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# Essential FOSS Tools for Effective Integration of ICT in Elementary Teacher Education Curriculum

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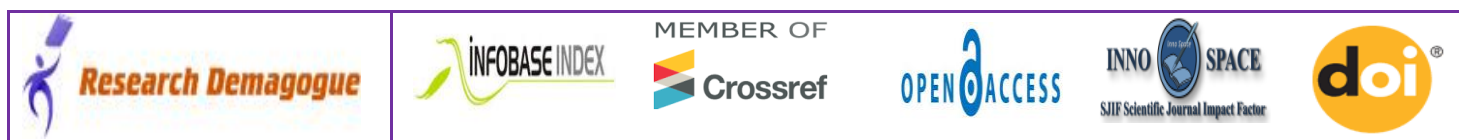
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**Introduction**

Open Source Learning is an emerging education practice that allows students to capitalize on the scope and power of the Internet to create and manage their own learning experiences and produce interactive material that is available online to everyone. By Using ICT, whole process of education including teaching learning and evaluation can be automated. But integration of ICT in the schools of third world countries are facing difficulties in raising funds for purchasing expensive commercial software. Free and open source software is the solution for this problem. But teachers who are not having knowledge on this software will not be able to use them. Teacher training curriculum should address this problem. This paper will try to give information about many such free and open source tools and their application in the teaching process.

The educational community has discovered open source tools in a big way. Analysts predict that schools will spend up to \$489.9 million on support and services for open source software by 2012, and that only includes charges related to operating systems and learning management systems. Teachers and Professors are using open source applications as part of their educational curriculum for a wide variety of subjects. In India use of such tools are very limited due to ignorance of teachers in these aspects.

In addition, educators have created numerous organizations and Web sites dedicated to open source educational software, including SchoolForge, the Open Source Education Foundation (OSEF), OpenOptions, the National Centre for Open Source and Education and FlossEd.org. For this list, the investigator collected educational apps from a variety of categories that can replace popular commercial software. In many cases, the open source options listed here offer features that aren't matched by their closed source counterparts. Even though this paper includes very limited number of these tools, many more can be found on the Web.

**FOSS Initiatives of IT @ School Project by Government of Kerala**

Some of the free software applications developed or customized by the project include the following.

1. Application software like Open office, GIMP, Dr. Geo, Rasmol, KEduca, Klab etc.
2. Examination software - to conduct IT practical examination to more than 1.6 million students.
3. Handbook for GNU\Linux - prepared as a user manual for working in IT@School GNU\Linux.
4. Training modules in GNU\Linux - to train teachers in open source.
5. Textbook for standard 8<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup> - Prepared in association with SCERT.
6. ICT training programme based on Free and Open Source Software (FOSS) for students who require special attention.
7. ICT training to all visually challenged teachers in the State using the free software - ORCA.

**Use of FOSS in Teacher Education**

There are numerous number of software tools available for various educational activities such as teaching, learning, evaluation, co-curricular activities, student information and class room management and library management. All level of teacher education courses comprise of following streams such as science, mathematics, social science and language. The following is taxonomy of FOSS tools that can be used on all above listed streams of teacher education.

**Mathematics Education**

1. **GNU Dr. Geo** is a free software (source code, translations, icons and installer are released under GNU GPL license), created by Hilaire Fernandes. As its name suggests, it is interactive geometry software. Operating System: Linux, Mac OS X, Windows, Android, Sugar
2. **GraphCalc** does everything a handheld graphing calculator would do, and it's easy to use. As the Web site says, "GraphCalc can be your first, last, and only

line of offense against the mathematics that threaten to push you over the brink of insanity. It slices, dices, shreds and purees functions that leave other calculators wondering what hit them." Operating System: Windows, Linux.

