DEPLOYING OPEN SOURCE SOFTWARE (OSS) IN UAE SCHOOLS

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Abstract

Computer science educators aim to discover new technologies and methods to reach the students and improve the educational system in schools. Implementing the open source software in many schools has affected the overall cost of education to governments; for example, the cost of the servers implementing the open source operating system software at Grant High School in South Australia in 2004 was nil for the licence and for obtaining other essential application software. To the best of our knowledge, no research study has yet been carried out on this topic in the UAE schools. Here, we look at a similar experience in the Canadian International School in the UAE, in which the open source software OpenOffice has been deployed. OpenOffice was installed in the computer lab at the school, and three workshops were run for each of three grades: 6, 8, and 11. Feedback was collected from the students after they had performed the lab exercises. A cost estimation study was conducted and is discussed in this paper.

Keywords: Open Source Software, Closed Source Software, Schools, UAE.

1 INTRODUCTION

Open source software (OSS) is defined as program source code that is freely available to the public. Unlike proprietary, or closed source, software programs, open source programs can be modified and distributed by anyone and are often developed by a community rather than by a single organisation. For this reason, the phrase "open source community" is commonly used to describe the open source software development project environment. According to the (Kay, n.d.), “Open Source Software goes through a type of natural evolution resulting in rapid development, increased reliability, and decreased cost. In addition, when we speak of “free software”, we are referring to the freedom of the user to read, redistribute, modify, and use the source code, rather than [to] the lack of cost”.

Computer science educators aim to discover and develop new technologies and methods to reach students. There are three main characteristics that these educators should focus on: (1) understand the students’ interest and capture their attention; (2) assess their level of understanding and retention of the material; and (3) encourage them to pursue their own independent creative work (Kay, n.d.). Computer science educators believe that open source software (OSS) can serve as a supportive technology in the effort to effectively teach computer science to students. Based on an analysis of some research questions by IT educators, OSS has the potential to positively affect students’ career development. That research also concluded that “the most important factor is whether the skills students learn through the OSS experience are supported by, or are compatible with, the hiring company’s projects and its customer base” (Jeffrey, 2009). According to the (Kay, n.d.), OSS has the potential to expand the classroom to include a large number of projects and more widely distributed teams. Their objective is to introduce students to the computer science community and to the practice of peer review. This is in addition to the obvious benefit that OSS provides, which is its availability at low or no cost. In summary, OSS reduces the overall cost of the technology required for the classroom setting, which might otherwise be out of reach for schools financially (Kay, n.d.).
To illustrate, both commercial GIS software and open source GIS software are available for courses on geographic information systems (GIS). This all-important software is required for giving students the software skills and other advantages that can help them in the job market (Smith, 2011). Smith goes on to point out that “some GIS teachers prefer to use open source software because it is free of cost and allows for the freedom to modify and distribute GIS applications” (ibid).

According to Smith (2011), it may be a good opportunity to consider OSS in classes if:

1. Teachers want their students to learn GIS in a short time, but there is no financial support for schools to purchase, or for software vendors to sell, GIS software.
2. Students want to install and try GIS software on their home computers.
3. School computers are using a non-Windows operating system, such as MacOSX or Linux.
4. Teachers want to focus on certain aspects of GIS functions, such as Web mapping, spatial analysis, and database management, and they realise that GIS packages with these individual functions are expensive, or that adding them would be too expensive.
5. Teachers want the ability to add selected GIS functions for their students in the future.

