ICT Integration: A Roadmap for Philippine Educational Institutions

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Abstract:

The effective use of information and communications technology (ICT) is a must for creating world-class educational institutions and globally-competitive workforce. This proposed roadmap is a multi-stage, multi-user approach aimed at guiding educational institutions acquire and develop the appropriate info-structure (information infrastructure) and competencies (knowledge and skills) for optimizing the use of technology by school administrators and staff, teachers and students. The roadmap is accomplished through an ICT (information and communication technologies) integration methodology that involves systematic planning, implementation, training and evaluation of every aspect of the technologies to be used.

A Brief History of Computers in Education

Before 1981, only a few schools in many developed countries (USA and Europe) had computers until the release of the IBM personal computer or PC in 1981. The PC is considered an affordable independent machine which is suited for personal use compared to the large mainframe computers at that time. In less than a year, some schools in the developed countries started acquiring PCs— marking the start of the computer revolution in education.

By 1982, the schools started to teach students to program in BASIC— a computer programming language. Students had to learn BASIC since it was the only language that came with the computer then. There were no computer applications such as word processors or spreadsheets yet during those times. In order for students to use the computer, they had to program it to do something. With BASIC, students were able to create simple application programs that could perform arithmetic operations with textual screen displays. Different versions of BASIC still exist today like QBASIC. Visual Basic, a popular software development tool, is also based on the original BASIC language.

In 1984, a simple programming language called LOGO was released. In LOGO, a student can command a screen object (called a turtle) to start at any point on the screen and move around the screen following certain paths. For example, starting from the center, students can program the turtle to move 30 paces north (up) and then 20 paces west (left) for it to reach the upper left corner of the screen. Students can also program the turtle to follow paths that can resemble any shape such as a square, a circle, a ladder, etc. LOGO became one of the standard computer languages that were recommended to students since it simply did not only teach them to program but more importantly, it taught them how to think logically. Something similar to LOGO is now included in advanced LEGO kits; it allows children to program LEGO construction sets like simple robots.

By 1986, more computer applications for educational use have begun to emerge. The ability of the computer to display text on screen and accept simple user inputs such as A, B, C or Yes and NO convinced educators that computers can be used for DRILLS and PRACTICES. After giving their lessons, teachers ask students to go through drill and practice sets via computer. Computers can present multiple choice questions on screen and students can key in their answers. After a series of questions, students immediately know how many questions they got right or even which questions they made errors on. These early courseware allowed students to review the lessons given them and take a test at their own pace. Some educators claimed that with these courseware, students were able to increase their test scores. To date, research on courseware as well as intelligent tutoring systems continue.

In 1988, office productivity software such as word processors and spreadsheets started coming out in the market. There was a significant shift from using computers as a teaching tool to using them for productivity. During this time, students were made to learn word processing and use computers as everyday tools for creating student reports, making calculations, etc. The main idea was to make students use computers in schools the way adults use them in their offices. It was a very logical strategy since it actually prepared students for some of the tools they would eventually meet when they have completed their schooling. It is estimated that 60 percent of all jobs would require some computer skills. Engineers and architects now use CAD (Computer Aided Design) and

CAM (Computer Aided Manufacturing) applications to do work. Accountants use specialized accounting software, while artists use photo editors and graphic tools. Nearly every profession uses some kind of dedicated software to do their work. This marks the recognition of the importance of being "computer literate".

By 1990, nearly every student in developed countries has been using a word processor and other applications for their schoolworks. Soon, content specialists from various areas of discipline have begun to capture data and create databases. Others have been developing specialized applications in various subject areas. The use of computers in education has now shifted to the use of curriculum specific tools such as History databases, Science databases, simulators and data probes. This marks the beginning of real educational software. The main criticism however, is that these software are mostly textual in nature. Graphics and color in computers in 1990 was still very uncommon. Much improved versions of these applications exist today in a lot of educational/reference CDs. Even major publishing companies such as Britannica and Grolier now have electronic versions of their encyclopedias.