3. **GunPlot** is a command-line tool creates both 2D and 3D graphs from mathematical functions. Because it doesn't have a GUI, it's not as easy to use as most of the other graphing apps, but it does have extensive help available on the Web site. Operating System: Windows, Linux, Unix, OS X, and others.
4. **TTCalc** is a calculator performs multitude of scientific operations using very large numbers. Unlike the Scientific Advantage product, it doesn't keep track of units, however. Operating System: Windows.
5. **Maxima** Calling itself "a computer algebra system," Maxima graphs in 2D and 3D and performs differentiation, integration, Taylor series, Laplace transforms, ordinary differential equations, systems of linear equations, polynomials, and sets, lists, vectors, matrices, and tensors. It offers a barebones graphic interface, or you can run it in command line mode. Operating System: Windows, Linux, OS X.
6. **Argumentative** lets users create "argument maps," visual displays of the reasoning involved in creating a good argument. It's great for students studying persuasive writing, logic, debate, speech, social studies, and any subject that requires essay writing. Operating System: Windows.

#### Science Education

1. **Step** does a good job of demonstrating the effect of physical forces. To use it, you simply place some virtual objects in the demonstration area, add some forces and see what happens. (Note that in order to use Step on Windows, you'll have to download KDE for Windows.). Operating System: Windows.
2. **Celestia** lets you view the night skies from any point on earth at any time or virtually fly through space to see the sky from any point in the known universe. Although Starry Night comes with some additional resources (a book and some videos) that add more information about space, Celestia offers the same functionality and it's free instead of hundreds of dollars. Operating System: Windows, Linux, OS X.
3. **Stellarium** let you view the night skies from any point on earth's surface at any date and time. It's so accurate, it's used by a number of planetariums, and it's better than most of the comparable commercial applications. Operating System: Windows, Linux, OS X.
4. **KStars** Part of the KDE desktop, KStars offers much the same functionality as Stellarium - seeing the night sky from any point on earth at any time. It also adds some features for amateur astronomers, like the observing list, altitude vs. time tool, and what's up tonight tool. Operating System: Windows, Linux.

5. **Kalzium** replaces The Elements and Isotopes Kalzium offers a free guide to the periodic table, including chemical data, energy information, diagrams, and a glossary. It also includes a helpful equation solver and calculator. Operating System: Windows, Linux.

#### Social Science Education

1. **WorldWind** offers very similar functionality as Google Earth. Now you can also download a Java SDK for WorldWind that lets you create your own apps based on the technology. For educators who aren't interested in writing their own apps, the site also includes links to Web applications that other people have created with WorldWind, including ones that track earthquakes and global warming. Operating System: OS Independent.
2. **Marble** is a world globe app offers special features for classroom teachers, like topographic maps, map keys, temperature and precipitation maps, and more. You can even change the date and time and watch how the sky and twilight zone on the map changes. Operating System: Windows, Linux, OS X.

#### Languages Education

1. **JILetters** is a very simple application which presents a choice of alphabet letter buttons - when one of these is pressed another window pops up with a picture of an object/animal and then the letter and object is read out
2. **BingoCardMaker** offers a fun way to teach students new vocabulary words. This Java-based app lets you create Bingo Cards easily using your bank of images. Operating System: OS Independent.
3. **TuxType** Designed for elementary students who are learning their way around the keyboard, TuxType offers basic typing lessons and two fun typing games. This app doesn't offer quite as many games, lessons, and features as the commercial software, but it does provide a good introduction to typing for young students. Operating System: Windows, Linux, OS X.
4. **Klavaro** makes it easy to learn to type on international and other non-standard keyboard layouts in addition to the standard QWERTY keyboard. This app includes progress tracking and a contest that can run on a local network, but it lacks some of the fun games of other apps. Operating System: Windows, Linux.
5. **FlashQard** is based on the Leitner Method, FlashQard lets you create "different card types for different purposes" and presents the cards in a manner designed to optimize learning. It also includes a handy "e-speak" feature that pronounces vocabulary words for you. Operating System: Windows, Linux.
6. **jVLT** Designed primarily for learning a foreign language, this Java-based program includes the capabilities to track a vocabulary word's gender, part of speech, and examples of the word in use in a sentence. Other jVLT users have created pre-existing vocab lists that you can download, including English-Czech,

German-French, Thai-English, French-English, practical Chinese, and several others. Operating System: Windows, Linux, OS X.