One of the best known OSS projects is Moodle. According to Intyre (2010), it is used as a free software e-learning platform, and it is also considered a Course Management System (CMS), a Learning Management System, or a Virtual Learning Environment. In addition, Moodle is designed to assist instructors and professors in constructing and customising online courses, exams, and so on, with a focus on communication and collaborative construction of content on a flexible platform (Shaheen E. Lakhan and Kavita Jhunjhunwala, 2008). Moreover, the author points out that it is open source licensed and its design is modular, “which means that many people can develop additional functionality, and development is undertaken by a globally diffuse network of commercial and non-commercial users, spearheaded by the Moodle company based in Perth, Western Australia” (Intyre, 2010). Furthermore, “Moodle can be downloaded to any computer and used to support a single instructor site or a system of thousands of students. It is licensed by the open source initiative under general public licence (GPL)” (Shaheen E. Lakhan and Kavita Jhunjhunwala, 2008). In fact, statistics show how rapidly Moodle has spread around the world. According to Intyre (2010), “Moodle has a significant user base with 45,721 registered and verified sites, containing 32 million users in 3 million courses”. In addition, as pointed out by Shaheen E. Lakhan and Kavita Jhunjhunwala (2008), “A growing community of over 200,000 registered users in more than 175 countries supports Moodle”. It expressly encourages students to contribute to their own learning through direct participation in their field of interest.

Another famous OSS project is OpenOffice. Intyre (2010) explains that OpenOffice is a suite of office software products which is used throughout the world. It includes spreadsheet, word processing, database, and multi-media presentation software, among others. It is extremely easy to use, anywhere and anytime. In addition, “OpenOffice has a significant user base and is available in 80 languages, and also it provides all the necessary functionality for teaching IT skills and has ECDL/ICDL approved courseware available from Blackrock Publishing” (Intyre, 2010).

2 LITERATURE REVIEW

2.1 Open Source Software in Schools

Nowadays, the rapidly developing OSS is available at lower cost, or free of charge, to everyone, which makes it a valuable resource for schools. According to Gary Hepburn and Jan Buley (n.d.), “the real challenge is in helping educators, administrators, and technical support personnel realise the huge potential OSS holds for teaching and learning and in planning an appropriate implementation approach that addresses the socio-political barriers”. In addition, this is a period in which schools can begin to use OSS, both in the classroom and on their administration computers (Shaffer, 2012). At this time, it is important for schools to establish a sound plan, which should include the time-consuming technical...
process of changing its computing environment, as well as addressing the socio-political challenges that will accompany such a change (Gary Hepburn and Jan Buley, n.d.). There are two methods for introducing OSS into schools, according to Gary Hepburn and Jan Buley (n.d.), which are the following:

1. Run OSS on the Windows or Mac operating system. OSS can be installed and successfully run on both these systems. This approach reduces software costs and releases schools from restrictive licensing agreements, without limiting the use of closed source software.

2. Use the Linux operating system with Windows or Mac. Linux can be installed on school computers already loaded with the Windows or Mac operating system. The hard drive is divided into two to accommodate both operating systems and their applications. This allows the operator to select the OSS when booting up the computer, which can save schools the expense of existing commercial software, as well as providing motivation for users to try the less familiar OSS option.

The essential role of a school is to teach students. In the case of computing courses, this involves teaching them how computers work and how to control individual applications through the user interface and depending on the various programs that run them. The user also should also be taught about operating systems, hardware drivers, and other system functions by learning about the source code that makes computers to do what they do (Shaffer, 2012).

One of the well-known open source educational projects is Edubuntu. According to Intyre (2010), this is an operating system designed specifically for schools, which is easily and quickly set up, and requires no technical expertise or knowledge. Some of the applications that Edubuntu offers for primary schools and secondary schools are listed by Intyre (2010): “For primary schools: early learning environment (Gcompris), and educational games and activities from Tux4Kids and KDEEdu projects. For secondary schools: full office suite, plus applications for instant messaging, graphics, sound, and video. Access to thousands of other high quality open source programs at no cost”.

