

Enhancement of ICT Education via FOSS Solutions in Developing Countries Through Sri Lankan Observations

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Abstract

Information Communication Technology (ICT) education is a human right in which regards every country should provide quality ICT education to the school student community because their skills and knowledge form the key ingredients in the development process of any country. When one implements ICT education, Software is one of the most critical ingredients in its implementation. For Sri Lanka, the cost of licensed software involves a massive financial commitment against the allocated funds for education from the Gross Domestic Product (GDP). As a solution to the above issue, Free and Open Source Software (FOSS) products can be substituted with a lot of benefits and reliability. Inclusion of FOSS based activities in the school curriculum is of paramount importance in developing countries. However, FOSS usage for teaching ICT in schools is minimal today but it has greater capabilities than non-FOSS products in addition to its being economically sound. This study highlights the importance of ICT education and how FOSS could be introduced to the curricular activities of schools as a gateway to connecting to higher education as well as to industry. Moreover, Feasibility and productivity of FOSS with ICT education is also discussed against Non-FOSS products. In addition to this, from ICT literacy to ICT specialization subject software requirements is also explored and suitability proven through the use of FOSS products. Finally, how to enhance the quality ICT education through the use of FOSS products in a sustainable manner to achieve the expected outcomes and how to compete with global challenges without affecting the economy of developing countries by introducing research facilities and an ICT culture among the school community is discussed.

1. Introduction

Including Sri Lanka, most developing countries, are constantly struggling with issues of poor economic performance, poor productivity and inefficient governance. Today, it is believed that e-governance (re-engineering government) does and could play a vital role in enhancing the quality of life of a nation [1] [3]. ICT is an effective ingredient in this process and this implies the need of educating the citizens with ICT education through the general education system[2]. It has also been reported that there is an ever widening gap between the urban and rural areas with respect to economic standards in Sri Lanka and other developing countries. It is believed that the setback in ICT literacy amongst the rural people is a vital factor that contributes to the socio-economic development of a rural society. Most people believe this gap [3] can be eliminated by introducing an ICT culture to the Sri Lanka educational system as an initial driving force. When implementing ICT education in any country, several factors contribute to its success and one of the most essential infrastructures for ICT education is software [4][19]. Therefore, especially any developing country should consider its student development as well as the financial aspects of the country when selecting a software product for ICT education. When ICT education in any developing country is initiated, Licensed software development organizations provide relevant software and training free of charge or at reasonable cost, along with a lot of facilities. In the past, most implementers were aware of closed source licensed software [5]. Later, the provision of such software with actual costs and awareness of such software has had a substantial

effect on ICT education as well as on the financial aspects of such countries [5]. Due to these usages against poverty of the country, the sustainability of successful ICT education becomes a big issue. This study investigates the present usage of software in the Sri Lanka educational system, estimated cost for software, what the alternative option to overcome the financial aspects for software and overall benefit that obtain in the country are, and finally recommend a software for quality ICT education.

2. Research Methodology

A survey was conducted to determine the present status of ICT education in Sri Lanka but this paper highlights only the software impact on ICT education in the Sri Lankan educational scenario. A sample of 35 schools were selected from 5 districts. There were 1295 students, 60 ICT teachers and 35 principals selected for the sample survey. In addition to this, several interviews were conducted with several officers from the Ministry of Education (MOE), National Institute of Education (NIE), National Colleges of Education (NCOE), National Education Commission (NEC) and ICT personnel from provincial educational offices, to gather relevant information for same. Further, the status and information of ICT education in the selected countries were collected through different methodologies.

3. Present Software Usage in Sri Lankan Schools

The most essential software components of ICT education are operating system and office application software. Sometimes other application software and programming languages are specified in the curriculum from time-to-time [6]. This study investigates the usage of operating system software and office application suite in the Sri Lanka school environment. The survey result shows that 93% of schools use Microsoft Windows as the operating system while 4% of schools use both open source and Microsoft operating systems. In addition to this, one section of the ICT text book for grade 10 [7] highlights open source operating systems and its usage. Further, 89% schools use Microsoft office while 6% schools use open office applications and 7% use both packages. The above statistics shows that a majority of Sri Lankan schools use Microsoft products and that a considerable number of schools use both Microsoft software and open source software to suit their literacy courses.