By 1992, color monitors, sound cards and computers with large hard disk space began to emerge. This also marks a significant change in the pedagogical approach. It is believed that students will learn best by producing a product for an audience. If you make them teach or report about a topic to their classmates, they will learn it better and they can adjust the presentation to the level of their own classmates. The movement towards teaching using multimedia and hypertext has begun. It was also around this time that CD-ROMs (Compact Disk-Read Only Memory) and sound cards have become commercially available and were fitted in computers in schools.

1994 was a milestone. The most significant event was the opening of the Internet for commercial exploitation. Although the Internet has been around for more than 20 years, it was available only to a limited number of academic and research users. It was designed primarily to allow researchers to share large data files from different computers. The Internet is literally just a network of computers. The first major educational benefit of the Internet to the academic community was the ability to communicate with other members

of the community at a faster rate and cheaper price, i.e., via e-mail. Later on, users started to add attachments to their e-mails and made electronic information exchange a reality. In addition to e-mails, academic users made extensive use of FTP (file transfer protocol) in order to access data that is available in the servers of other academic and research institutions. There is already an Internet2 that is being used by advanced universities for computationally intensive research.

By 1996, several Web-browsing applications such as Mosaic, Internet Explorer and Netscape Navigator became freely available. It allowed schools to access larger databases from commercial sites as well as publish their own Web content. 1996 is considered the boom year of the WWW (or the World Wide Web) when almost every school, research institute or company set up their own websites. This opened up a wealthy source of information for students. In addition, search engines began to emerge to help students find the right information from the Web. The Web did not only cover academic topics but nearly every topic imaginable including hobbies, special interest areas, cause-orientated topics, professional topics, etc. thus, providing a platform for life-long learning.

Before 1998, the Web was viewed and used as a large digital library. Most of the information was in textual form. The webpage publishers controlled the content and the flow of information was simply from the source. By 1998, media-rich Web content with graphics, animation and interactive sites began to emerge. Some educators began creating their own digital content using simple multimedia editors and courseware development applications. More and more students really began using the Internet. They were accessing from their computer laboratories, their library, their classrooms, their dormitories, Internet cafes, and also at home. Thus, "anytime and anywhere learning" via computer systems is becoming a reality.

By 2000, the main concern was moved towards digital literacy. Computers were no longer the only device where digital information can be accessed or processed. Portable devices such as pocket PCs, cellular phones, and personal digital assistants (PDAs) have become available and affordable. With various devices, platforms and standards arising and nearly every daily activity done via these devices— from shopping to schooling, the

ability of students (or even citizens) to navigate themselves in a digital world has become a major requirement. Technical terms such as MP3s, JPEGs, DVDs, SMS, etc., have become part of their daily vocabulary. Digital cameras, DVD players, MP3 walkmans, and pocket PCs are becoming standard 'toys' of students in the Digital Age.

By 2002, has seen the rise of two types of systems to support education. Educational Management Systems (EMS) and Content Management Systems (CMS). EMS are use to support the administration of schools through library systems, enrolment systems, scheduling and student information systems while the CMS are used to control the delivery (access) of instructional materials. Good CMS can even monitor students who have viewed or downloaded the lessons and allows students to submit projects and take quizzes on line. Major book publishers worldwide have partnered with large EMS and CMS developers to make their education materials available to schools. Most of the large schools in the US, UK and Australia are now using EMS and CMS to support most of the college courses. In the Philippines a few of the major schools are also beginning to use these systems.

By 2004, several big schools worldwide have started offering 'degrees-on-line' for some bachelor, masteral and even doctoral programs. Some schools on the other hand are using a so called "mixed-mode' where some of the courses are offered on line while others are still taken in the classroom. Most educators see this as a trend for some college programs but still not a mode for basic education. Most schools who offer such programs have ties with book publishers and uses popular text books as content with book authors are the teachers.

