TEACHING BASED ON FREE SOFTWARE

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Abstract — *There are many situations in teaching where classes in computer laboratories are problematic. Most of the time it happens due to bad hardware or software configuration and virus. To solve these problems the LabTEVE - Laboratory of Technologies for Virtual Teaching and Statistics - of the UFPB developed a Linux remaster named KLabTEVE for Statistics teaching. This remaster contains all software necessary for the Statistics classes. All content is free and can be used directly from the KLabTEVE CD without any previous installation. This feature guarantees that all configurations will be perfect in any computer and that the programs necessary to the classes and homework will be available. To verify the effective utility of the KLabTEVE were carried out two surveys during the school semester. These surveys demonstrated that the students welcome this kind of innovation and the necessity of adaptation of high education to new technologies.*

Index Terms — *Free Software, Educational Software, Usability.*

INTRODUCTION

The use of Free and Open Source systems have been motivated by governs as a way to reduce costs and have more control in applications development. Besides of costs restrictions for governs, the costs of commercial packages are too right to the Brazilian reality and many users cannot buy an operational system or application for home use.

Universities are joining to this idea using free software and reducing license costs. In that meaning was observed that the software tool is not the most important factor in the learning process of concepts basically because it changes according to the technological development. More than that, in the last years was observed the appearance of much free software similar or better to proprietary software.

Still in the didactic context, one of the most significant problems is related to computer laboratory classes. Many times, the machines do not contain the necessary software working correctly, it was not installed or a virus erased computer data. This is a permanent source of teachers' complaint. For students, a long time in the classes is wasted with fittings in software. Because most of the students are just users of the software, they would like to have the same tools that use in the university to work at home and without the complication of their installation.

Motivated by these problems, we developed the KLabTEVE, a Linux remaster that includes several packages and tools. The KLabTEVE allows students to have the same environment and the same set of tools. The remaster is a Linux distribution based on the Kurumin [1], a Brazilian Linux based on the Knoppix [2] that was based on the Debian [3] (all developed by volunteers). The KLabTEVE is a complete system executed directly from the CDROM, without any previous installation. However, if the user wants to install all the packages in his computer, the KLabTEVE scripts allows to do that.

LINUX DISTRIBUTIONS

There are several projects based on Linux in several countries and also in Brazil. Some of them are for general purposes and others are for educational purposes. In this session, we present some Linux distributions, which can be used directly from CD-ROM (live-CD) and/or installed in the user's computer, maintaining all its functionalities. We present bellow some Linux distributions for general purposes.

Famelix [4] is a project related to the development of a user-friendly Linux for Windows user. Based on Debian [3], a very stable distribution, its interface was designed to provide all functionalities for non-expert users as: automatic disk mounting, Windows-like graphical interface, automatic printer recognition, network mapping, Brazilian Portuguese language, use of the popular fonts (Arial, Times New Roman, etc). The main idea of the project is allow an easy migration of commercial environment users to a free platform.

KEPE [5] Linux is another Linux project based on Debian dedicated to provide a GNOME graphical environment for users. This distribution can be used directly from the CDROM and automatically to recognize graphics adapters and network connection. It also uses the Brazilian Portuguese as default language.

Kalango Linux [6] is a live-CD Linux with several tools for automatic hardware configuration. It uses the K Desktop Environment (KDE) as graphical environment. Several free software packages are present in that distribution for general purposes, as OppenOffice and KOffice.

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Kurumin [1] is one of the most important live-CD Linux distributions in Brazil. Totally in Brazilian Portuguese, this Linux offers several configuration scripts and shortcuts to install new programs and uses KDE graphical interface. It is based on Debian and is very stable. The Kurumin is very well documented and includes a tutorial about how to create personalized remaster. Some free software included in the Kurumin are: Kurumin Office, Blender, KOffice, Java Runtime Environment, Firefox Mozilla, etc. From that distribution, several others live-CD Linux distributions were developed in Brazil.

Bellow, we present some Linux distributions for educational purposes.

ADIOS [7] is an Australian project and the name is an acronym for "Automated Download and Installation of Operating Systems". There are two versions for it: the first is dedicated to provide for students an operating system where they have administrative privileges in a laboratory, and the second is a live-CD based on Fedora Core Linux [8] for general home use.

EduLinux [9] is a Canadian project based on Mandrake Linux, nowadays Mandriva [10], distribution for French language. It was developed for speaking educational and governmental organizations. The main goal of the project is allow an easy migration of commercial environment users to a free platform.

