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Building a Smart education in developing countries: Case of Chad

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ABSTRACT: ICTs are gaining more and more areas. Education will not be the rest. But introducing ICT into a college or high school in a developing country like Chad is a complicated process because the operating conditions of ICT components are not always met. In this work, we will examine different possibilities and difficulties faced by these secondary schools in the process of introducing ICT into educational activities in Chad. We propose some ways to address these situations; and finally we provide some advices to the main actors of the education system.

KEYWORDS: ICT, computer science, high school, hardware, software and education.

1 INTRODUCTION

Information and communication technologies (ICTs) are now indispensable tools without which humanity would have difficulty keeping its bearings and its balance. ITCs are true vectors of communication but also of blooming at different levels. ICTCs impose themselves in all disciplinary fields: health, industry, videoconferences.

If the highways of communication occupy a place of choice in our society, it goes without saying that they are involved in places of formation of public opinion, including colleges and high schools.

In 2017, we conducted a survey relative to ICTs in about 30 secondary schools in Chad [1]. Indeed, we collected data in 10 institutions in N'Djaména (Capital of Chad) and 18 institutions in secondary cities including Abéché, Bongor and Moundou. Only volunteers participated in our survey. 104 teachers and 300 students actually participated. On 650 questionnaires sent (500 to students and 150 to teachers), 404 came back to us, a rate of 62.15%. Table 1 gives the participation statistics by city.

Table 1. Participation statistics by city

Town	Institutions			Pupils	Teachers
	public	private	total		
NDjamena	4	6	10	89	37
Abeché	3	4	7	56	23
Bongor	3	5	8	88	28
Moundou	3	0	3	67	16

This survey aimed to make an inventory of the use of ICT in secondary education and the wish to introduce ITCs into secondary schools. It focused on the following main aspects:

a) knowledge of ICTs by students and teachers;
b) use of ICTs both in the classroom and outside school;
c) the use of some common hardware and software;
d) ICT preference in learning (for students) and in teaching (for teachers).

We found that 82.67% of pupils and 93.07% of surveyed teachers expressed the wish that ICT be introduced in schools and used to deliver courses. This shows the willingness of teachers and students to have SMART schools.

With the new vision of the Chadian government oriented to a policy of development which integrates information and communication technologies, it is essential to educate children, early in ICT tools. This vision is evidenced by the organization of the first international exhibition of ITC in September 2014 in N'Djamena and the launch of the project of construction of the African Telecommunication and Information Center (ATIC).

Early in 2011, the Economic, Social and Cultural Council of Chad, in its policy letter on education system, proposed a gradual introduction of ICT in secondary education to improve learning. Already in 1996, UNESCO (United Nations for Education, Science and Culture Organization) encouraged States to teach computer science at the high school [2]. The computerization of certain public sectors (Ministry of Finance and Budget, the Ministry of Public Service, etc.) is a precursor sign that the future will have digital sciatic nerve. We will have smart administrations, smart economics, smart agriculture, smart education, etc. Here we will focus on SMART education.

We call smart education, a learning process which uses modern technologies mainly ICT to help pupils to learn and facilitate teachers' tasks. It includes education process and school administration. In this work, we will focus more on computer science at schools.

The goal of SMART education in middle and high schools is to introduce to students the main functions of ICT, in a perspective of struggling against "technological illiteracy, the use of the ICTs and to develop critical thinking skills, abilities in technology, social behavior and ability to act and work individually and in a team [3], [4].

At secondary schools, ICTs will serve as a working tool; that means they will facilitate the organization of the school's activities: management of teachers, students, student grades, timetables, writing notes and correspondence, etc. They will also be disciplines to teach: they will give to students the knowledge they need to master ICTs. We note that ICTs also have virtues for teaching other disciplines: we can use them for simulating concepts presented in classes [5].

In Chad, some secondary or even primary schools have introduced computers in their schools either as a working tool or as a discipline for transmitting computer skills to students. In our survey, 43% schools use computer for the management and less than 4% teach computer science to their pupils.