For 2005, we are seeing that there are emerging waves of behavior for using ICT and the Internet, referred to as Web 2.0, it can best be described as participatory, open and 24/7 learning. Teachers are beginning to create blogs sites instead of personal or course sites. Blogs are liker personalized publications of teachers of their ideas or lessons that their students can read and react to. Every student can comment and reply to a blog entry which has been proven to facilitate the exchange of ideas with the teacher as well as with other students. In addition, blog sites can be fed with dynamic information using the so

called "RSS feeds" - really simple syndication and other dynamic content technologies. In addition, collaboratory tools such as Wikipedia an emerging on line encyclopedia is proving that contribution of ideas from various people can be as accurate as expert authored encyclopedia such as Britannica Online

This short history of computers in education is intended to show that decisions to acquire computers or any technology for schools must be centered on how it can support real student tasks. Computer education teachers and subject coordinators are encouraged to re-examine their current status and find convincing answers to the question of why they are offering computer subjects in their school. Furthermore, they need to revisit their teaching strategies and most importantly, assess the real benefits that their students get from following their courses.

From data storage to information source and communication medium. The use of the term "computer" to describe the PC a misnomer. Although we can use them to make computations, they are more often used as devices for composing and storing the letters and reports we produce. Expanding their traditional text-only capabilities to include images, graphics, sound, video and animation has made computers invaluable tools for teachers to better present lessons and for students as self-teaching tools. With the advent of CD ROMS, computers have significantly expanded their storage capacities to present huge amounts of textual and non-textual information. For example, the text and images in the 27 volume Britannica Encyclopedia can be stored in a single CD while the full multimedia version with animations, activities, videos, images and text is stored an 2 CDs. The range of existing CD titles for teaching and self-learning now covers nearly all academic areas. Furthermore, numerous computer-based tools such as tutorials, subject specific references, simulators, and other learning aids are now available for both teachers and students of all ages.

Developments in digital communication have a far greater impact on the way we use computers. The linking of computer systems with telecommunication systems has further expanded the role of the computer as major communication device. With network technologies and the Internet, computers can now be linked and can access an infinite

amount of information found in servers from all over the world. The amount and range of information available over the Internet is so vast that it can rival even the best book-based library in the world.

In addition, communications technologies has turned the computer into a communication device that can support both asynchronous and synchronous communication in text-only (email, threaded discussions and chat), voice-only (telephone conversations via internet – Voice-over IP), video (teleconferencing) or all these modes together. This has opened a new medium for delivering instruction. In fact, the internet is being considered as the fourth media – following radio, TV and print. Very recent developments in mobile communications and mobile devices holds a even more promising medium for support various aspects of education.

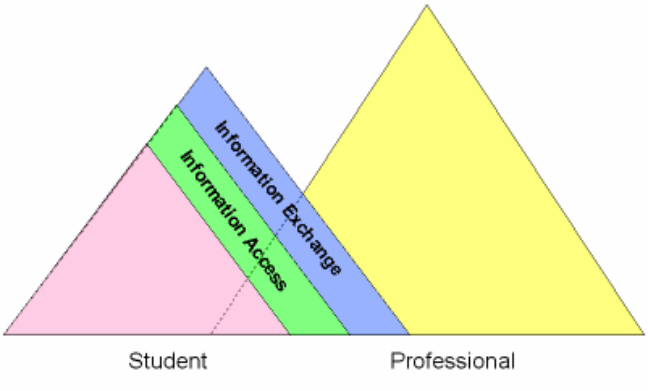
Technology in Education. Technology in education today is almost synonymous to the use of computers in the classroom. Digital technology has it made possible to store various media – textbooks, presentations, images, audio recording, video and played back via computers and other mobile devices. Unfortunately, some local educational institutions only regard computers and computing skills as an area of study rather than a technology that students must use. Computing is often presented as a specialized and independent topic or skill that students must acquire. Computer education traditionally focuses on learning the history, parts, functions and programming of these machines. Often the only skills that students acquire are in basic word processing and simple file management. What is lacking is the emphasis on using the technology to support the teaching and learning of traditional content areas such as Language, Math, Science, etc.
The use of IT in schools, however, should be viewed from two perspectives:

a) a school as a learning institution whose main role is are for teaching and learning as previously described; and
b) a school as an organization that has internal business processes to support – student information, registration and enrolment, accounting, faculty information, library systems, etc.

