

Open Source Software (OSS): Realistic Implementation of OSS in School Education

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Abstract

Purpose: Freedom to think for the generation of new ideas and act to conceptualize them, are the concepts which are revolutionizing today's world. The software world is also not left untouched. Open Source Software (OSS) has brought the idea of sharing of ideas for the betterment of Computer Science to the forefront. With the passage of time, open source software has not only gained prominence in the server software segment, but is also penetrating the desktop segment. Open source softwares are attracting attention all over the world; especially governments of developing nations are working on the promotion and spread of OSS. The advantages of localization, freedom to modify the software, and easy availability are factors that are attracting people towards OSS. The impact of OSS is felt in many arenas. Education is one of them; in India itself, Kerala and Goa have pioneered the use of OSS in school education.

Design/Methodology/Approach: In this research paper, the authors focus on OSS in education and its realistic implementation in school education. The authors conducted an empirical study on school students to study the effect of OSS on their learning curve.

Findings: The authors propose a curriculum for the school that is based on OSS.

Research Implications: The apt usage of information and communication technologies (ICTs) has the potential to improve the quality of education. However, educational institutions face many constraints, like financial, equipped staff, resources, etc. The high cost of software along with the hardware poses major challenge. OSS with its unique features proves to be of great help by lowering the cost factor of the software. OSS not only provides financial benefits, but also there are many other advantages of OSS which prove to be a boon for the education sector.

Value: This research paper will aide policy-makers and decision-makers, to understand the potential use of OSS in education—how and where it can be used, why it should be used, and what issues are involved in its implementation. In particular, officials in ministries of education, school and university administrators and academic staff should find this research useful.

Keywords: Open Source Software; Education; School Education; Information and Communication Technology (ICT); Realistic Implementation- OSS.

Paper Type: Empirical

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Introduction

OSS is a software that gives user the freedom to use, study, and modify the software based on local needs and preferences. This freedom is vital for the growth and development of Computer Sciences. Certain distinctive advantages of OSS are as:

- Lower costs
- Reliability, performance and security
- Build long-term capacity
- Open philosophy
- Encourage innovations
- Alternative to illegal copying
- Possibility of localization
- Learning from source code

Previous studies show that OSS based educational infrastructure in comparison to proprietary software to facilitate the process of teaching and learning has proved to be more beneficial in stimulating cross-boundary learning and modifying the technologies into the desires of the users (**Pearson & Koppi, 2002**). Many more studies propagate the use of OSS in education. Now, the next step is to design an age-appropriate syllabus based on local needs and environment that could be implemented in schools. It also requires the development of course-material for the teacher's aide. Through this research paper we propose an OSS based curriculum based on the recommendations of **National Curriculum Framework (NCF) 2005** proposed by the National Council of Educational Research and Training (NCERT), India. We have also developed the study material which can be instrumental in realistic implementation of OSS in schools of India.

The paper investigates the need of OSS in education, its merits for the students, educational institutions and the nations especially developing ones. It further depicts an empirical study of effects of OSS inside the classroom environment. The paper also presents an overview of the proposed comprehensive integrated curriculum plan based on the recommendations of the *NCF 2005*. **Appendix A**, gives the introduction of proposed software included in the curriculum with a sample of the course material developed. **Appendix B** shows the samples of the work done by students using OSS.

Need of OSS in Education

As Computer Science educators, we constantly seek new channels, methods, and technologies to reach and intrigue our students. We hope to first capture their interest, then develop their understanding, work towards retention of the concept, and finally encourage their own

independent creative work. Throughout this process, we try to teach them skills that they can apply in the real world. The breadth of our field and the variety of pedagogical approaches make this process very difficult.

We believe that OSS can serve as a channel, method, and technology to teach and learn Computer Science. OSS has the potential to expand group work beyond the classroom to include much larger projects and more distributed teams. OSS can also be used to introduce our students to the larger Computer Science community and to the practice of peer-review. Finally, OSS can provide us with free or lower-cost technology in the classroom, permitting us to use technology that we might otherwise be unable to afford.

Merits for the Students

- Students use open source in school, which substantially shortens their learning curve when they go to work for software companies.
- Students who are encouraged to build projects on top of OSS bases can build more interesting and exciting systems than they might have developed from scratch.
- The foothold of OSS is increasing in the industrial sector. Today's learner will be tomorrow's professional. If he/she is not equipped with the desired skill, he/she will find difficulty to adapt in tomorrow's job market. Teaching OSS from the elementary years of education adapts the child for future market and job requirements.
- Students, who take up Computer Science as a subject in higher secondary school and take up professional computing courses in under-graduate and post-graduate programs, remain largely aloof with the actual coding segment taking place in the software industry. Use of OSS will help them work and see the actual software codes; how they can modify them and be a part of a larger online community which is working on OSS.