The introduction of ICT in secondary schools requires contribution of all and ability of everyone. First, it requires the clear will of each other to make this policy a success. All the actors of the establishment must be informed of this innovation and all important details, in particular, hardware and software that the institution will acquire, computer training that will be necessary for its personnel as well as systemic approach to management that will result. It's not just about getting computers into classrooms without upsetting the habits of parents, students, and teaching practices. This introduction is synonymous of appropriation of these technologies to improve educational practices. It is translated by:

- ICT education;
- computer use and learning ;
- use of ICT in the realization of courses;
- computers maintenance,
- application of ICTs on adopted pedagogical approaches (skills approach, pedagogy by objective and pedagogy of large groups)
- the use of ICT for the management of human resources and materials of the establishment;
- etc.

In this work, we will examine different possibilities and difficulties that secondary schools face in the process of setting up a smart education in Chad. First we will introduce the importance of ICT in middle and high school. Then, we will talk about their impact on the school curriculum. We will discuss what it takes to succeed in smart education at a secondary school. Then we will expose some technological approaches that may interest high schools. Finally, we will present some suggestions to the main actors of the Chadian education system.

1 ICTs in middle School and High School

Information and communication technologies (ICT) have their place in secondary schools both as a working tool and as a discipline to teach [5]. Since all digitized information is processed by computer, we will be more interested in computer in the rest of our work. The goal of smart education is to provide to students general knowledge and a coherent idea of essential functions of computer, in order to introduce them to information and communication technologies. Students will find in ICT classes an opportunity to use ICT tools, to experiment, to discover and to create digital knowledge. At high school, ICT scan be used as working tool, as discipline to teach as well as means to teach other disciplines. Let us examine these kinds of use.

1.1 ICT AS A WORKING TOOL IN MIDDLE SCHOOL AND HIGH SCHOOL

As working tool, ITCs are used to facilitate the organization of the institution's activities. They can serve as a tool for administrative management and student management. In fact, computerizing the tasks of an institution is an excellent way to simplify its work, to manage a large amount of data and information in a precise and consistent manner. ITCs save time and increase productivity.

Activities related to administrative management in middle and high schools range from day-to-day management (notes and correspondences) to careers management. Human resources and time managements are also important tasks that a computer can help to achieve in an educational institution. All repetitive aspects of these tasks are eliminated by the use of a computer which allows storage and restitution of the documents and gives the possibility to make copies which one can modify as he needs. Calculations can be automatic if an appropriate program is available. Several tools in this direction are available. Word processing software and spreadsheets are examples. With the help of an experienced person or a computer scientist, a good expression of needs and good design can transform this software into specific tools for the institution. The use of a database is also an ideal solution for the management of educative institutions. All materials constituting the heritage of an institution are to be referenced in a database or in a specific document.

Activities related to student management starting by enrollments can be managed with the computer tool. All information about students can be recorded on a computer. That facilitates student search or classification operations. Spreadsheet software or a database can be used for this purpose. Time management, class notes and exams notes are lightened by these tools. It will be easy to follow the curriculum of a student. As a working tool, computer science makes an impeccable service to the school administration in general. Some middle and high schools in large urban centers are starting to use of computer in this way. In our survey, we note that 46.15% of public institutions and 26.66% of private institutions use computers for their administrative tasks.

Central administration must strive to provide all schools with computer tools that can enable them to benefit from the facilities offered by ICT.

1.2 ICT AS A DISCIPLINE

The second consideration of ICTs in middle and high schools is to insert them into the curriculum as a discipline to teach. This way holds more our attention. It is to see how to teach computer science to young pupils. Given the benefits of ICTs, it would be wise to initiate children early to the use of these tools. Information and communication technologies have become unavoidable in almost every field. School is a crucible of knowledge. It must offer ICT knowledge to its pupils. If it is been the lack of resources (human, hardware, software, etc.), it is desirable to begin ITC training in primary school. Some private institutions advocate teaching ITC in the nursery. This vision is very commendable if it is not just for marketing issue. Techniques and tools to achieve this vision exist today. Only the means will constitute the brakes.