4. Estimated software cost for the Sri Lankan education system

The Software industry is growing very rapidly [8]. Because of this, different versions of operating systems and other software are available in the school system. If schools use different Microsoft versions an ambiguity arises in the school system and this may create problems in the implementation of school curricula. Some developed countries change their software configurations or version along with technological developments every three years. Purchasing, Changing or updating of software every three years is another massive barrier to the implementation of ICT education in Developing countries. At present, in the Sri Lankan education system, 9714 schools are functioning [9] and 3260 schools have computer laboratories. The present student computer ratio in all the school population is 138:1 [9] while, the results of the sample survey shows that student to computer ratio for the schools conducting ICT specialization in their school is 1:24. According to the results of the sample survey, on average, every school conducting ICT specialization as a subject for the GCE (O/L) has 22 computers. In addition to this, 100% of the teachers have requested quality training to perform ICT education at quality level and they have also requested communication skills (English language training) to enhance their duties in a quality manner. All the above requirements can be provided in a phased manner, if one is able to provide a solid solution to the software issue. The estimation of financial consideration for essential software in the Sri Lankan schools systems is shown in Table 1.0 If the school use FOSS, according to the present situation, the government of Sri Lanka can save a

minimum of Rs.1304.00 million a year and Rs.3855.45 million in the future. This investment can be used to provide computers or other resources to schools that don't have computer facilities

Table 1.0 Licensed software Price table for education system (prices based on, March 2010)

| Item Name | Unit Price | For Present computer Labs(3260) Rs-in million | For all schools (9714) Rs-in million |
|--------------------------------|----------------------------------|---|--------------------------------------|
| MS Windows O/S (Client) | Rs 7000/= per machine *22 | Rs. 502 | Rs.1495.95 milion |
| MS Windows Server | Rs.70000/=(for one server) | 228.20 | 679.98 |
| MS office package | Rs 5000/=(for one machine) | 358.6 | 1068.40 |
| Virus protection | Rs.3000/= (Per machine) | 215.16 | 611.12 |
| Total price for the year | | 1304.00 | 3855.45 |

5. Benefits of the Use of Open System Software (FOSS) in School Education

FOSS can reduce licensing costs for schools, and BECTA's 2005 study shows that "for FOSS schools, cost per PC at primary school was half that of Non-Foss Schools, and the cost per PC at secondary school level was around 20% less than that of the Non-FOSS Schools" [10] However, the benefits go far beyond cost reduction such as improved reliability, the chance to use innovative, cutting edge technology, and a greener, more sustainable approach to computing. Therefore, FOSS is more flexible and adaptable than proprietary software [10]. There are four fundamental advantages in the use of FOSS in schools, which allow the freedom to [10]:(i)Use whichever software you choose (ii) Study and adapt the software so that it fits more closely to a school's own particular needs (iii) Improve on what's there already, through participating in the project's community (iv)Distribute programs to students and teachers, so that they can use the same platform at home and in school.

6. Usage of Foss

Open source provides access to the source code to users; the license shall not restrict any party. This means free redistribution, and that the programme has to include the source code. The government of India encourages the use of open source products [11] in their school education system. One of the major reasons is that "The syllabus/ curriculum should emphasize principles and not products". Further, literature review shows that the ICT industry and higher education in Sri Lanka has used open source software widely and that most people encourage the use of open source software[12]. As a developing country, if our ICT education system is embedded with open source, we may the obtain following benefits [1][19].Avoid money spent on software purchase, provide critical and deep knowledge to the students, to avoid the use of pirated software and hence government can easily introduce ethical aspects to the school community, to eliminate problems in ICT practical sessions due to pirated software, provide a wide range of ICT skills in the use of open source products rather than using limited facilities available in closed source software products. Provide flexibility: Open source Products are customizable and can involve third parties. New features and tools can be imported from the open source community, to provide continuous involvement: extensive collaboration ensures that software products keep improving. Programmers from different institutions and organizations, schools, along with volunteers, contribute freely to the products.