The Freeduc [11] is a live-CD Linux built by the Organization for Free Software in Education and Teaching (Ofset). Ofset is a french organization, whose goal is to promote free software in education. Freeduc is based on Knoppix, excluding some applications and including educational software. The graphical environment of FreeEduc is the XFce window system. Freeduc also supports a number of European languages, including English, Spanish and Italian.

Skolelinux [12] is a Norwegian project based on Debian Linux to replace Windows with Linux in schools. The goal of this project is to make Debian easy to install and maintain for schools, with applications available on the students in several languages, including in Brazilian Portuguese [13]. Skolelinux is used by schools in several parts of the Europe and of the world.

KLabTEVE

KLabTEVE is a Linux remaster, a Linux operational system increased by a set of programs, all free from distribution and use. Due to Kurumin's facilities, documentation and Brazilian Portuguese support as described above, the Kurumin Linux distribution was used as base for our remaster, the KLabTEVE.

The main advantage of a remaster is the configuration of a personalized system and environment, with selected programs and tools. This remaster is recorded in a CDROM and can be used directly from it. The CDROM is a boot disk that recognizes the computer resources and provides a complete environment work without modify the data contained in the hard disk of the computer. If the user desires, the remaster can also be installed in the computer (hard disk). In this case, the operational system and all the applications included in the remaster will be installed. A remaster is a good solution for cases where a specific set of tools needs to be available no matter the system previously installed in a machine.

The initial motivation to develop the KLabTEVE was the laboratory classes for Statistics course students. So, KLabTEVE version 1.0 used 633 MB and was developed from the Kurumin Linux version 3.31 with Linux kernel 2.4.25-klg. This Kurumin version already presents several text editors, an Office suite and Java interpreter. Programming languages as gcc and gcj, Java were added to it. Were also installed Mathematical and Statistical programs as SciLab, the R Software with many optional packages (total of 41) and some graphical packages as Blender, QCad, and Flash for the Firefox browser. To attend Computer Sciences students in computer graphics classes, the OpenGL, GLU and GLUT libraries were also included in the remaster.

The current KLabTEVE version is 1.2 and has more seventeen packages for R, a free Internet access provider, RLPlot to creation of scientific graphics, OpenStat3 for Statistics, two Latex front-end and a folder "Como Programar" with tips about how to compile and execute programs in C, Pascal, Fortran, Java and OpenGL.

FIGURE. 1
KLabTEVE DESKTOP.

As Kurumin Linux, KLabTEVE also uses the K Desktop Environment (KDE) as graphical environment. To facilitate the use of the system for users that never used Linux, several icons were installed in the desktop for fast access of new programs. Figure 1 presents the graphical interface of the KLabTEVE and the icons installed in its desktop. Figure 2 presents the XV package for image visualization and conversion. All the R packages present in

this remaster are described at http://www.de.ufpb.br/~labteve/kurumin.html.
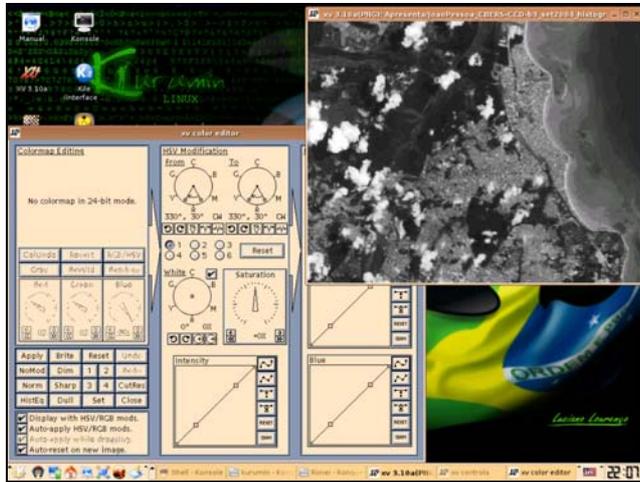

FIGURE. 2
XV RUNNING IN KLABTEVE.

At this time, KLabTEVE 1.2 contains the main programs and tools used in the courses of Statistics, Mathematics and Computer Science. Table I shows a list of some packages available in the KLabTEVE remaster. It has also been used in laboratory classes to provide a common environment for all students. The KLabTEVE is available to free download at http://www.de.ufpb.br/~labteve/KLabteve12a.iso. This ISO file contains an image of KLabTEVE 1.2 that can be opened and recorded in a CDROM by any CD record program.