There are various software licensing prototypes in the commercial division. In general, proprietary software is paid for in schools on a per/computer basis, on a site basis, or based on other devices (Agency, 2005). As we have seen, OSS is easy to use and designed for all ages, including primary schools, secondary schools, and post-secondary education, anywhere, anytime, and on any device. According to the Agency (2005), there are three reasons to offer OSS in schools:

1. OSS can support the school administration effectively by offering the educational user appropriate functionality;

2. OSS compares favourably with non-OSS solutions, in terms of the total cost of ownership, for use in schools;

3. The success of school-based OSS implementations and applications has been demonstrated in case studies.

Some case study data were collected during visits to four primary and four secondary schools, where interviews were conducted with SMT members, teaching staff, and pupils, and a network manager examined and highlighted how OSS is being used in those schools (Agency, 2005).

2.2 Estimated Cost of Using Open Source Software in Schools

Saving money and using the most appropriate software in all organisations are the main goals for governments around the world. One of the ways to achieve these goals is to use OSS, as the acquisition and start-up costs of this software are low. As well, there are many benefits to using it once it has been installed. In terms of saving money, access to open standards and architecture, as well as interacting with more than one vendor and service provider, can give the purchaser the flexibility to choose the team that his/her organisation would like to deal with. As Shaikh and Cornford (2011) have said, “Open source software, along with open data policies and the promotion of open standards, has become a significant part of the language that governments speak when they consider how to develop and manage their future information systems and data infrastructures” (Sheihk, 2011). In fact,
companies are now beginning to consider the total cost of ownership, which is defined as “a method to describe all costs of a certain infrastructure” (TOOL, 2013).

According to Netc.org. (n.d.), “All software has a true total cost of ownership (TCO). The TCO includes the [purchase] price, any hardware and software upgrades, maintenance and technical support, and training (or retraining). Time and frustration may be hard to measure”.

TCO is a very important concept to master if a business is to succeed, but evaluating it is not an easy task, as it is difficult to accurately determine the cost of OSS, which includes purchase cost (if any), reliability, and functionality. The cost of the licence is nil, but there are other factors that affect the cost of owning OSS, such as the cost of the open source application and the support services, all of which are driven by different supply chains (Sheihk, 2011).

According to (Moyle, 2004), TCO components commonly identified include the following costs:

- Hardware purchase and maintenance;
- Software acquisition and upgrades;
- Software compliance;
- Vendor management;
- Direct labour support;
- Security and anti-virus management;
- Service and leasing;
- Telecommunications and network;
- ICT infrastructure;
- Technical training and user professional development.

Australian and New Zealand Schools (Moyle, 2004):

![Table Four: Identifying costs: servers using open source operating software at Grant High School (2004) - Figure 1](image)

Implementing an open source platform in Australian and New Zealand schools has affected the overall cost to the governments of these countries. Figure 1 shows that the overall cost of the servers that use the open source operating system software at Grant High School in South Australia in 2004 were nil for the licence and for acquiring other essential applications software.
By contrast, in the same year, the total cost of using proprietary operating system software (closed source) for the servers at Grant High School was $1,200 for the software licence and to acquire the most important applications was $9,895. The cost of the server hardware for the open source implementation was $6,500, compared to $9,900 for the proprietary operating system (closed source).

![Table Six: Desktop Applications - proprietary and open source software at Grant High School (2004)](image)

Figure 2. Desktop Applications costs at Grant High School in South Australia in 2004.

Figure 3 shows the desktop applications that were used by the students and staff at Grant High School in 2004. The open source material cost was nil, whereas the cost of using the proprietary software (closed source) was $4,025.

![Table Five: Identifying costs: servers using proprietary operating system software at Grant High School (2004)](image)

Figure 3. Identifying costs at Grant High School in South Australia in 2004.

Orwell High School and Sir Frederic Osborn School (Banahan, 2006):

According to the research carried out at these two schools, they both installed the Linux operating system and replaced the hardware with the new thin client devices, which saved each school £26,250 per annum. The licensing costs were difficult to estimate, since they change from year to year. However, in a published case study, John Osborne (Orwell High School) estimated the annual licensing costs to be £25,000.
In fact, it was the technical salaries associated with using the Linus operating system that most affected the overall cost, compared with using the Windows operating system. According to John Osborne, the time spent on maintaining this system over a two-month period was 45 minutes per week. In his view, a system based on Windows fat clients would require two full-time technicians. At a fully costed annual rate of £35,000 and presuming that 1.5 technician salaries were actually been saved, this translates to £52,500.