In this work, we will reflect on this aspect. We will make an inventory and will analyze the different possibilities to teach computer course in middle and high schools. We will make proposals of approaches and programs to teach computer science to students for well equipping them at the end of their school curriculum.

1.3 ICT AS MEANS OF TEACHING OTHERS DISCIPLINES

Another way to promote ICTs is to use them as means for teaching others disciplines in middle and high schools. The goal is to get the pupils to acquire knowledge through ICTs rather than teaching pupils the use of ICTs. This requires teachers who can use ICTs. That option will start with the training of all teachers. This training will certainly focus on computer science in general, but also on computer science applied to each discipline. The goal is to equip teachers with knowledge, techniques and applications that can help them to implement computer science to deliver their courses. There is software to simulate concepts presented in a given course. For example in chemistry, there are tools to represent atoms and their combinations in molecules. Ongoing reaction simulations are also well shown.

If this option is considered, the government must integrate in the initial training of the future teachers all the recipes to equip them with useful knowledge and tools.

1.4 IMPACT OF ICT ON THE SCHOOL CURRICULUM

There is a legitimate need to ask questions about ICTs curricula in middle and high schools. As no formal ICT education program is available in Chad now, each precursor of institution has developed its ICT curriculum. Each curriculum comes down to the goodwill and competence of the teacher in charge of this course. The only plausible measure of these ICT courses will be the result (what students could have learned as ICT skills). The fact that some private general education institutions are embarking on ICT education is already laudable, and it is to be hoped that the other general education institutions - especially the public ones - will follow them.

It is time for the responsible of the training in middle and high schools to study the programs of computer science courses to be taught in these institutions. National education experts, in collaboration with IT experts and other resource persons, can define a national curriculum for computer science. Until we are there, we propose in the following a framework which one can follow for the computer science classes in the middle and high schools.

It should be mentioned that the introduction of computer classes will have a real impact on the organization of teaching including the timetable of the different classes. It will be necessary to insert hours for ITC course and its practical works, since the computer sciences requires implementations on the machine (computer). To respect hour quotas set by the Ministry of National Education, it is necessary to increase the number of hours per day either by starting early classes in the morning (instead of 7:30 start at 7:00) or by delaying the exit classes at the end of day (instead of 12:30 end at 13:00 for example). For older pupils, classes can be considered in afternoons. The days of Saturday must be as fulfilled as the others. A profound reorganization of the school calendar with long days from 7 am to 5 pm is also worth exploring.

It would not be excluded to nibble a few minutes of teaching on other disciplines to make hours of ICT courses. But, that will not fail to create impacts on these disciplines.

Computer science must be a compulsory discipline, taught in all levels of middle schools and high schools. We propose at least two hours per week to be devoted to it. The course should have a title relative to its content and will focus on the fundamentals of computer science, computer systems, programming tools, computer networks, key network services, computer maintenance, software, specific applications (multimedia, graphics, etc.), etc.

1.5 DIFFICULTIES FOR SMART EDUCATION

First, human and financial resources of secondary schools are rare. These resources must be shared among several tasks according to priorities. It will take extra money to hire ICT teachers or to buy ICT equipment. ITCs introduction has a real impact on the school's budget. Then, we note the attitude of certain educational actors to resist change. In fact, some school executives and disconcerted teachers no longer want to be jostled or disturbed in their way of working. Even using ICT as a tool does not please to everyone, some administrators prefer to stay in their manual or mechanical system. Some teachers are not ready to immerse themselves in a bath of ICT, to integrate the ICT in their courses, even as a tool of presentation of courses. This can hinder the introduction of ICT in their institution. Fortunately, according to our survey, only 7% of teachers do not which to introduce ITC in school. We noted that those teachers declared not knowing how to use computer science tools. We wonder if they are afraid of some ITC investment they have to do that they think it is expensive? They can be sensitized to the benefits of ICT in education and the benefits that students will gain during and after school.