#### Evaluation

1. **TCEXAM** helps your students to take an exam from any PC or mobile device with a browser. It greatly simplifies test preparation and grading. You can download the code directly to your Web server or purchase a TCEXAM hardware appliance. Operating System: OS Independent.
2. **iTest** first create a database of questions and answers. You can then have iTest create unique tests for each student or each group of students. While students are taking the test, it offers the instructor an overall view of what's happening. Operating System: Windows, Linux, OS X.
3. **Safe Exam Browser** helps you in following way, when your students are taking a test, you don't want them to be surfing the Internet or using other applications that might help them cheat. This app prevents them from leaving the test window, using shortcuts, right-clicking, etc. Operating System: Windows.

#### Co-curricular Activities

1. **LenMus** Developed by a music student, this app helps users learn music theory concepts and improve their ear. It also includes a basic score editor for composition students. Operating System: Windows, Linux, OS X.
2. **GNU Solfege** improves your musical ear like Earmaster, GNU Solfege offers a number of exercises that teach students to identify and sing intervals, recognize rhythms patterns, sing scales and chords, and identify harmonic progressions. Operating System: Windows, Linux, OS X.
3. **Tux Paint** Best for younger children, TuxPaint lets kids make their own artistic creations with a variety of stamps, drawing tools, and special effects. Because of its light footprint, it can run on old or new PCs, including tablets. Operating System: Windows, Linux, OS X.
4. **GCompris** contains a huge number of educational games to play in for kids age 2 to 10 will find it covers basic keyboard awareness, geography, algebra, reading, art and much more. Operating System: Windows, Linux.
5. **ChildsPlay** is a 'suite' of educational games for young children. It's written in Python and uses the SDL-libraries to make it more games-like then, for instance, gcompris. The aim is to be educational and at the same time be fun to play. It is aimed at pre-schoolers and kindergarteners; this app includes a variety of memory and letter recognition games, as well as classic pong and pacman. The graphics aren't as well developed as the commercial products, and it doesn't have a storyline, but the games are fun for young children. Operating System: Windows, Linux, OS X.
6. **ANTS** is IT@School (Govt. of Kerala) initiated Project engaged in giving training in Animation movie making

skills entirely based on Free and Open Source Software such as KToon, Gimp, OpenShot Video Editor and Audacity.

#### Classroom and Student Information Management

1. **OpenSIS** does not charges upfront licensing fees, the "Open Source Student Information System," or openSIS, can lower a school district's total cost of ownership by 75 percent when compared to PowerSchool or other similar systems. Like the commercial software, it integrates student demographics, gradebooks, scheduling, attendance, and more. Operating System: Windows, Linux.
2. **Focus/SIS** is a newer SIS, which is completely Web-based and designed to make it as easy as possible to comply with state reporting requirements. It also streamlines attendance taking, scheduling, grading, and other administrative tasks. Operating System: OS Independent.
3. **ClASS** doesn't offer as many modules and features as the comparable commercial packages; ClASS offers a teacher-centric approach that focuses on making it easy to record and access data from within the classroom. It tracks student information, attendance, and grades from a Web-based interface. Operating System: OS Independent.
4. **OpenAdmin** is a Web-based school administration program offers different Web sites for administrators, teachers, parents, and liaison officers. The interface is bare-bones, but it does offer an extensive feature set and is available in multiple languages. Operating System: OS Independent.
5. **Edcanvas** is the one place for teachers to create and deliver lessons digitally. Teachers and students can use Edcanvas to organize their work and present knowledge. Operating System: OS Independent.

All the tools mentioned above were supported by big community of professional software developers. Anyone can get help from these communities for documentation and support for using them. Most of these tools can be downloaded from the websites like sourceforge.net, github.com or schoolforge.net. Online documentation and training is available for most of them. Anybody with a little attitude and conscious effort can master in using them. Curriculum developers of teacher education must add information and practical work on some of these software tools that can modernize our schools cost effectively.

#### Conclusion

The overwhelming rate of developments in information and communication technologies brings plethora of opportunities in education. Somehow our schools and teachers are still lagging behind in grabbing these opportunities. Conscious, thoughtful and concentrated effort from everyone in the education field is needed for helping our teachers to transform into techno pedagogues. This paper is one such effort for introducing some of the most essential free and opens source tools; they

can effectively replace expensive commercial software tools. If this effort helps in modernizing at least few of the financially backward village schools, then only we can say, this effort is fruitful.

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