Merits for the Educational Institutions

- Free and OSS can save the school's money in a context where schools – even the affluent ones are short of money.
- Teaching students' way of life is the aim of education. Schools should promote *"open source software just as they promote recycling"*, which will benefit society as a whole.
- OSS does not demand high end hardware configurations which result in *"lowered carbon footprints"*.

- OSS opens the code for the students, permitting them to learn how software works, thus helping to build good future coders.
- Proprietary software rejects their thirst for knowledge by keeping knowledge secret and “*learning forbidden*”.
- Schools teach students to be good citizens – to cooperate and share with others who need their help. This is the *philosophy of open source*.
- The training to use free software, and encouragement to participate in the free software community, generates a sense of importance of sharing and collaborative development amongst the students.

Merits for the Nation

- Sovereignty and security issues.
- Promote growth of local software industry.
- Induce economic development tapping on local talent and human resources.
- Encourage use of local software at national level.
- Reduced costs and dependency on imported technology and skills.
- Affordable software for individual, enterprise and government.
- Access to government data without barrier of proprietary software and formats.
- Ability to customise software to local languages and cultures.
- Lowered barriers to entry for software business.

Research Undertaken

- **Effects of OSS inside the classroom (Subject: Mathematics)**

We, along with a mathematics teacher, planned a research plan for students of **Class III, Section A and B**. The strength of each section was 36 students.

Methodology

Research Plan 2010

Actions	Timescales/ Key dates	Resources / Sources of support and challenge	Success Criteria	Comments /Amendments to plan
Collect data related to the understanding the students of class III, already have related to the topic	2 nd week of September.	We will be using worksheets and photocopy of student's class-work.	The worksheets will be completed individually.	The worksheet assessment and the oral assessment gave a different output for certain students who were good in oral work but poor in

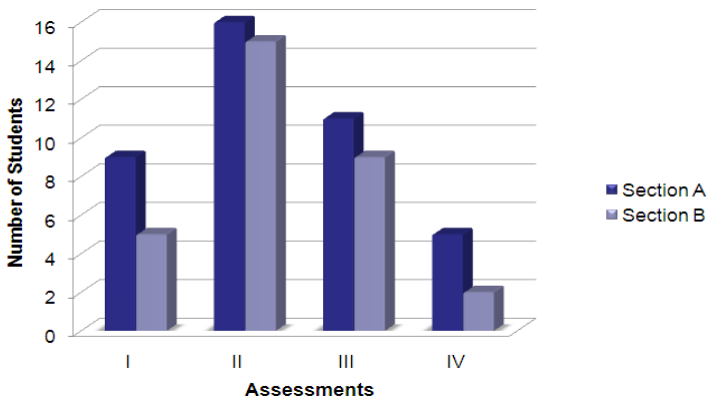
Multiplication and Money and identify the student groups who are struggling with the concepts				comprehension.
Explain the concept of Multiplication and Money using multimedia modules.	Mid September	Using computer and the module available related to the topics.	All the children will have access to a computer and the module.	Learners were keen to watch the multimedia modules.
Provide students with opportunities to use their concept knowledge to play computer games and to improve their skills by trying to improve their scores Software used: Tux Math and GCompris	3 rd week of September.	Using Free and Open Source Software. The computer teacher will also act as a resource person. The challenge will be to adjust the timetable so that the computer lab is available to this group of students.	All the students will be able to play the games with increasing difficulty level	The idea of taking a mathematics class in the computer lab was enough to excite the students. The game play of Tux Math provided ample opportunities for oral and mental mathematics calculations. The results were saved and the game play could be continued in the next lesson which gave the learners an opportunity to wait for the upcoming mathematics class.
Assessment to gauge the students level of learning Software used: Tux Paint A grid	Last week of September.	Assessment sheets, Classroom observation, interview with students.	To see that Students have achieved the expected learning outcome	Using the capabilities of the free and open source software tux paint, a grid was designed which was included as a stamp in the software. The teacher gave questions that had to be solved using the grid and answers be noted in the grid. This was used later by the teacher for assessments.
Feedback	1 st week of October	Feedback Form	To get the learner's point of view.	The learners gave positive responses about the whole exercise.

The above methodology was adopted in section 'A' of class III. In section 'B' with the same teacher the approach was kept conventional. To gauge the performance of the students periodically assessments were conducted. In this study, we conducted **four (4) assessments**. The results of the assessments of both the sections were compiled and tabulated. A comparative study was then conducted after the assessment of both the sections.

Results

The study clearly showed that the number of students who grasped the concept in less time period and with a better quality were more in section 'A' where certain open source software were adapted in conformance with the syllabus of the class (**Fig. 1**).

Fig. 1: Comparative analysis of students of Class III A and III B



Discussion

After the completion of the study, a feedback was taken from the students as well as the concerned subject (Mathematics) teacher (**Fig. 2**).

Fig. 2: Sample of student feedback forms

Feedback Form
 Name: Anant Wigan Age: 8 Class: II A
 Comments on Mathematics Class:
I enjoyed the maths class in the
computer lab. I played many games on
calculator.