It should be noted that there are other fears in the mind of pedagogues and national education professionals. First of all, it is the fear that the introduction of ICTs will be similar to the different tools introduced in secondary education that, it is difficult to assess their impact on teaching. These tools include laboratories in physics, chemistry, biology, geology, languages, etc. Many hopes have been placed in these tools but the results remain mediocre if not null. In most secondary schools, laboratories have never seen the days. The few institutions that have managed to dispose of these laboratories cannot operate properly. The various machines and the different products necessary for practical work are absent from these laboratories. Many institutions end up ignoring the practical work.

Then, in a practical way, the introduction of ICT presents much more requirements compared to those of the laboratories of physics, chemistry and biology. These requirements begin with the availability of rooms, ITC equipment (computers, tablets, printers, scanners, and other peripherals), software (basic and educational) and end up with the presence of electrical energy passing by air conditioning and cleanliness (dust control).

It is clear that ICT requires more consistent loads than those of conventional laboratories. However, across the country, institutions cannot set up and run these traditional laboratories. We are entitled to question the capacity of these institutions to introduce and teach ICT in their breasts. Therefore, there is a real risk that ICT education will be purely theoretical and will present the wonders of ICT without teaching pupils how to use and draw better parts of these ICT tools.

One aspect that puzzles us is the misuse of ICT tools by learners. We focused more on the teacher-led use aspect with a particular focus on computer sciences. However some ICT tools like mobile phone, MP3 players, digital recorders, photos, etc. are used directly by many pupils. Moreover, these tools have infiltrated institutions without great realization. We saw in our survey that 72.67% of surveyed pupils say they use MP3 and only 10.70% of them do not use phone. Many students wear helmets with music players in the school yard and even in the classroom. They spend most of their time following music to the point of hurting their study time. This is very bad. However, when used wisely, these tools can bring added value to pupils training. For example, MP3 recorder and player can be used by students for note taking and revisions of courses. It can allow readings of audio books (which can be downloaded from Internet). For course recording, this must be done in agreement with the teachers and other pupils, at the risk of undermining the sensitivity of others. Some institutions try to limit the use of phone and MP3 in their erea. But it's a fight that is not won in advance.

1.6 ICT RISKS

The introduction of ICT in the education system as the development of any new technology is not without risk for teachers and pupils. We can already see that it is easy for everyone to take pictures or to make some video recordings without that targeted people knows. This can pose serious problems. We can mention the attacks on personalities by the communication of personal data, the risk of humiliation, blackmail, the violation of secrets or even cyber-harassment, identity and title theft.

Teaching staff and pupils can deal with Internet and social networks use that can affect their personalities. Pupils are increasingly experts in use of Internet and social networks as evinced our survey where we note pupils who do not use the computer declare making use of the internet. But pupils do not always control the scope of their actions. They do not always protect their personal information. Many of them may be victims of the scam and several baits offered on the Internet. An example can better illustrate. It is the case of a girl student who met on Internet someone who said being European and seeking an African wife. The young student had discussions about two weeks with this user. The latter make that he was too interested in the girl and made several proposals among which to "get married her" and "bring her in Europe". Stunned, the girl had trusted this stranger user who, in this euphoria of illusions, asked her to have her best photos. The girl had sent him simple pictures, then pictures where she was filmed semi-nude with "bare-bones" and pictures where she was naked. Once in possession of these pictures, this Internet user changed his attitude and became kidnapper. He had blackmailed the girl for ransom against publishing of the theses photos. Having no means, the girl did not know what to do and, saw her intimate photos on the Internet. Unable to bear, she gave herself death.

This illustrative example shows the unsafe situation to which young people face on the internet and social networks. With nowadays technological advances, one must be vigilant about the use of these tools for professional and personal purposes. Teachers should engage pupils in good practices that can prevent and mitigate these digital risks.

2 PROPOSALS TO BUILD A SMART EDUCATION IN MIDDLE AND HIGH SCHOOL

Successful ICT education in middle and high schools with added-value requires careful preparation before starting. This preparation must begin with the training of trainers in sufficient numbers and quality. The design of ICT didactic textbooks will follow. Thirdly, the acquisition of ICT educational tools comes. Finally the preparation of classes and the launch of ICT education itself end the building. We will examine these different stages.

