICT in Higher Education, *Anusandhaan - Vigyaan Shodh Patrika*, 4(1), 69-73. doi: 10.22445/avsp. v4i1.4397.

Throndsen, I. & Hatlevik, O. E. (2013) *Examining gender differences in ICT literacy, interest, and use: Norwegian results from the ICILS 2013*, *Digital Expectations and Experiences in Education*. Edited by E. Elstad. Rotterdam: SensePublishers. doi: 10.1007/978-94-6300-648-4.

Umar, I.N. & Jalil, N.A. (2012). ICT Skills, Practices and Barriers of Its Use Among Secondary School Students, *Procedia - Social and Behavioral Sciences*, *46*, 5672–5676. doi: 10.1016/j.sbspro.2012.06.494.

Youssef, A.B. & Dahmani, M. (2008). The Impact of ICT on Student Performance in Higher Education: Direct Effects, Indirect Effects and Organisational Change, *RUSC. Universities and Knowledge Society Journal*, *5*(1). doi: 10.7238/rusc.v5i1.321.