In the Philippines today, only a handful of schools have implemented computer systems that support the management of their institutions. School administrators primarily use computer for simple record keeping and creating correspondence letters. Very few have actually integrated their enrolment with their accounting and the registrar functions. Even in some technologically advanced schools, administrators are often the last to adapt the technology or have the poorest technology skills.

Technology integration. There are numerous definitions and interpretations as to what technology integration really is. In the proposed roadmap, technology integration is both a process and a goal. The goal of technology integration is to use of information and communication technologies for efficient school administration and effective teaching and learning. Technology integration is a continuous process of upgrading technology infrastructure, updating level of competence and enhancing the work quality of students, teachers and administrators.

Use of the technology. One of the common reasons why schools invest in computer technology is because students need to learn about it. Although very few would admit it, schools actually use their investment in computer facilities to justify tuition fee increases and often purchase computers primarily because of the prestige associated with the so-called state-of-the-art laboratories without genuine appreciation of the real benefits. Computer education has recently been included as a formal academic topic by the Department of Education. The focus, however, has mostly been on learning the parts and functions and some basic office automation skills such as word processing and file management. Rarely is the computer presented as a source of information, a learning tool, a teaching tool, a research tool, a problem-solving or decision-making tool for students, teachers and administrators. The real justification for acquiring technology is its usefulness to support the efficient administration of schools and for more effective teaching and learning. The roadmap presents the various level of usage for different users.



Integration is a continuous process. Schools who have found innovative ways to acquire computers often underestimate the additional expense needed for competence building and maintenance. Computer hardware is estimated to be 'twice the speed at half the price every two years and the shelf-life of software is approximately 18 months. With these rapid development, it is again estimated that 50 percent of what users know becomes obsolete every year. A number of CEO's of large global organization have stated that 'the trouble with computers is that the technology outstrips our ability to use it effectively'. It is evident that school cannot (and should not) aspire to get the latest technology, however, real planning is needed in order to assure some degree of future-proofing. The roadmap presents a methodology to support this process.

Significance of Technology Integration.

There have always been and will always be gaps between the competencies required by industry and those provided by schools. While industries continues to move at internet-speed towards integrating technology in the workplace, schools continue to prepare future workers using traditional methods, further widening the knowledge and skill gap. Alarmingly, Filipinos face a real threat of not qualifying as citizens of the New Digital-Global Society unless schools fully integrate information and communication technologies in the administration, teaching and learning activities of local schools.

Technology skill gap. It is estimated that 70 percent of all jobs will require some level of technological (computer related) skill. As more company operations become automated or computer-assisted, new entrants to the workplace must acquire the relevant technological skills need to operate in the digital society. Computer literacy is slowly being re-defined as digital literacy. The ability to search, manipulate and communicate digital information from various sources and tools. Students of the digital age must

become “infotectives” who can graze the net to satisfy their hunger for information. In addition, students need to learn

Benefits of Technology Integration. Technology bring to educational institutions tangible as well an intangible benefits. Like most business organization, the primary reason for acquiring technology is to improve productivity. By automating routine business processes such as record keeping, accounting and financial management, etc. organizations can provide better services to a wider number of customers. A school is actually a business organization whose customers are students, the parents, teachers and alumni. Thus, the first benefit for schools is improved productivity and efficiency. By putting up systems that would support routine aspects of the operation as well as easy access to information, improvement in the quality of life have been reported. Teachers spend less effort preparing lessons plans and computing grades. Administrators and staff can readily access data and information as they need them in order to make decisions. Students feel proud for turning out better-looking reports and assignments.

Support for new learning approaches. A much stronger reason to integrate technology is to the support for new learning approaches. The two most widely accepted approaches today are: directed and constructivist. Young students need to learn fundamental concepts and acquire basic skills. They need to be directed in order to achieve simple educational goals. Younger students have shorter attention span and thus need to be presented more active materials. Computers with their multimedia capabilities allow teachers to present more graphically processes, concepts and principles. The television and radio are familiar information media for the younger generation. They can adopt to the changing media much more that adults who have been used to higher textual materials. For independent learners, computers can deliver self-paced instructions that can suit various learning styles.