At the Sir Frederic Osborn School, the internal cost savings are expected to be about £120,000 in the first year, by applying these software applications:

1. Office suite, including a word processor, a presentation package, and a drawing tool (OpenOffice);
2. Database (Star Office);
3. Desktop publishing and Web publishing (Scribus, Nvu);
4. Graphics editors (Gimp, Inkscape);
5. Web browser and various email services (Firefox, Thunderbird, etc.);
6. Bundled educational software (KDE);
7. A virtual learning environment (Moodle);
8. Optional remote access from home via No machine NX technology for those with Internet access.

Austrian Schools (Bierhals, 2013):

The secondary school in Weiz, Austria, installed the open source operating system in 2003 to achieve their goals, which were to reduce costs and to develop a user-friendly, sustainable, and flexible system. This resulted in the creation of desktop4education, which is now being used as a reference by the Austrian Federal Ministry for Education, Arts and Culture.

Various applications make up the basic school packages and secondary school packages, among them:

- Tuxmath – a math application
- Tuxpaint – a basic paint programme
- Tuxtype – 10-finger typing software
- G-Compris – learning software for students aged 2 to 10
- Qcad – a 2D construction programme
- Geogebra – dynamic math software
- WX Maxima – a GUI for Maxima, the computer algebra system (CAS)
- Qucs – an integrated circuit simulator
- Dr. Geo – interactive geometry software
- KDE-Edu – free educational software based on the KDE technologies

As for network services, desktop4education offers the following features, which are built on the SUSE Linux Server platform:

- the CUPS print server
- DHCP dynamic IP allocation
- DNS
- the NTP time server
- openLDAP for centralised user administration
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- the Samba data server
- Apache-Webserver with PHP5
- the MySQL and PostgreSQL database servers

It also offers pre-installed Web applications, without a licencing cost:

- Joomla! – a content management system
- Moodle – a learning platform
- Gallery (v.1) – an easy-to-use photo organiser
- DokuWiki – a documentation manager
- phpMyAdmin – MySQL database manager
- phpPgAdmin – PostgreSQL database manager
- x2go – a terminal server
- squid – a proxy server
- gnump3d – an mp3 file server

In summary: “The software provided everything a school needs, it is easy to administer, and does not involve any licensing costs” (ibid).

3 DEPLOYING OPENOFFICE AT THE CIS IN THE UAE

OpenOffice is free software consisting of various software programs, including a word processor (Writer), spreadsheet software (Calc), and presentation software (Impress). It can be downloaded in a variety of languages and is suitable for all types of users.

OpenOffice programs are similar to Microsoft Office programs. They have the same layout, although some of the options they offer are different.

The Canadian International School (CIS) is a private school in Abu Dhabi which provides a high quality education, encouraging students to work hard and play hard, and balancing the two. Their educational system, which is based on the system used in Alberta, Canada, is well-known to Canadians and throughout most of the world. Students taught in this system are well prepared for life after graduation. They have developed confidence and flexibility, as well as communications skills and the ability to work as part of a team. In addition, many extra-curricular activities are offered to the students. The very large computer lab at the CIS, which contains 150 computers, is available for their use, with the support of any of their teachers. We had the opportunity to visit this impressive school, and provide OpenOffice workshops to students in various grades.

Below is our detailed plan for delivering OpenOffice labs to CIS students.