TABLE I
SOME PACKAGES OF KLABTEVE 1.2A.

Package	Purpose
Kurumin Office	text edition, presentation, image edition and electronic spreadsheet
Kile	Latex front-end
LyX	Latex front-end
gcc	C compiler
gcj and java	Java interpreter
Mesa3D	OpenGL, GLU and GLUT libraries
Blender	3D modeling, animation, rendering, post-production, interactive creation and playback
FreePascal	Pascal compiler
OpenStat	Statistical package
R	Statistical analysis package and more than 50 additional packages
QCad	2D CAD system
XV	image viewer and converter
SciLab	mathematical programming package
RLPlot	generator of graphics
f2c	Fortran to C converter
GIMP	image edition

STUDY CASE

KLabTEVE 1.2a was used during the second semester of 2004 in a course of Statistics Control of Quality. The students used the OpenOffice suite for text edition and electronic spreadsheet, the SciLab for mathematical programming and the R with qcc (quality control package) for statistics data treatment. In spite of the initial resistance due to the first contact with Linux, the students lost little by little the fear of using it.

Two surveys were developed to verify the utility of the remaster to the teaching. The goal was to obtain an initial and final comparison about the contribution and facility of use of the system by students, and to obtain suggestions for its improvement. Both surveys were based on questionnaires as proposed by [14], where several questions about students' preferences should be answered on no-numeric scales, but with the identified ends. The questionnaires also contained other questions of multiple choice and also discursive questions. The statistical analyze of data was conducted using statistical descriptive methods as proposed in [15].

The first survey was conducted at the beginning of the semester with the distribution of the KLabTEVE. The second survey was conducted at the end of the semester before the final test. In both surveys the students were inquired about free software, its contribution for the student education, previous knowledge of Linux and previous packages used for Statistics. A blank area was available for student suggestions. No identification was required in the questionnaires but the student could identify himself if he wanted it. All students (in the total of nine) answered both questionnaires.

In the first survey did not know what was free software 66,67% of the students and 77,78% of them never had used Linux. All declared themselves as Windows users (88,89% for more than five years), even the 22,22% that couldn't define what it was, and 11,11% were curious about learning Linux. A percentage of 77,78 of them did not understand how Linux and free software could be important for a Statistics professional. In spite of it, have already used or knew what was Linux 77,78% of the students and 22,22% declared himself as a regular user of the system. About the packages included in the remaster, the OpenOffice was mentioned by 66,67% and R was mentioned by 11,11%.

In the second survey, at the end of semester, did not know what was free software only 11,11% of them. A percentage of 88,89 considered the Linux and free software use important or necessary to the Statistics professional. When compared to the Windows operational system, the KLabTEVE environment was considered more beautiful, with more options of games and packages (free). In this case, Windows environment was considered more intuitive and friendly. In programs comparison, the R (Figure 3) was mentioned as a package with more statistical options, more graphics and more easy to install than the SPSS (commercial package). In this case, SPSS was considered more beautiful

and intuitive. When compared OpenOffice to the Microsoft Office, OpenOffice was mentioned as more beautiful and with more draw options, but Microsoft Office was considered easier to install new options. Both packages were considered easy to work.
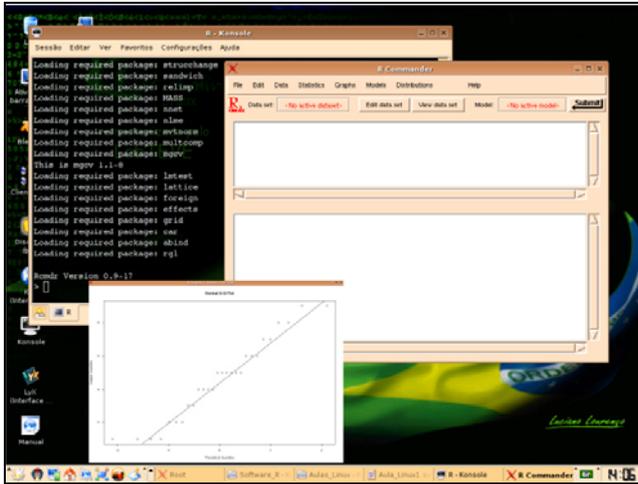
FIGURE. 3
INTERFACE OF THE R SOFTWARE EXECUTED IN KLABTEVE.