2.1 ITC TEACHER TRAINING

Like teaching any discipline, teaching ICT requires qualified teachers so it is necessary to train ITC teachers in information technologies. Teaching staff can benefit from initial ICT training during their training in teacher training schools (Advanced Normal Schools). This is the case of the Advanced Normal Schools of N'Djamena and Bongor. Teaching staff can also benefit from an ICT impregnation in the form of training on demand in an ICT training center. This option concerns teachers who are already active in the institutions. Depending on the school's ICT teaching approach, teachers who can use ICT in their courses or ICT teachers can participate in this training requested by the school. A compromise must be found between the training center and the institution regarding the program of this training. Because it is good to give to the staff the resources they need to carry out their work.

As far as regarding the initial training, the Advanced Normal Schools of N'Djamena and Bongor started with mathematics teachers. This is already a step and must be considered for all future teachers. For ICTs are found everywhere and provide services in all disciplines and not in mathematics alone. This choice may be motivated by the fact that in mathematics, it is easy to translate into computer science language everything that is done (the concepts taught). We note that this approach of the Advanced Normal Schools of N'Djamena and Bongor considers computer science as a sub-discipline of mathematics and not a discipline apart. It can also handicap the teaching of ICT in middle and high schools. Mathematics teachers cannot absolutely teach ICT courses, especially since the mathematics programs themselves are very broad. An ideal solution is to train computer science teachers who will be responsible for providing computer science courses in middle and high schools. This amounts to consider computer science as a discipline in its own right.

So is not an ITC teacher supposed to know the different aspects of his discipline? Computer science alone (not to mention ICT as a whole) is a world where there are many courses to teach. Among these courses are those relating to computer hardware and their designs, others are related to software and processes of their construction, others still relate to techniques and computer tools. An IT teacher must know the different approaches to solve a problem in a computerized way. He must therefore be able to present the analysis, design, development and implementation of a chosen computer solution. Already, deep knowledge of his main working tool (computer) will allow him to quickly solve the various implementation problems that will arise during the practical phases. So, it is wise for achieving successful ITC training, to have teachers dedicated to teaching ICT and to consider ICTs as autonomous discipline with clearly defined schedules in timetables.

2.2 PREPARATION OF CLASSES

Teaching ICT in an institution requires a secure place where the various tools for practical work and experiments will be placed. We are talking of machines room or ICT laboratories. This kind of premises must meet a number of standards. Among these standards, there is the space needed to contain the equipment, good floor condition to avoid dust, good ventilation, good air conditioning, clean electrical installation and good cabling system (network). Modern laboratories also have access management systems for filtering users. With the increased use of laptops, practical ICT work can be done in ordinary classrooms with acceptable comforts such as electricity, proper electrical wiring, air conditioning and others. Laptops are increasingly used in classrooms for taking notes in some higher institutions.

2.3 ESSENTIAL MATERIALS

Having rooms to implement ICT, schools need ICT materials for the training. For basic training, the focus is more on the IT component. Thus, the acquisition of computers or tablets becomes an imperative if one does not wish a purely theoretical ITC training. Desktop computers are well suited for machine rooms but one can also consider laptops or even digital tablets. Laptops are envied for their small size and small weight. But in a machine room, they require in dragons (safety cables) to fix them to prevent users from moving them as they want but also to limit their still. We note that there are XO laptops which are intended for the education of young children. These machines are at the heart of any computer system. They are essential for any introduction to the use of ICT. They allow data acquisition, processing, storage, publication and transfer. For a good use of ICT in education, we must bring pupils up to adapt quickly the manipulation of these machines including the manipulation of keyboards, the mouse, sliders, screens, etc.

Alongside computers, one must acquire other accessory machines that are useful for any computer system but also for the training offered. These are, for example, printers, scanners, CD-ROM or DVD drives, CD or DVD burner, digital tablets, etc.