7. Strength and Suitability of the Open Source for the Education System

Well-designed educational software can be a key enabler for flexible education [13], although embedding it at an institutional level brings its own demands for change management [14]. Open source software is flexible for both educational and institutional activities. Educationally, flexible software should enable educators to design and manage effective learning experiences and materials and provide an interface that is appropriate for education. Meanwhile it should provide students with opportunities to learn at their convenience and provide an interface dedicated to learning. Institutionally, flexible software should provide institutions and their developers with facilities to adapt and integrate the product with local administrative processes, ICT platforms and teaching culture. It should also help universities to join effective federations and partnerships with other institutions, which requires adherence to open standards and tolerance of diverse coding languages and platforms, including those that are popular with other nations. Further, in general, the view appears to be that these open source software applications are as easy to use as the non-open source software equivalents [15]. Considering the above facts and the existing evidence about the reliability of FOSS, the following basic essential activities can be performed in the schools system smoothly. (i) Run the school's servers and provide school-wide services such as internet access and SchoolNet facilities (ii) provide the operating systems for classroom and/or Administrative purposes including all required software from ICT literature to ICT specialization subjects (iii) Provide applications software for classroom and/or administrative purposes.

8. Alternative Software for the Smooth Implementation of the School

Curriculum.

If developing countries use FOSS for their teaching/learning purposes, they can provide more skills to teachers and students and the other school community. Further, FOSS provides deeper knowledge and critical thinking abilities to the school community [4]. The following describe the suitability of FOSS rather than the use of other Non-FOSS for school education.

8.1 Operating System Software and Application Software

Provide the operating systems for classroom and/or administrative computers (eg. Red Hat Linux, SuSE Linux, Ubuntu and other Linux from Oracle etc) against the different versions of Microsoft Operating Systems. Provide application software for classroom and/or administrative (the relatively low-cost StarOffice and the free OpenOffice) are of particular importance [15]. Further, Open Office is in around 92 different languages. It includes the following features and programs and they are able to perform more features than the closed source operating systems.[16] **OpenOffice Writer**: text processor, equivalent to MS Word. **OpenOffice Draw**: 2D vectorial graphics, equivalent to MS Word graphic tools. **OpenOffice Calc**: spread sheet, equivalent to MS Excel. **OpenOffice Impress**: presentation, equivalent to MS PowerPoint. **OpenOffice Base**: database, equivalent to MS Access. **OpenOffice Math**: formula or equation editor, no feature equivalent in MS Office.

8.2 Graphic Packages

More advanced graphics packages are sometimes necessary to produce multi-dimensional illustrations, process photography, put together texts and illustrations, and layout pages, posters, leaflets, text books and other educational resources in the school system. Further, Popular commercial graphic software packages in the market are:[16] CorelDraw, Publisher, MS Visio,

Illustrator, PageMaker, Adobe Photoshop, In-Design, 3D Studio MAX, Maya, Animation, Carrara etc. All the above Software products are closed source while their features, facilities and developing capabilities are low with respect to the FOSS graphics software available in Web[10]. **Scribus** an excellent alternative to MS Publisher, Quark Xpress, Adobe PageMaker or Adobe In Design to lay out any document. **Inkscape** (2D vectorial graphics) Equivalent to Adobe Illustrator. **Dia** (diagram creation) Similar to MS Visio. **QCad** (2D CAD) a kind of AutoCAD software limited to 2-dimensional graphics. **Gimp** (2D graphics and photo) Equivalent to Adobe Photoshop [15].