Feedback Form
 Name: Mishra Rupita Age: 7 Class: III
 Comments on Mathematics Class:
I wait for my maths teacher. She
takes me to the computer lab to
do maths. I give tests also on computer.

Appendix A**Review of the Mathematics teacher**

Before starting my lesson on multiplication using computer aided technology, I assessed the previous knowledge base and the level of understanding of my Class III students through a worksheet. I found that the majority of students understood that multiplication was grouping of objects but were not clear about multiplication as repeated addition. I also talked to my colleagues teaching Class III and all of them unanimously agreed that the students of Class III (A) were very restless with a short attention span and that they were also finding it difficult to keep them engaged for longer periods. At this point I would like to mention that I follow the activity based method of teaching and I teach every topic through some activity to make it interesting to students. Yet we were all facing the challenge of keeping Class III-A engaged. I also observed the computer lesson of this class and was surprised to see the level of engagement in the same students. This made me decide that using computer as a tool for teaching mathematics will not only help in improving student performance but will also increase student engagement.

I had discussions with our computer teacher, Ms. Gunjan Kotwani who has been working with OSS (Open Source Software) since the past few years and is also working on integrated learning approach for students of classes I to V. She went through the Mathematics syllabus of Class III and gave me valuable inputs on which topics could be taught using certain software. We both took Mathematics lessons in the computer laboratory. We shared few tips on how to help students when they were facing some difficulty in carrying out their Mathematics assignment on computers.

I started my lesson on multiplication using multimedia modules. I explained the concept of repeated addition using this software. We then took the class to the computer laboratory where the students would have access to individual computers and could apply whatever they had grasped from their previous lesson in the given assignment. We noticed that the level of student engagement was very high; in fact they did not want to return to their classroom at the end of the lesson. After 3 lessons in the computer lab we assessed the student learning and were surprised at the result as we found that there was not any significant improvement in their learning. After discussions with other mathematics teachers, we realized that what the students also needed in Mathematics was daily practice and drilling which included pen and paper exercises.

We made some basic changes in our plan and interspersed Mathematics lessons with assignments on computer as well as exercises in the notebooks, worksheets and home assignments. As we progressed we noticed that the students were responding better.

Curriculum Planning

This study aims to provide a realistic implementation of OSS in schools. The major problem faced by the schools willing to adopt OSS in Computer Science curriculum is the lack of study material. The teachers are not equipped enough to handle OSS in their classrooms. A series of training sessions with adequate support in the form of study material and services can play a defining role in the implementation of OSS.

This curriculum has been designed keeping in mind the recommendations of *National Curriculum Framework (NCF 2005)*.

Appendix B

Class	Age-Group of Children	Suggested Software
I	6-7	TuxType, TuxPaint, GCompris
II	7-8	TuxPaint, Tux Math, Introduction to OpenOffice.org Word Processor
III	8-9	OpenOffice.org Word Processor,

		Introduction to Logo programming using KTurtle
IV	9-10	Introduction to OpenOffice.org Presentation, Basics of Logo programming using KTurtle
V	10-11	Advanced OpenOffice.org Word Presentation, Programing Basics of Logo programming using KTurtle
VI	11-12	Internet Browser (Firefox), Raster Graphic Editor- GIMP, OpenOffice.org Calc (Spreadsheet package)
VII	12-13	Vector Graphics Editor-Inkscape, Introduction to Database using MySQL, HTML programming using BlueFish
VIII	13-14	Database concepts using MySQL, Introduction to programming using Java NetBeans, Database connectivity between Java and MySQL, Page-layout program-Scribus
IX	14-15	Advanced Java programming using NetBeans
X	15-16	Introduction to programming in C++ using GCC compiler
XI	16-17	Based on recommendations of CBSE
XII	17-18	Based on recommendations of CBSE

Conclusion

The study aims to lay stress on the need of use of OSS in a developing nation like India. The use of OSS will promote free thinking, innovation, development of new software models and the field of Computer Science can reach to great heights. The students need to be exposed to these software at an early stage of their mental development. Use of OSS will teach the usage of tools rather than laying importance to software. For example, a document can be created in any word processor software. The student should be comfortable in adapting to various word processors available. Ultimately the tools of a word processor will be similar, only their placement and arrangement might be different. Since Computer Science is a rapidly evolving field in which new software and technologies keep on emerging. This kind of flexibility with the software is essential. In this context, the acceptance and adaptability for the changing software is necessary for the students.

This research aims to provide a practical, feasible and working model of OSS in education. For this the development of study tools like course-material, resource CDs, etc. are essential to provide support to the teaching community and will also help in removing the hitch to adopt OSS in education. Still there are many challenges in the implementation of OSS in school curricula. The major one being the reluctance to change. The teaching fraternity first needs to be convinced about the benefits, OSS can give to their students. The unavailability of teaching resource material for OSS is another hitch. And lastly teacher training and OSS maintenance are the challenges which need to be overcome for effective implementation of OSS in school education.

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