- Printers: devices that allow you to print out data from the computer. There are several printer technologies, but nowadays, inkjet and laser printers are the most used. Some multifunction printers offer scanner functionality. These machines will be used to print some documents.
- Scanners: devices that allow us to get digital documents from paper version. This is the case of photos and diagrams that could illustrate some courses. Thanks to the scanners, they can be easily reproduced on a computer. There are several types of scanners.
- CD-ROM / DVD players: these devices are present on most computers. But they can be absent on some machines. We often note their absence on laptops too much miniaturized. They allow reading CD-ROM or DVD storage media. In addition to this type of machine-integrated drives, there are external CD-ROM or DVD drives that can easily be worn and used on any computer that provides an option for connection.
- CD-ROM / DVD burners: these devices allow you to reproduce CD-ROMs and DVDs. They look like CD-ROM or DVD drives but they give the ability to write on CD-ROMs and DVDs. They make sure the data backups. Nowadays, CD-ROM or DVD drives also play the role of scanners. These devices can be used by learners to store their documents on removable disks.

- Multimedia Equipment: Multimedia is becoming more and more important in the computer system. Broadcasting audio files or video files would allow some illustrations during classes. Among this equipment, there is the projector that is used to project documents (text or videos), headphones or speakers that amplify sounds, microphones to create sounds, and so on. These elements are accompanied by software that ensures smooth operation.
- Digital tablet: A digital tablet also known as electronic tablet is a slim laptop that comes in the form of a touch screen without a keyboard and offers same functionality as a personal computer. It provides access to multimedia content such as television, web browsing, agenda, calendar, simple office automation and consultation and sending e-mails, etc. Tablets also offer great educational opportunities in both ICT and other disciplines. Several educational mobile applications are available on online Internet stores (Google play store, Apple store ...). They can be downloaded and installed on tablets. Some are free and others are paying. Among these applications, there are those that simulate the role of trainer and can facilitate training or self-training. A teacher can use them to stimulate to his students some interesting concepts useful for his classes. Tablets will be very useful for pupils for revisions of their courses and exercises. Pupils can use them for their self-assessments. There are several types of tablets (depending on manufacturers, versions and sizes). Tablets use different operating systems (Android, Windows mobile, Apple's IOS, etc.).
- TBI (Interactive Whiteboard): whiteboard is an interactive device designed for schools. It permits to use collectively a computer. A teacher or a student can write and erase on it as on a classic board. He can also view and edit any type of document (text, images, sounds, videos) using a stylus that plays the role of the mouse and can save files. The whiteboard does not require an internet connection. There are resources prepared in advance for the whiteboard. These resources are enriched with interactive exercises and varied multimedia activities. Whiteboard is a better way for computer-assisted teaching. Institutions which succeeded implementing this system will take great advantage.

The quantity of materials depends on the size of the machine room but must take into account the size of the institutions.

By side of hardware, textbooks are needed for a good smart education. Experienced teachers in this area, in collaboration with the National Curricula Center (NCC), should make effort to make ICT training manuals available. In some countries, such as Israel [6], Greece [7], France [8], the United States, Canada, Germany, associations or interest groups bringing together researchers, scientists and Education experts have offered comprehensive computer science education curricula for schools. The NCC can call the Chadian associations evolving in the field of ICT (Tchad-Linux, ADIL, etc.) to the rescue, for the design of manuals. The existence of such textbooks can contribute to the creation of ICT lessons and their implementation in institutions. Digital course materials must also be offered. It is desirable to have these supports in two formats: a short format (e.g. PowerPoint) and a long format as a text document (Word or PDF). Indeed, the short format is indicated for presentation in the classroom, it includes only the main points to highlight. It is commented and illustrated by examples presented orally during the presentation of classes. It does not have many details and there are fewer illustrative explanations. These aspects will be putted into the long format where one can expose more widely all that is necessary for understanding presented concepts. In other words, it is the format of classical text documents.