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Grade/Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday, April 25</td>
<td>12-4</td>
<td>Installation of the software</td>
</tr>
<tr>
<td>Sunday, April 28</td>
<td>12-3</td>
<td>Grade 6 workshop</td>
</tr>
<tr>
<td>Tuesday, April 30</td>
<td>12-3</td>
<td>Grade 8 workshop</td>
</tr>
<tr>
<td>Sunday, May 4</td>
<td>12-3</td>
<td>Grade 11 workshop</td>
</tr>
</tbody>
</table>

A survey was conducted among CIS students to obtain their feedback as a result of learning to use the Writer, Impress, and Calc applications in Open Office. Fifty-nine responses were collected from Grade 6, 8, and 11 students, and then analysed.

Students’ background:
The 18 grade 6 students had previous experience working with Microsoft Word and PowerPoint, but not Excel.

The 18 grade 8 students were very helpful and respectful. They were very anxious to know more about OpenOffice, and gave the instructor their full attention during the three labs. Most of them were familiar with Microsoft Word and PowerPoint. Two of the students didn't know how to use Excel.

The 23 grade 11 students were quite familiar with Microsoft Office, and said that they wouldn't like to change to OpenOffice. However, when we explained the cost savings involved, they thought that if they learned OpenOffice and used it more, they would make the change. All the students had previous knowledge of Microsoft Office and experience using it.

Students’ feedback:

Most of the grade 6 students were excited to finish their practical lab assignments during the workshop. The majority became enthusiastically involved in the discussions and exercises, and, significantly, none of the respondents felt they hadn’t learned anything in the labs. This is revealed in their responses in Tables 1 and 2. Fifty percent of the students believe that there is no difference between OpenOffice and Microsoft Office. The other 50% found that there were some differences in the user interface. However, they felt that it was easy to manage those differences and to learn new ways to do things; for example, changing fonts and layouts in PowerPoint. Many of the students, about 88%, said they would like to take another lab in Open Office, which shows that they could work with OpenOffice and help their school financially by using software that is available free of charge.

Table 1. Grade 6 general evaluation of OpenOffice labs – 1

<table>
<thead>
<tr>
<th></th>
<th>Easy</th>
<th>Average</th>
<th>Difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writer</td>
<td>44.4%</td>
<td>50%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Impress</td>
<td>33.3%</td>
<td>66.7%</td>
<td>0%</td>
</tr>
<tr>
<td>Calc</td>
<td>44.4%</td>
<td>50%</td>
<td>5.6%</td>
</tr>
</tbody>
</table>

Table 2. Grade 6 general evaluation of OpenOffice labs – 2

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The objectives of the labs were clear</td>
<td>66.7%</td>
<td>33.3%</td>
<td>0%</td>
</tr>
<tr>
<td>The labs helped me learn about the topics</td>
<td>77.8%</td>
<td>22.2%</td>
<td>0%</td>
</tr>
<tr>
<td>I feel that I can be creative in OpenOffice</td>
<td>44.4%</td>
<td>50%</td>
<td>5.6%</td>
</tr>
<tr>
<td>I now feel more confident about my computer skills</td>
<td>44.4%</td>
<td>55.6%</td>
<td>0%</td>
</tr>
<tr>
<td>I would to take another lab in OpenOffice</td>
<td>50%</td>
<td>38.9%</td>
<td>11.1%</td>
</tr>
</tbody>
</table>

Tables 3 and 4 present the evaluation of the responses of the grade 8 students with respect to the OpenOffice labs. It is clear that more than 61.1% of the students either agree or strongly agree that the labs helped them learn the OpenOffice topics. In addition, approximately 55.5% of them either agree or strongly agree that they are now more confident about their computer skills and would like to take another programming course. The students were also asked whether or not they were interested in
taking additional labs in OpenOffice. About 50% of them said that they would like to do so (agree or strongly agree with the statement).