8.3 Open Source Learning Management System Tools

Another aspect of the open source movement on education is the rapid usage of open source Learning Management Systems (LMS) tool and other learning applications. LMS tools are used mostly to create and manage the learning contents on the web. [17]. In addition to the above, a major area of software used in the school education systems is web designing, programming and multimedia etc. Similar to the above, there is a lot of collections of closed source software currently used in the schools system and money is spent on the purchase of Non-FOSS products. All the above features in the commercial software or more features and flexibility to the education system is embedded in FOSS [18]

9. Flexibility of Use of Open Source Products in the Sri Lankan School System

The literature review shows that the ICT industry and higher education in Sri Lanka widely used open source software and that most people encourage the use of open source software[12]. The results of the sample survey reveal that, ICT teachers in the Sri Lanka educational system recommend the use of software and operating system as follows. The survey result shows as many as 67% of ICT teachers recommend use of both open source and Microsoft products for school education while 8% ICT teachers recommend only open source products. Moreover, this attitude of teachers can be redirected with considerable changes using a strategic and tactical approach to introduce and to implement FOSS in the ICT curriculum in the Sri Lankan school system. This is good positive pathway to embed open source in the school curriculum in Sri Lanka. If MOE, NIE or relevant organizations introduced more awareness programs about the advantages of open source and its usage, this usage percentage can be increased. Further, the sample survey reveals that still 66% ICT teachers are unable to install, configure and troubleshoot the operating systems software and application software in Microsoft products. If MOE or relevant training authorities take this opportunity to fulfil the skills requirements of software usage for teaching learning activities using Open source training programs and if they provide training facilities to use and configure open source products, one can increase the usage of open source products, hence can save money spent on the purchase of Microsoft- products and Provide critical and deep knowledge to students as well as to teachers. Because of this, more productive people can be generated in developing countries in the future. Further, by generating powerful software development groups from the school environment, through which software industry developed on a large scale, later can be used to eliminate poverty through foreign currency to provide at least a little bit of support to the economy. Moreover, the sample survey shows that 20% students face difficulties in ICT practical sessions due to the lack of properly installed software, virus threads and other obstructions. As many as 20% of the students feel this and it may imply that the lack of complete software creates unnecessary difficulties. Considering the facts above, the government should recommend the use of open source products as a policy with immediate arrangements for installation, troubleshooting and training of ICT teachers and relevant officers and thus the Sri Lankan student community, teachers and administrators will get greater advantages than earlier.

10. Conclusion and Further Research Activities

At present, teachers and students in Sri Lankan schools have not adequately mastered ICT education [19] while the problem of the literacy level has been overcome to a certain level in a majority of schools. Further, school ICT curricula are implemented based on different software versions where some are licensed while some are pirate software. This may create several issues in the implementation and evaluation process. Moreover, financial aspects do not permit fulfilling software requirements using licensed software products. In addition to this, ICT teachers in the school systems are willing to use FOSS and they expect quality training based on face-to-face as well as on-line methodologies on the use of open source products. There is substantial availability of FOSS products with greater capability than non-FOSS products. With the aim of feature compatibility with higher education, industry and to compete with the global developments, FOSS products should be embedded in the school system. In order, to implement quality ICT education in Sri Lanka or any developing country with FOSS the following activities should be implemented: (i) Provide properly designed training programs that are compatible with the curriculum. (ii) Include the principals to the curriculum rather than use a specific product. Every three years the curriculum should be revised. Further, every year MOE, NIE, NEC or the relevant capable and responsible authority should decide on and declare the recommended FOSS software and its versions. (iii) Provide awareness programs to school principals, responsible officers to the MOE, NIE and other offices involved in enhancement activities of ICT education. (iv) Most capable people from the national universities, industry or capable people from education should provide training to master trainers with the guidance of the NEC, MOE and NIE. (v) Provide facilities and encourage teachers, students through teachers to establish, implement and maintain supportive initiatives (vi) Provide facilities to develop research and development activities to enhance the ICT education curricula and implementation procedures because the school student population is the backbone of the economy of any country.

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