The constructivist approach, on the hand, is based on the assumption that people learn best if they construct their own knowledge through personal experience. It is most effective after students have acquired the basic concepts and principles through directed methods. The main ideas behind the constructivist approach is to give students good

problems to work with, link them to learning resources and make them to work in groups to solve the problem or discover the knowledge. Computers are excellent at supporting all activities. Problems can be presented various to students in textual or non-textual forms such as an illustration, a video or an animation. All learning resources – text, tables, graphics, and even support software to run simulations or do sample calculation can be made available. Moreover, students can use the capabilities of the internet to link to non-static resources such as university libraries, research laboratories, government reports, news agencies and other dynamic information source. Students can even use the communication possibilities of computers to contact real people – such as their teachers or the authorities in the field. Students can use the same facility to work collaboratively and share their individual findings to other members of the group. With this, students are not restricted to the confines of the classroom to do their work. Learning groups do not even need to be limited to the members of the class.

Enhancing the quality of life of students, teachers and administrators.

The nature of the tasks of students, teachers and administrators involves acquiring and transmitting huge volumes of information in both verbal and non-verbal forms. Word-processing has significantly changed the way letters, reports and other written documents are made. Users are now able to edit, store and proof-read their work before actually printing. Students are able to turn in not only better looking report but through the aid of spelling checkers, thesaurus, grammar checkers and integration of pictures and illustrations, student outputs are able to express their ideas with relative ease. Through the use of spreadsheets, teachers and school administrators were able to automate the tedious task of computing student grades but more importantly, they now can use the sophisticated software to analyze and compare student performance not previously possible. Integrating computers with communication systems has further allowed students, teachers and administrators to exchange notes, reports and data.

Why a Roadmap ?

There are several questions often asked on about ICT in education -"Where do I start ?", "What do we do with computers ?' or "Where do we go from here ?". The roadmap is intended as a guide for educational institutions who are not familiar with the various

paths and milestones of information and communication technologies. It enables schools to estimate their current status and target future destinations in their acquisition and use of the technology. The main concepts in the roadmap are:

1. Basic Education and Higher Education have different ICT needs.
2. Students, teacher and Administrators have different needs and tasks.
3. Technology utilization is a continuous process.

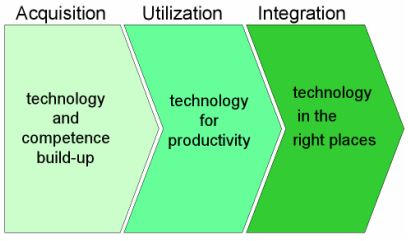
Information Access and Knowledge Exchange. From an ICT point of view, basic level educational institutions (BED) and institutes of higher learning (HED) have ICT different needs. BED are generally smaller and are operationally less complex than colleges. The role of ICT in BED is primarily for information access and for HED it is information and knowledge exchange.

From a macro perspective, knowledge and information in BED is from the teacher to the students. Teacher and students can use ICT to enlarge their sources of knowledge. In HED, however, modern learning approaches such as constructivism, encourages the knowledge is best acquired not from teachers but by interaction among students with the teacher acting as a facilitator and a scribe. The three major concepts of constructivist learning are: focused on real-problems, linking learners to knowledge sources and learners working in groups through knowledge and information exchange.

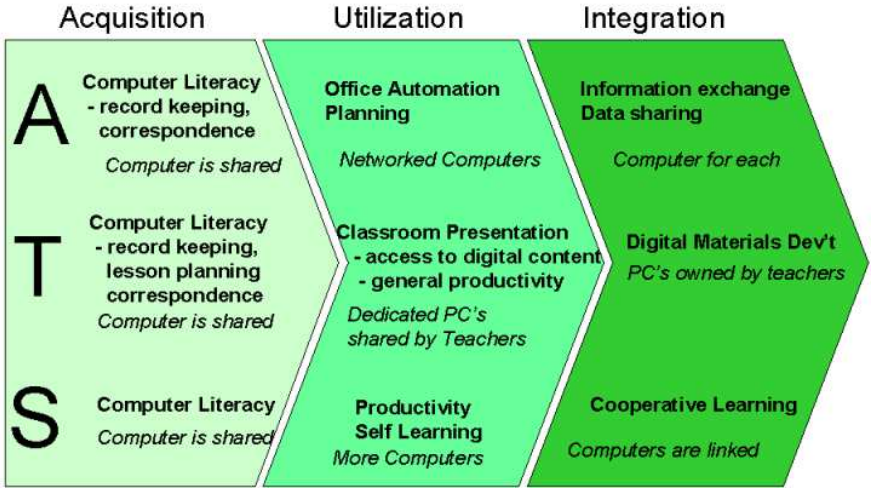
A Roadmap for Basic Education (BED) Institutions.