Table 3. Grade 8 general evaluation of OpenOffice labs – 1

<table>
<thead>
<tr>
<th></th>
<th>Very easy</th>
<th>Easy</th>
<th>Average</th>
<th>Difficult</th>
<th>Very difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writer</td>
<td>38.9%</td>
<td>16.7%</td>
<td>16.7%</td>
<td>22.2%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Impress</td>
<td>11.1%</td>
<td>22.2%</td>
<td>27.8%</td>
<td>38.9%</td>
<td>0%</td>
</tr>
<tr>
<td>Calc</td>
<td>16.7%</td>
<td>27.8%</td>
<td>38.9%</td>
<td>16.7%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 4. Grade 8 general evaluation of OpenOffice labs – 2

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The objectives of the labs were clear</td>
<td>27.8%</td>
<td>33.3%</td>
<td>16.7%</td>
<td>11.1%</td>
<td>11.1%</td>
</tr>
<tr>
<td>The labs helped me learn about the topics</td>
<td>27.8%</td>
<td>16.7%</td>
<td>44.4%</td>
<td>5.6%</td>
<td>5.6%</td>
</tr>
<tr>
<td>I feel that I can be creative in OpenOffice</td>
<td>38.9%</td>
<td>33.3%</td>
<td>5.6%</td>
<td>22.2%</td>
<td>0%</td>
</tr>
<tr>
<td>I now feel more confident about my computer skills</td>
<td>22.2%</td>
<td>33.3%</td>
<td>16.7%</td>
<td>27.8%</td>
<td>0%</td>
</tr>
<tr>
<td>I would take another lab in OpenOffice</td>
<td>33.3%</td>
<td>16.7%</td>
<td>22.2%</td>
<td>11.1%</td>
<td>16.7%</td>
</tr>
</tbody>
</table>

The survey results revealed that more than 50% of the students would like to replace Microsoft Office with OpenOffice. Also, most of the students felt that there was no difference between these two office suites, and this is what led them to say that they would be willing to use OpenOffice instead.

Tables 5 and 6 present the evaluation of the responses of the grade 11 students with respect to the OpenOffice labs. It is clear that more than 69.5% of the students either agree or strongly agree that the objectives of the labs helped them learn the OpenOffice topics. In addition, approximately 56.5% of them either agree or strongly agree that they are now more confident about their computer skills and would like to take another programming course. The students were also asked whether or not they were interested in taking additional labs in OpenOffice. Most of them (about 56.5%) gave a neutral response to this question, because they were at a higher grade level and didn’t want to take more labs offering instructions and steps to follow. They would like to be more creative and learn on their own.
Table 5. Grade 11 general evaluation of OpenOffice labs – 1

<table>
<thead>
<tr>
<th></th>
<th>Very easy</th>
<th>Easy</th>
<th>Average</th>
<th>Difficult</th>
<th>Very difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writer</td>
<td>47.8%</td>
<td>30.4%</td>
<td>13%</td>
<td>8.7%</td>
<td>0%</td>
</tr>
<tr>
<td>Impress</td>
<td>47.8%</td>
<td>26.1%</td>
<td>21.7%</td>
<td>4.3%</td>
<td>0%</td>
</tr>
<tr>
<td>Calc</td>
<td>43.5%</td>
<td>17.4%</td>
<td>34.8%</td>
<td>4.3%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 6. Grade 11 general evaluation of OpenOffice labs – 2

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The objectives of the labs were clear</td>
<td>39.1%</td>
<td>30.4%</td>
<td>21.7%</td>
<td>4.3%</td>
<td>4.3%</td>
</tr>
<tr>
<td>The labs helped me learn about the topics</td>
<td>30.4%</td>
<td>17.4%</td>
<td>34.8%</td>
<td>13%</td>
<td>4.3%</td>
</tr>
<tr>
<td>I feel that I can be creative in OpenOffice</td>
<td>26.1%</td>
<td>26.1%</td>
<td>39.1%</td>
<td>8.7%</td>
<td>0%</td>
</tr>
<tr>
<td>I now feel more confident about my computer skills</td>
<td>30.4%</td>
<td>26.1%</td>
<td>30.4%</td>
<td>13%</td>
<td>0%</td>
</tr>
<tr>
<td>I would take another lab in OpenOffice</td>
<td>17.4%</td>
<td>21.7%</td>
<td>56.5%</td>
<td>0%</td>
<td>4.3%</td>
</tr>
</tbody>
</table>