The Figure 4 shows the percentages of students in the first survey and in the second survey who knows what free software is. It can be note in the first survey that most of the students did not know about free software. The Figure 5 shows the inversion of the students' opinion on the importance of free software in their future profession.
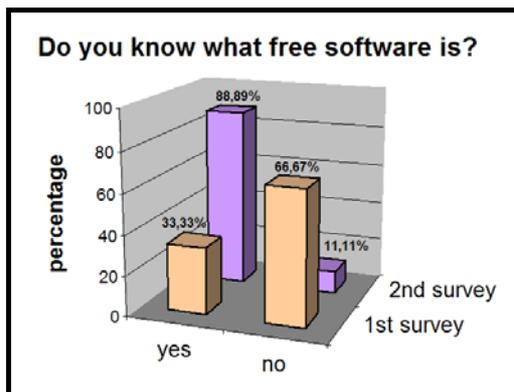

FIGURE. 4
PERCENTAGE OF STUDENTS IN THE FIRST AND SECOND QUESTIONNAIRES WHO KNOWS WHAT FREE SOFTWARE IS.

The inversion of the students' opinion on the importance of free software is observed in three comparative questions about commercial software and free software, as it is shown in the Tables II, III and IV. In the Table II Linux is

considered better operational system in three of the four requirements. The statistics students use operational system basically as support for statistical packages, for text editors and for others programs as games. In this case, Linux can offer more free programs and free games than Windows.
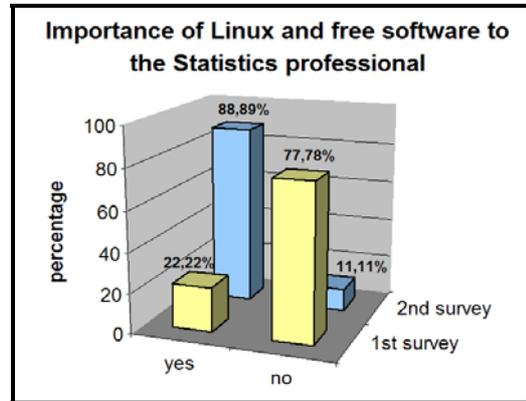
FIGURE. 5
PERCENTAGE OF STUDENTS IN THE FIRST AND SECOND QUESTIONNAIRES WHO BELIEVE OR NOT IN THE IMPORTANCE OF LEARNING A FREE SOFTWARE OR PACKAGE IN THEIR PROFESSIONAL LIFE.

TABLE II
COMPARISON BETWEEN KLABTEVE AND WINDOWS

User Opinion	Software or Package	
	KLabTEVE	Windows
general appearance	better	
number of programs available	better	
games available	better	
intuitive		better

The Table III shows OpenOffice as better office suit choice in three of the five requirements. The main use for office suit by a statistics student is the edition of texts and formulas, followed by graphs. In few times the student needs to install options or to alter specific menus.

TABLE III
COMPARISON BETWEEN OPENOFFICE AND MICROSOFT OFFICE

User Opinion	Software or Package	
	OpenOffice	Microsoft Office
general appearance	better	
edition options	better	
draw options	better	
installation of new options		better
installation of menu options		better

The Table IV shows a balance between the two statistical packages. The facility of use for the interface more elaborated contributes to the SPSS to be the best in three options. However, in number of statistical analyses, graphical options and facility of installation of new options

the R Software is considered better. For a statistics students both of them are good statistical packages. However, as R Software is free, the student can download updates by Internet and to have a package more robust and with more options of statistical methods.

TABLE IV
COMPARISON BETWEEN R AND SPSS

User Opinion	Software or Package	
	R	SPSS
general appearance		better
number of statistical options	better	
graphical options	better	
installation of new options	better	
intuitive		better
facility of use		better

FINAL COMMENTS

In general, the KLabTEVE system was well evaluated for its first users. Several students reported the use of KLabTEVE for homework and Internet access. In last case, the use is justified because KLabTEVE is completely virus free when running from the CDROM. At UFPB the system is in use in statistics teaching and by teachers of other areas and courses, such as in the Computer Graphics.

The survey helped to verify the students' interest in KLabTEVE and free software. We observed that the initial resistance happens based on the myth that Linux is not user-friendly. But, after some days of use, the initial resistance was broken and users adopted the KLabTEVE. It demonstrates also that free software can be largely applied in the educational environment and even in the professional environment and points out to the necessity of adaptation of the academy to this new technology.

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