The technology integration roadmap for BED starts from acquiring technology and competence to the use of ICT in the right places. The 3 user groups – Administrators, Teachers and Students – need different hardware, software, and training. It also has three major stages – namely:

1. Acquisition – technology and competence build-up
2. Utilization – technology for productivity
3. Full Integration – technology in the right places



Acquisition. Obviously, no amount of integration can be achieved without acquiring the necessary facilities and competencies of the users of these facilities. The kind of facilities needed by each major group is dependent on the goals of a given group. In general, administrators should be the first to acquire and learn to use the technology. The success of technology projects is extremely dependent on how supportive the management is to the cause. Leadership has been identified as one of the major soft issues that must be addressed for the success of technology projects. When major decision makers appreciate and know how to use the technology, they become more competent and confident in advocating the use of technology in the institution.



This first level is very critical since it sets the pace for the succeeding stages of integration. Expectations must be carefully match so as not to set them too high for the rest to follow nor too low for participants to get bored. If the school is starting from zero, then any small gain can be significant. In most cases, hand-holding strategies can help prevent frustration on the part of the users. Targets in the integration stage are modest and simple – to introduce the technology and make users comfortable with it. Actual use of the technology for productivity is targeted for the next stage.

Utilization. What people do with technology should be a result of matching individual and institutional needs with available technology and how competent they are at using it. The utilization stage is aimed at productivity. Administrators, students and teachers are expected to identify tasks and use the appropriate technologies. With the current state of technology, administrators can use the technology to cheaply automate common tasks such as record keeping and financial management. Teachers, on the other hand can use

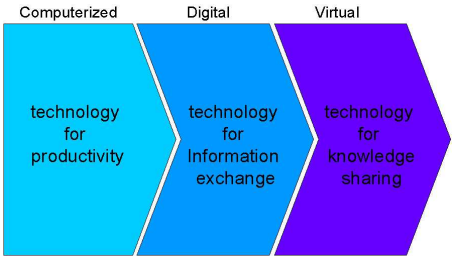
ICT for professional development, make better class presentations and compute student grades. While students can use computers to prepare better reports and learn from drill and practice courseware.

Integration. Real integration occurs when schools are able to use technology in the right places and can no longer operate without the technology. After issues such as "What is the right age to introduce computers to children in schools ?", "What activities should have computer support ?" and "How much impact has technology on improving learning?" have been answered. A school is considered mature enough to use the technology. Often, it is difficult to justify the costs and measure the real benefits. Administrators and teachers should take responsibility for the impact that technology may have on their students. Full integration is the stage where a school is using all the relevant technology where it all school activities that can benefit from it.

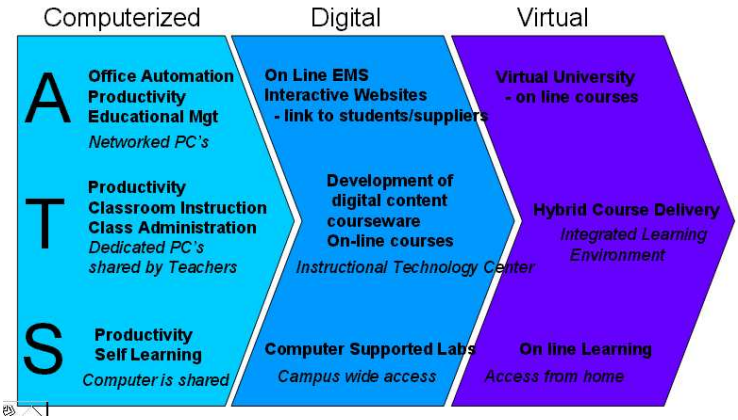
A Roadmap for Higher Educational (HED) Institutions