All the students, according to the surveys, believe that there is no difference between these two office suites. They commented on what they thought were the most valuable and least valuable aspects of the OpenOffice labs. Among the most valuable aspects reported by the students include the following: “You can be creative”, “I’m learning to use a new program”, “You can make a nice project”, and “I am impressed by Impress”. The least valuable aspects reported by the students include these comments: “Some of the things I already know, so I did not learn much that was new”, and “I didn't really get to use it properly”.

4 DISCUSSION AND RECOMMENDATIONS

The Canadian International School (CIS) is a private school in Abu Dhabi – Khalifa City, which has about 150 desktop computers. It has two labs, one of them a Microsoft lab and the other a Mac notebook lab. The hardware specifications are the following: 125 machines have an Intel processor, and are loaded with the Windows 7 platform and Microsoft Office. They also have 25 Mac laptops loaded with Microsoft Office. The software that is used to manage the student system is PowerSchool for recording grades, generating reports, preparing exams, and storing curricula. This software handles all teacher data and registration activity data. Destiny software is used for the library, Tally software for accounting, and Excel for the other activities. For security and CCTV, they use VMS (Video Management Software). The cost of the hardware for each machine is 2000 AED (Arab Emirates Dirhams), which brings the total cost of the hardware for all the computers to 300,000 AED. In terms of servers, they have two, which cost around $3,000 each, depending on their specifications. The
security and anti-virus software costs them 7000 AED annually. They also pay 2000 AED per month for their Internet service. The following table summarises the estimated cost of software for the CIS:

<table>
<thead>
<tr>
<th>CIS Proprietary Software</th>
<th>Cost</th>
<th>OSS</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating system</td>
<td>Windows (100 users)</td>
<td>74,000</td>
<td>Linux (openSUSE)</td>
</tr>
<tr>
<td>Office applications</td>
<td>MS Office (100 users)</td>
<td>111,000 AED</td>
<td>Open Office</td>
</tr>
<tr>
<td>Student information system</td>
<td>PowerSchool</td>
<td>18,500 AED, plus 9,250 AED annually</td>
<td>FOCUS/SIS</td>
</tr>
<tr>
<td>Library System</td>
<td>Destiny</td>
<td>5,000 AED annually</td>
<td>Koha</td>
</tr>
<tr>
<td>Accounting</td>
<td>Tally</td>
<td>5,000 AED</td>
<td>OrangeM</td>
</tr>
<tr>
<td>Anti-virus</td>
<td>Kaspersky</td>
<td>7,000 AED annually</td>
<td>Moon Secure Antivirus</td>
</tr>
<tr>
<td>Fingerprint – Time and Attendance</td>
<td>DAMS</td>
<td>1,000 AED</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>221,500 AED</strong></td>
<td></td>
<td><strong>0</strong></td>
</tr>
</tbody>
</table>

If we only replaced the Windows Operating System and Microsoft Office in UAE schools, we would save around: 448 * (185,000 AED) = 82,880,000 AED.

5 **CONCLUSIONS AND FUTURE WORK**

Implementing open source software (OSS) in UAE schools will have a huge impact and result in changes in the cost to the country of providing Microsoft Office to school and university computers. OSS also has many other advantages: lower development and maintenance costs, freedom to choose maintenance contractors, less dependence on a single service provider, frequent releases and updates, easy and enriched customisation, a viable alternative when replacing legacy software, reusable older legacy hardware, and the opportunity to develop solutions that are appropriate for organisational needs. OSS is now used in many countries, for its benefits to both the country and the individual. Now it’s the UAE’s turn to implement it in their systems and make it an important part of their educational system. Our future work will involve the use of other types of OSS in UAE schools.

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