2.4 Essential software

Hardware without software is not useful. Basic software and specific software must be provided for the training that institution plans to offer. The basic software, also known as the operating system, is the one that generates the use of any computer. Several basic software exist but the most used on PC and laptops are in the order MS Windows and Linux. These two systems alone account for 94% of the PC operating systems market part. Linux exists under several distributions (Mandriva, Ubuntu, Debian, Red Hat, Opensuse, etc.) and is free. That is to say, we are free to use, modify, share and distribute it. MS Windows is a proprietary operating system of Microsoft and requires a license for its use. Application software are those that must meet the needs of the training defined by the institution. They run on basic software. Therefore, they are dependent on operating system. There are at least three types of application software: paid software, open source software, and freeware software. Paid software is proprietary applications that require money to pay for it. They require an alphanumeric code (a license) when they are installed. It is strictly forbidden to share this software and the number of copies allowed to install are agreed upon purchase. Open source software is developed by volunteers and some companies and is available to public freely. They are usually free but they can also be object of a commercial transaction. Educational institutions can benefit from the open source software. Freeware software is variant of free software but with some conditions of use. Indeed, they are proprietary software but are distributed freely. The owner may limit some rights such as software distribution, copying or printing. Freeware software can run for free for an unlimited period of time. This software is accompanied by paid versions. Examples of freeware include anti-virus AVG Anti-Virus and Avast. There is also software called sharewares which are software that can be used for free for a period or with limited functionality. You must pay to continue using the software after the trial period, or to have access to the full version. It is the case of Winrar and Winzip compression software.

Institutions have the choice between these different types of software. We should know that each type of software has its advantages and limitations. Someone is much more feature-rich. Others are ease of use thanks to intuitive graphical interfaces. The choice can be guided either by the requirements of the market (software widely used in the world of employment), this is the case of expensive software (Autocad for example); either by the beauty of its graphical interface; either its ease of use; either by technical constraints related to the operating system or hardware (CPU, memory ...).

The current trend is to use free software. Most paid software has free equivalents with similar features. Table 1 presents the software commonly used in education, develops equivalence between those who are paid and those who are free [10].

Table 2. Commonly used software [10]

Type of software	Paid software	Free equivalent software
Office	iWork, Microsoft Office StarOffice	OpenOffice, LibreOffice Onlyoffice et KOffice
Text processing	Microsoft Word, Lotus Symphony Documents	Writer, Abiword
spreadsheets	Microsoft Excel, Lotus Symphony Spreadsheets	OpenOffice Calc, KSpread, , LibO Calc, Onlyoffice et Siag
Presentation	Microsoft Office PowerPoint, Lotus Symphony Presentations	Impress KPresenter
Drawing tools	3D Turbo, AutoCAD, Bocad Adobe Illustratorn, CorelDraw Adobe Flash et Maya	LibreCAD, SagCAD, python-CAD, LibO Draw OOo Draw, DrawSWF, Blender
Image tools	Photoshop, Corel Photo-Paint PhotoFiltre, Paint.NET, Autocad	GIMP, Mypaint, Pinta Krita, blender ou Gimp
PDF reader	Adobe Acrobat, Foxit Reader Aperçu (Mac OS X)	Foxit reader, Ghostscript/Ghostview Xpdf, Sumatra PDF
PDF printer	Nuance PDF Professionnal Adobe Acrobat	PDF Creator, ScanSoft PDF Creator
Scientific calculation	Matlab	Scilab
Website Creation	Adobe Dreamweaver Microsoft FrontPage Netscape Composer	Joomla, Bluefish, BlueGriffon, Komodo
Web browser	Internet Explorer, Opera Safari	Google Chrome, Firefox Lynx, Links
Database Management System	FileMaker Pro, IBM DB2, Microsoft Access, Oracle, Microsoft SQL Server	MySQL, Ingres, MariaDB, MySQL, PostgreSQL
Compression and archiving	WinRAR, WinZip	7-Zip, Gzip and PeaZip
Programming languages	MICROSOFT Visual Basic MICROSOFT Visual C++ MICROSOFT Visual J++ Borland Pascal, Turbo Pascal Borland Cpp et Delphi	Dev-Cpp NetBeans Eclipse Free Pascal Virtual Pascal

2.5 LAUNCH OF ICT EDUCATION

The introduction of ICTs into youth training should normally begin with sensitizing students about the added value of ICT. Students should be informed on the well-being of the computer science code, encouraged to respect it and sign it by themselves. The practical conditions of access to the machine rooms must be presented and discussed with the students at the first classes.