The roadmap for colleges and universities begins where basic educational institutions have left. Again, the roadmap identifies three user groups and three stages namely:

1. Computerize – ICT for productivity
2. Digital - ICT for information exchange
3. Virtual – ICT for knowledge sharing



Computerized. Based on the standards set by BED in the first roadmap, HED are expected to have a more institutionalized approach to using ICT. At their onset, HED are expected to use computers for productivity and automate basic operations. For administrators, an integrated educational management system that supports enrolment and registrar operations, student information systems, etc. should be in place. Both students and teachers are using the technology to support teaching and learning as well as research.



Digital. The digital stage is where the school begins to take the maximum benefits of digital technology particularly the exchange of digital information. To differentiate this stage from the previous one, computerized library systems help student find printed books while true digital libraries allows student direct access to digital contents of electronic books and journals.

Virtual. The most advanced stage to date could allow schools to operate in a virtual fashion. Administrators can manage schools from remote locations, teachers can deliver lessons from venue and students need not be physically present in the school campus. The main target of the virtual stage is for students and teachers to create and exchange knowledge using the technology. Technologies to support the virtual and digital stages are still evolving. It is extremely difficult to predict how computers will be like and what new technologies will be useful for educational institutions.

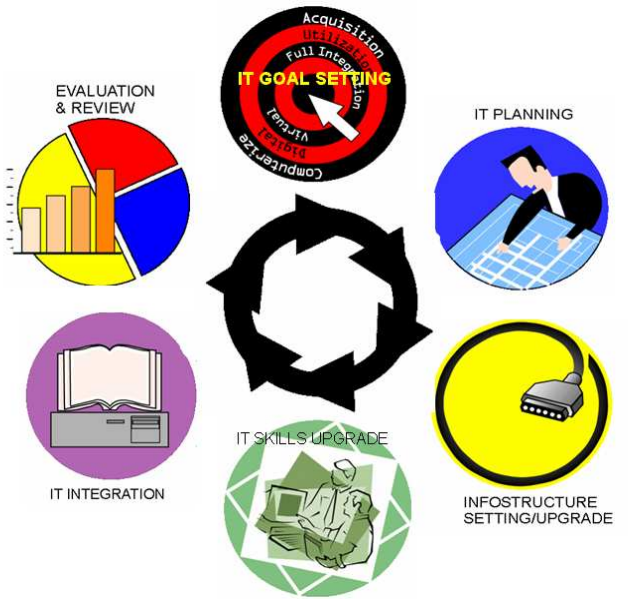
It should be noted that the roadmap for administrators, teachers and students may have their own independent timelines. Currently, a lot of teachers and administrators feel that their students are better than them in using computers. Ideally, the administrators are expected to be the first, followed by the teachers and students.

Integration Methodology

Following the roadmap, a 6-step methodology is proposed. The methodology defines the activities to be accomplished namely:

1. IT Goal Setting – schools identify the stage they want to achieve

2. IT Planning – schools evaluates their current status and prepares a working plan for upgrading of technology and competence of the users. The planning should involve all persons involved – not just the IT department.
3. Infostructure Setting/Upgrade – based the plans, the necessary hardware, software and support structure must be in place.
4. IT Skills Upgrade – users are trained and given time to master the new technology
5. IT Integration- actual use of technology.
6. Evaluation and Review – evaluation on how well the technology achieved the goals set in step 1 and setting up new goals based on the roadmap.



In summary, the proposed technology integration roadmap) is a multi-stage, multi-user approach aimed at guiding educational institutions acquire and develop the appropriate info-structure (information infrastructure) and competencies (knowledge and skills) for optimizing the use of technology by school administrators and staff, teachers and students. The roadmap is accomplished through an ICT (information and communication technologies) integration methodology that involves systematic planning, implementation, training and evaluation of every aspect of the technologies to be used. It is intended to be a eye-opener and a guide for schools to be purposeful in their aim to utilized technology.

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