First practical works will be an opportunity to present the different tools of the machine room with an emphasis on their usefulness. Tools that will be used can be announced and those which will be the subject of other courses can be indicated. It is not uncommon to be surprised by indelicate connections damaging some equipment especially if one uses materials of different voltages. The first meeting in the machine room should also be used to explain the mechanism of starting the various tools and to clearly say what not to do and the risks that we incur. For a good use of the machine rooms, one will put more emphasis on the respect of the schedules in particular the schedules of occupying machines rooms conceived by the manager in collaboration with the schooling service or the studies direction. This measure will make it possible to avoid coincidences in the machines rooms by some teachers and the inconvenience that may entail.

2.6 MACHINES ROOM MAINTENANCE

The big problem with computer systems in Chad is maintenance. It is common to see that dust is easily dropped on tables and chairs in offices. However dust and computer equipment do not mix. It is therefore necessary to provide a maintenance service which will deal first with the cleanness of the machine rooms and then with the proactive and curative maintenance of the machines. When there is new hardware or software, the maintenance team must test to ensure compatibility with the existing system before integrating them into the system. In other words, it must make general diagnoses to ensure that the equipment is operating at a satisfactory level. Some tasks that can be allocated to this team are:

- Installation of new hardware and software;
- services maintenance for hardware and software;
- services support for the use of machines room hardware and software;
- check the functionality of the backup device on the server ;
- ensure the preventive maintenance of machines;
- maintenance of file system (defragmentation and disk analysis tools) by verifying the integrity of the data on the hard drives of the workstations;
- hard disk integrity tests and check the cooling system of the machine rooms;
- detection of system failures ;
- etc.

In addition to these tasks, the maintenance team can help users in machines rooms to gain control over available resources. Written reports from the maintenance team on the system can help to make improvements.

These different activities can be entrusted to a maintenance company on the basis of a maintenance contract. But, in order to ensure the sustainability of the computer system, it would be good to recommend to institutions to have their own maintenance team and to negotiate support from a maintenance company for some tasks where competence lacks.

3 CONCLUSION

Computer science is ubiquitous in other sciences. Gearing up pupils with computer science will allow them to be more productive in the field they are considering for their career. In other words, early computer science education would give to pupils a mastery of digital age tools and enable them to participate effectively in the changing world and avoid them to be eternal consumers of the technological products [8], [9]. Moreover, it should be mentioned that ICTs are constantly creating new jobs. ICT mastery will provide the opportunity to take advantage of these new job opportunities [3].

However, computer science does not consist simply of using some applications (software such as Word, Excel, etc.) that students can learn in class at school. It is something much more important. Indeed, computer science is both a science and a technique. It aims to build knowledge but also to build objects (concrete for example computer hardware or abstract for example programs). The construction of computer knowledge can result in the manipulation of computer. The construction of objects can begin with the introduction of abstract objects including programs. Writing programs is indeed an essential step in becoming an ICT actor. It is also an important step in understanding programs and mastering key concepts in computer science. Examples from North Korea, China, South Africa or Nigeria can show that getting into digital is a factor in emergence. Let ICTs be appropriate by secondary or even primary schools [7].

Successful ICT education requires revisiting teaching and learning resources, reviewing educational projects, updating pedagogical scenarios and learning activities. While ICTs can be used in all disciplines, educational content needs to be reviewed. Online services can help teachers in their educational investments. Finally, it is important to provide schools with examples of good educational practices with ICTs, good ICT learning scenarios, courses and activities. It is also necessary to support initial and in-service training of future teachers and practicing teachers. Through our survey conducted in 2017, we saw that there are needs to have ICT in secondary school. Here, we have provided to main education actors some advices and proposals to succeed in implementing ICT in secondary schools.

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